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WESTERN ELECTRICIAN

EVERY SATURDAY

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Power Development on the Chicago Drainage Canal.

THE close of the year 1907 found the initial equipment (16,000 kilowatts) of the power transmission plant on the Chicago Drainage Canal practically completed. The plant consists of a hydro-electric power house at Lockport, Ill., with four 4,000-kilowatt generating units, a 44,000-volt aluminum transmission line about 29½ miles long and a sub-station at Western Avenue and the Canal, in Chicago, where the current is transformed down to 12,000 volts for distribution to local points of use. Sixty-cycle, three-phase current is generated at 6,600 volts and raised in the station to the line potential by large transformers. The whole plant is built to have double the initial capacity, or 32,000 kilowatts, by extensions which can be readily made.

In every respect the plant is well designed and thoroughly and substantially built. It is owned and operated by the Sanitary District of Chicago, a public body organized under state law and governed by nine trustees, elected by the people. This board built the Chicago Drainage Canal and later the power plant which this artificial waterway affords. About $53,000,000 has been spent on the canal and its appurtenances. Sufficient funds being available to build the plant in first-class shape, no legitimate expense has been spared to secure apparatus and install methods representing the most recent advances in the art of electrical power transmission. The installation is therefore worthy of careful examination as representing the most modern ideas in hydro-electric work in plants of its class.

In the present article a general account of the undertaking will be given, with numerous illustrations. From time to time progress reports of the work have appeared in the Western Electrician, but advantage is now taken of the fact that the initial equipment is complete to view this important enterprise in its entirety.

Historical and General Data.

In 1889 the Illinois Legislature enacted a law creating the Sanitary District of Chicago, which had for its purpose the building of a canal from the Chicago River to a suitable point on the Desplaines River, the object being to divert the flow of sewage from Lake Michigan, thereby purifying the water supply of Chicago. The work was commenced in the year 1892 and completed in 1900.

The canal extends from Robey street and the Chicago River to Lockport, Ill., a distance of 29 miles, where it discharges into the Desplaines River, which in turn is an affluent of the Illinois River, which empties into the Mississippi River. At Lockport there is a fall of 12 feet, and the flow of water is regulated by means of a bear-trap dam. With the regulation flow of 275,000 cubic feet of water per minute quite a valuable power was thus incidentally created.

Some agitation was started, as early as 1897, to make use of this power for lighting the streets of Chicago, but the known fact that by extending the channel to a point 1¾ miles farther down would give [illegible] lower [illegible]

While the city of Chicago [illegible] the right to develop the power for municipal purposes private interests offered to pay the Sanitary District [illegible] per horsepower and make the necessary improvements to complete the development. A lively discussion of the subject ensued, and the proposal was rejected.

The city of Chicago could not raise the necessary money to develop the power, and the Sanitary District did not have the right to do so. The only recourse was to join forces and secure the necessary legislation, which was done in 1903. Some delay ensued pending the collection of the special tax provided, and actual work was not started until 1904, since which time it has progressed without unreasonable delay.

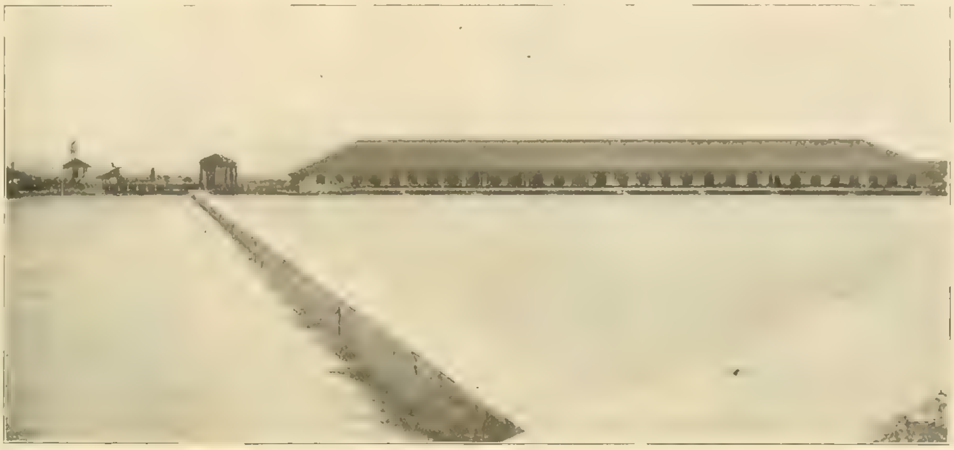
The original scope of the work was enlarged to provide for a ship canal as far as the power house and provision made for immense locks to be built at a later date. Canal locks are now provided for locking boats 22 feet wide and 100 feet long from the channel to the tailrace, which terminates in the Desplaines River at Joliet, from which point the old Illinois and Michigan Canal is available to the Illinois River.

Power House.

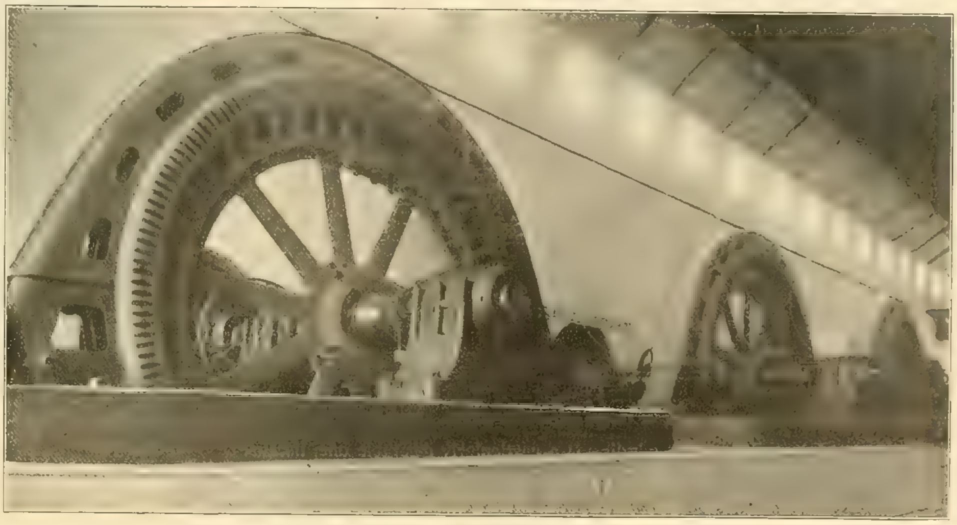
Reference to the outline map on next page will show the location of the power house, just outside the confines of the village of Lockport and within three miles of the center of the busy city of Joliet. The power house, controlling works and the ship lock, placed side by side, form the dam across the channel. The power house is 385 feet long, 70 feet wide and 47 feet high. The retaining walls of the channel are 40 feet high and therefore bring the water level near the top of the building on the receiving side, giving a fall of about 34 feet to the turbines, which furnish the power. These turbines are located in chambers at the floor level and discharge through chambers to the tailrace.

The movable-crest dam or controlling works joins the power house to the east. This part of the dam is for the purpose of regulating the flow of water in the canal. Ultimately the present controlling works at Lockport will be abandoned.

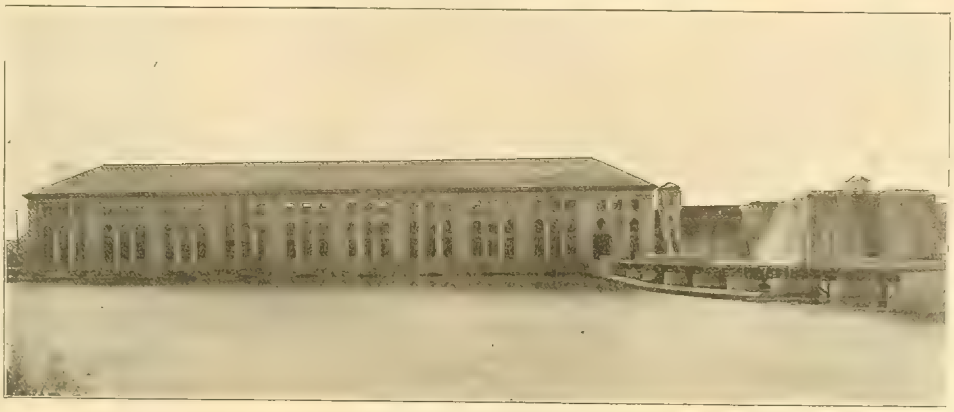
Joining the controlling dam to the east and com-



View from the Upstream Side, Showing Fender Wall.



Three of the Four 4,000-kilowatt Generators of Initial Equipment.

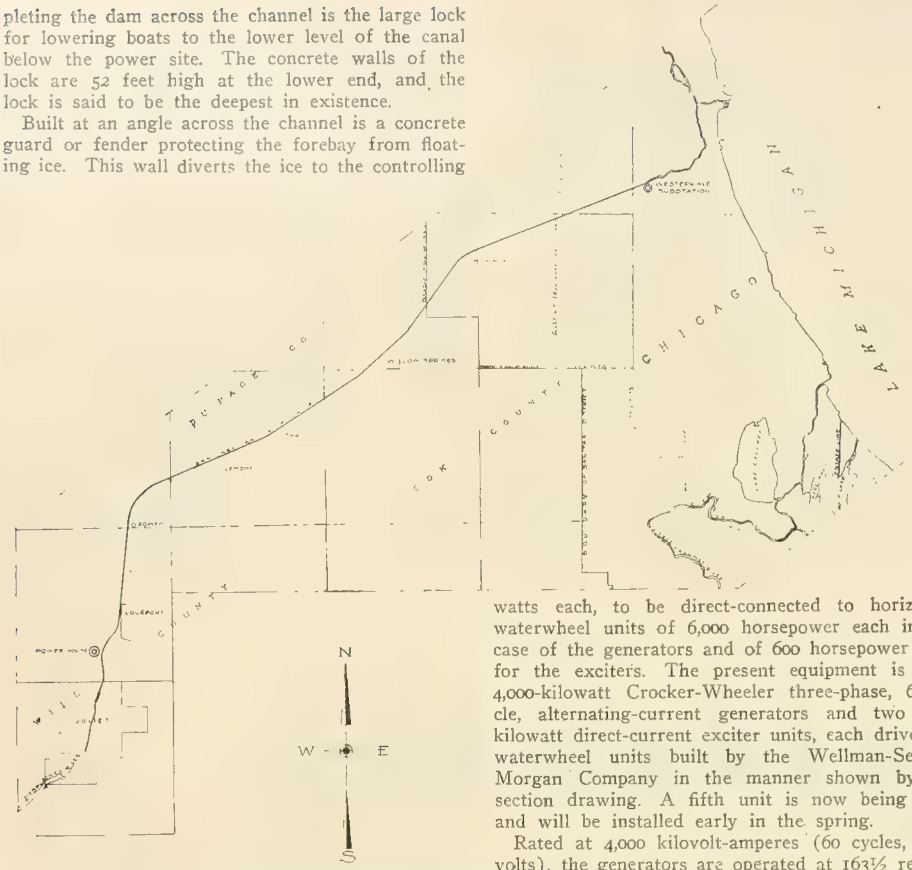


View from the Downstream Side.

HYDRO-ELECTRIC POWER PLANT ON THE CHICAGO DRAINAGE CANAL AT LOCKPORT, ILL.

pleting the dam across the channel is the large lock for lowering boats to the lower level of the canal below the power site. The concrete walls of the lock are 52 feet high at the lower end, and the lock is said to be the deepest in existence.

Built at an angle across the channel is a concrete guard or fender protecting the forebay from floating ice. This wall diverts the ice to the controlling dam. Within the forebay and protecting the wheel chambers from drift wood or other material which might get past the ice guard are a series of iron racks extending the length of the power house.



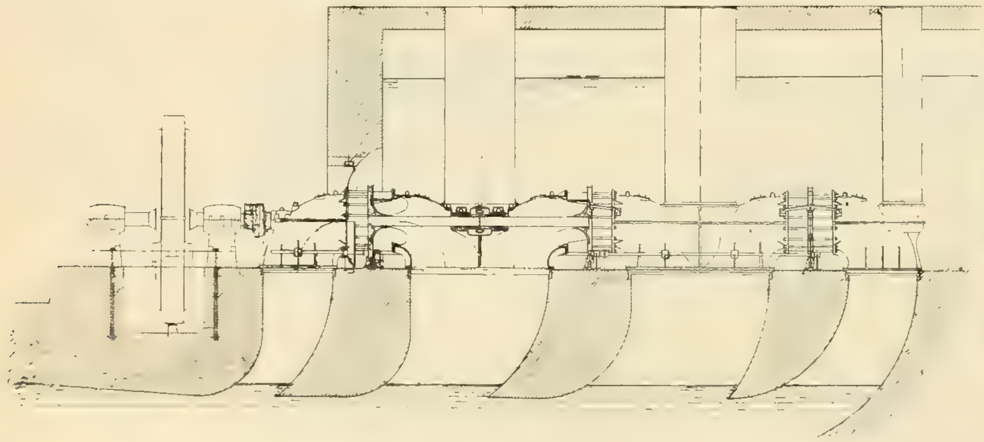
SKETCH MAP OF CHICAGO DRAINAGE CANAL, SHOWING LOCATION OF POWER HOUSE AND SUB-STATION.

Everything about the plant is built on solid rock, and the various structures are made of concrete. All the stone required in the concrete mixing was obtained on the spot. The power house is fireproof, no combustible material being used in its construction.

GENERATORS AND TRANSFORMERS.

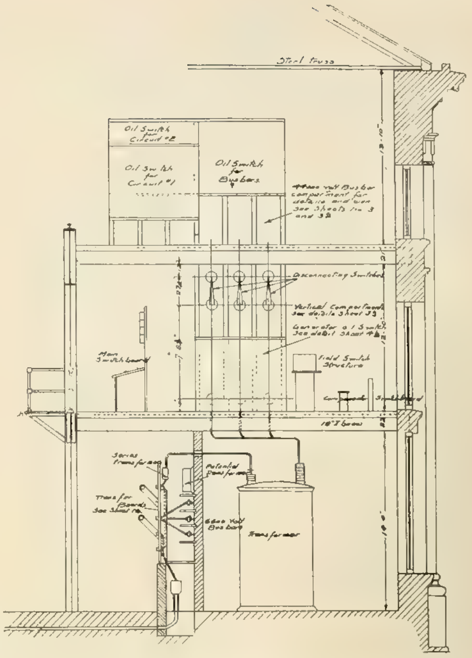
The power house is designed and constructed for the installation of eight generators of 4,000 kilowatts each, and three exciter units of 350 kilowatts each, to be direct-connected to horizontal waterwheel units of 6,000 horsepower each in the case of the generators and of 600 horsepower each for the exciters. The present equipment is four 4,000-kilowatt Crocker-Wheeler three-phase, 60-cycle, alternating-current generators and two 350-kilowatt direct-current exciter units, each driven by waterwheel units built by the Wellman-Seaver-Morgan Company in the manner shown by the section drawing. A fifth unit is now being built and will be installed early in the spring.

Rated at 4,000 kilovolt-amperes (60 cycles, 6,600 volts), the generators are operated at 163½ revolutions per minute. They are of very rigid construction, having frames of the box type, strong enough to prevent distortion due to their own weight and magnetic pull. The stator laminations are punched with partly closed slots, permitting the use of solid pole shoes. The windings of the stator are of the threaded conductor type, the conductors being placed in substantial insulating tubes inserted in the slots.



SECTIONAL VIEW OF WATERWHEEL AND GENERATOR UNIT, SHOWING WATER LEVELS.

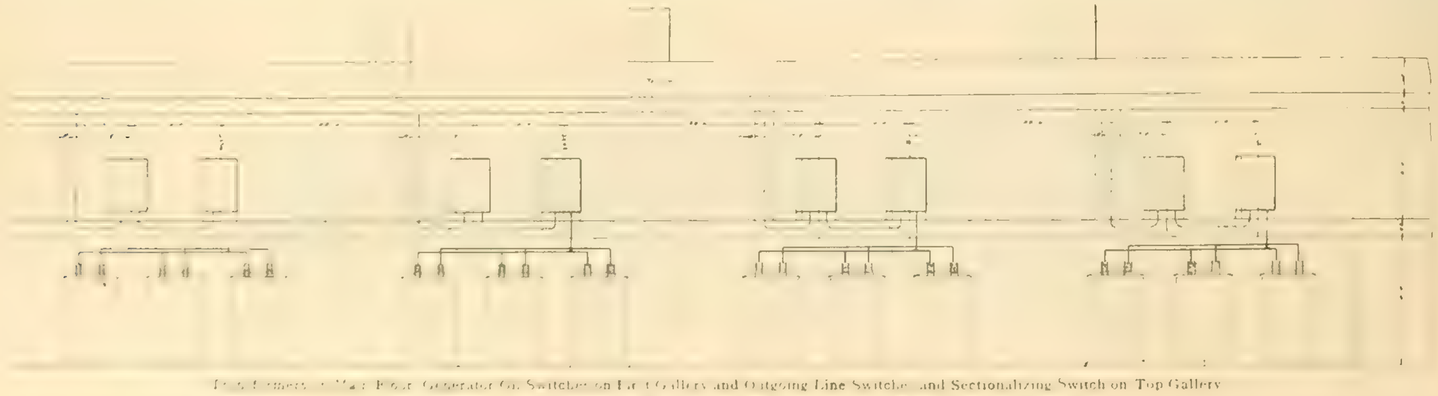
This winding is a particularly desirable one, because of the excellent insulation obtainable and because it leaves the rotor windings accessible without shifting the rotor axially. The distance between bearings is short and a rigid shaft is therefore assured. The rotor consists of a solid casting split in two parts and firmly bolted together, on the circumference of whch the poles and pole shoes, each a solid forging, are securely bolted. The rotor winding consists of flat copper conductor wound on edge, thus insuring radiating surface to every turn of the winding. This feature, together with the ventilated type of stator core and housing, is believed to insure low and uniform temperatures throughout.



TRANSVERSE VIEW OF PORTION OF DRAINAGE CANAL POWER HOUSE.

SIX 1,333-KILOWATT TRANSFORMERS IN DRAINAGE CANAL POWER HOUSE.

The transformer equipment consists of 12 single-phase oil and water-cooled step-up transformers of 1,333 kilowatts each, built by the General Electric Company, which company also furnished the switchboards, high-tension switches and lightning-arrester equipment. The transformers are arranged in banks of three. Each is guaranteed to operate safely un-



Transformers on Main Floor; Generator Oil Switches on First Gallery and Outgoing Line Switches and Sectionalizing Switch on Top Gallery

LONGITUDINAL VIEW OF PORTION OF EQUIPMENT OF DRAINAGE CANAL POWER HOUSE.

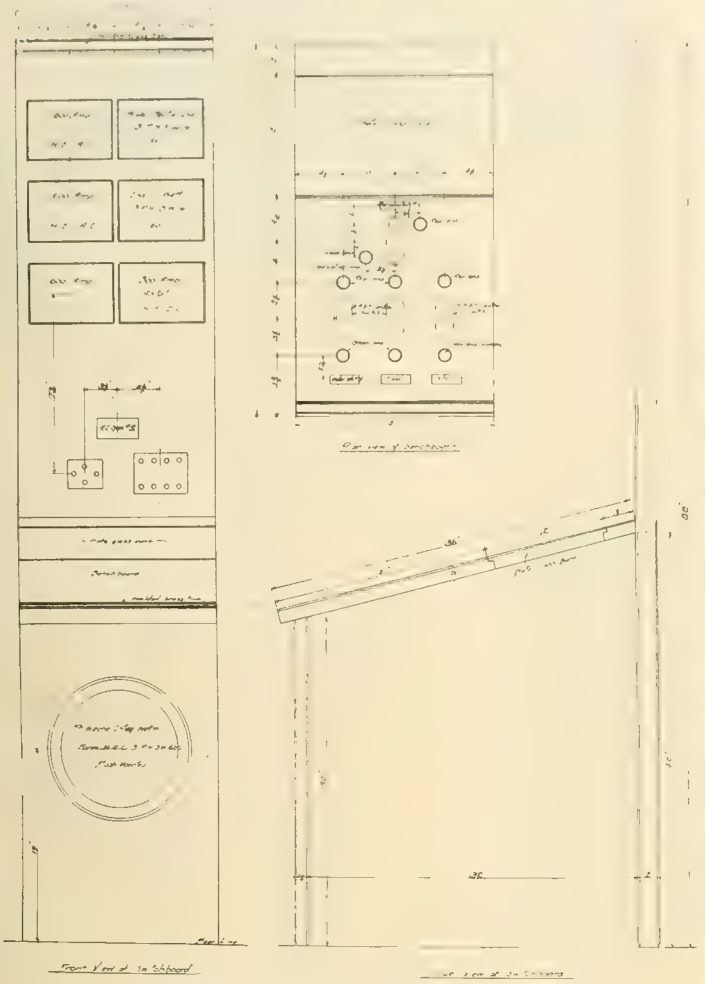
der an overload of 25 per cent. Th[illegible] arrangement of coils is such that damaged one[illegible] may be [illegible] replaced.

General Arrangement

The north half of the power house, a space 38 by 35 feet, is devoted to the generator and exciters, the waterwheel for each machine being located in a chamber adjoining. Traveling over the generator space is a 40-ton electric crane. The south half of the main building contains the switchboards, transformers, bus-bars, oil switches, circuit

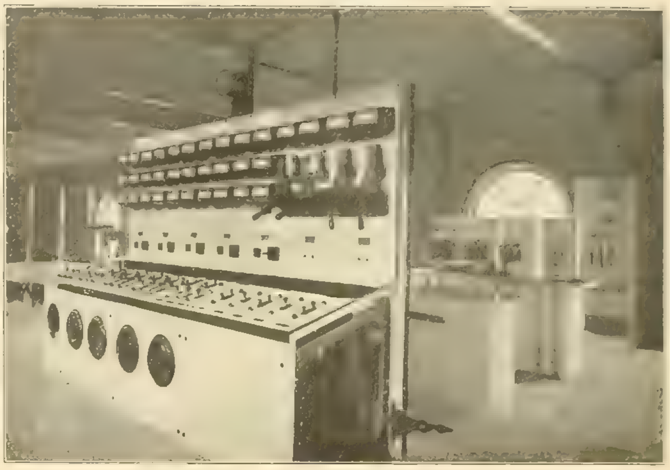
[illegible] interchangeable, and will only be used in case it [illegible] transformers ordinarily used on another generator. Each transfer board used with the transfer buses [illegible] inches wide and two inches thick and provided with barriers. It is provided with three single-pole, single-throw, hook-type switches of 450-ampere capacity, 6,600 volts; three single-pole, double throw, hook-type [illegible]

[illegible] sistances cut out, 150 amperes; minimum current [illegible] portioned to regulate the current strength between [illegible] resistance required for each of the direct-current generator field rheostats being 25 ohms in 100 divisions.



DETAILS OF MAIN CONTROL SWITCHBOARD

OIL SWITCHES



MAIN CONTROL BOARD IN DRAINAGE CANAL POWER HOUSE.

breakers, lightning-arrester apparatus, etc. Above the main floor are two galleries as shown in the transverse sectional drawing.

The general arrangement of the station is such that the waterwheel, generator and three transformers constitute a unit and is treated as such to the high-tension bus-bars, all switching being done on the high-tension side of the transformers.

Transfer bus-bars are provided for the purpose

This Lock, with Lift of 52 feet, is perhaps the Deepest in the World
NAVIGATION LOCK AT LOCKPORT POWER HOUSE ON DRAINAGE CANAL.

volts; three connecting bars between jaws of single and double-throw switches. Each alternating-current generator armature is connected to its transfer board by two three-phase stranded-copper cables of 300,000 circular mils each. Three series transformers are mounted on the top of each transfer panel, and through these the top switches on the board are connected to the primary side of the corresponding bank of main step-up transformers.

Switching Apparatus and Current Control.

To insure that a combined unit may be disconnected from the bus-bars under extreme conditions the high-tension leads from the transformers are carried through two three-pole oil circuit-breaker switches placed in series. After passing through these switches, which are placed on the first balcony or gallery, the leads are carried up to the second or top gallery in enameled brick compartments to the high-tension bus-bars, which are enclosed in compartments similarly constructed. To these bus-bars, which extend the entire length of the four units, the two outgoing circuits are connected through oil circuit-breaker switches provided with time-limit relays.

The circuits are carried in enameled brick compartments to the end of the building, where they are provided with lightning arresters at the point where they leave the power station.

The exciter units are connected to the bus-bars through automatic circuit-breakers and remote-controlled switches. These bus-bars are placed on a structure built of white enamel brick, arranged to carry the switches. From the bus-bars leads are carried to a similar structure on which are mounted the field switches for the alternators. Provisions are made on these structures for the installation of future apparatus. The rheostats for the fields of the alternators and exciter units are placed on the second gallery and are remote controlled. The

The control board is located on the first gallery and is built in uniform panels—one for each generator and exciter unit. The exciter panels are provided with the usual instruments, and each alternator panel has an ammeter on each phase, a watt indicator, power-factor indicator, ammeter for fields, synchronizing and voltmeter receptacles. A swinging panel contains two 6,600-volt voltmeters, frequency indicator and voltmeter on exciter bus-bars. A synchroscope is placed in the center of the board.

All indicating instruments are practically dead-beat and are guaranteed to be accurate within one-half of one per cent. throughout their entire range. The finish is a dead black with polished brass trimmings lacquered to prevent tarnishing. The direct-current instruments are of the shunt type and conform in size and appearance with the alternating-current instruments. The alternating-current instruments are used on 6,600-volt current. The operating panel is provided with push and pull type of switches for operating all switches, rheostats and waterwheel governors. Each switch is

TWO 350-KILOWATT EXCITERS IN DRAINAGE CANAL POWER HOUSE.

LOW-TENSION BUSBAR STRUCTURES IN DRAINAGE CANAL POWER HOUSE.

VIEW SHOWING BUSBARS AND CIRCUIT COMPARTMENTS IN TOP GALLERY.

provided with lamps to indicate the movements of the device it controls. An integrating wattmeter is also provided for each alternating-current generator. The board is so condensed that the entire plant may be operated in the limited space of eight feet.

Simple in appearance, the plant has yet apparently all the required flexibility.

Protection Against Ice.

Particular attention has been given to a source of trouble usually experienced with waterpower

TRANSFER BOARD AND BUSBARS.

plants, during winter months—that is, anchor ice and floating ice. A diagonal fender wall with arches four feet below the surface has been constructed in front of the wheel pits, and the greater part of the troublesome ice will be diverted to a bear-trap dam discharging below the power house. Such ice and debris that may reach the racks in front of the wheel pits may be raked out and passed over another and smaller dam which discharges below the power house. These provisions insure freedom from any actual interference in operation.

Transmission Line.

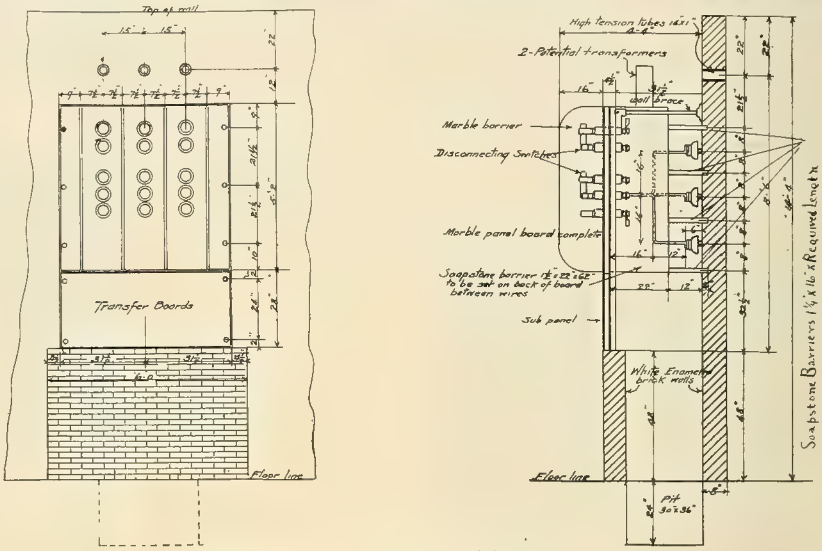
With its 60-foot steel masts and two circuits of three aluminum wires each, the transmission line running from the Lockport power house along the Drainage Canal to the sub-station at Western Avenue and Thirty-first Street, Chicago, is a fine piece of work. The wires of each three-phase circuit (one is held in reserve) are arranged in delta shape, as shown in an accompanying picture, one circuit on each side of the mast. The wires are spaced six feet apart. As stated, the transmission potential is 44,000 volts. A ground wire is carried on the peaks of the poles.

The poles or masts are of steel, square in plan section, of bridge construction, and weigh complete 4,000 pounds. On a side they measure 42 inches at the base and 20 inches at the top. The two cross-arms are similarly of bridge construction, the lower arm being 18 feet long and weighing 600 pounds, while the top arm is 12 feet long and weighs 300 pounds. The material used in the diagonal braces is 2 by 2 by 3-16-inch angle steel. The size of the material in the corner posts varies from 3½ by 3½ by ¼ inch at the base to 3 by 3 by 3-16 inch at the top of the pole. The rivets in the body of the pole are all three-quarters inch and in the cross-arms five-eighths inch. The Aermotor Company made these masts and received $130 apiece for the number furnished, between four and five hundred.

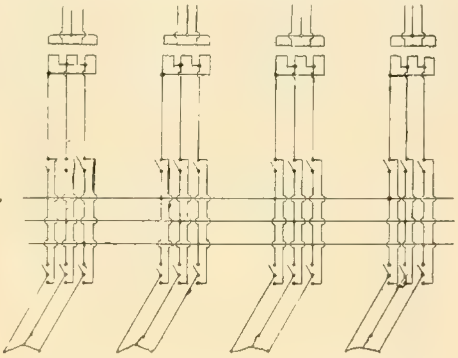
The poles are placed 350 feet apart. They are set into the ground six feet and the hole filled in with concrete, which is brought up six inches above the surrounding earth and rounded off at the edges so that no water will lodge about the base. The accurate alignment is beautiful and praiseworthy. The poles are designed to carry the transmission wires on the lower arms 47 feet above the ground.

The wires are carried 16 inches above the metal arms. The Locke insulators used have a diameter of 14 inches and are 12 inches high. They were tested assembled ready for use at 120,000 volts. Each of the four shells or petticoats tested at 60,000 volts before assembly. This insulator, mounted on a suitable metal pin, is guaranteed for a maximum horizontal strain of 4,000 to 5,000 pounds and is ordinarily rated for 60,000 volts.

At the top of the pole the four corner posts end in a cap which is fitted with a socketed clamp tightened down on the one-half-inch iron ground wire, carried the whole length of the line. This cable will connect all the poles electrically, and on account of its position above the transmission wires is expected to receive any lightning which may

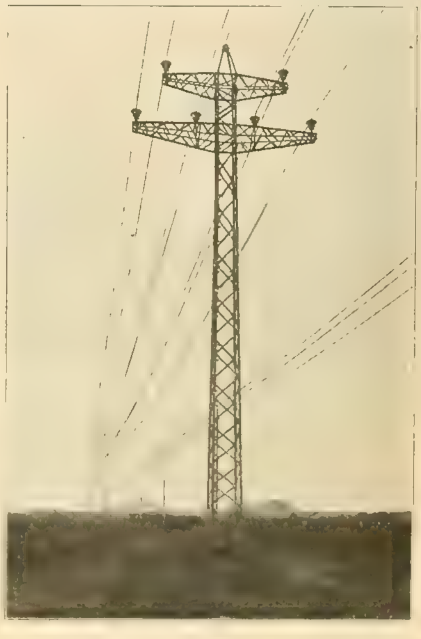


DETAILS OF TRANSFER BOARD AND 6,600-VOLT BUSBARS.



TRANSFER BOARD AND TRANSFORMER CONNECTIONS.

[illegible]



A VIEW OF THE DRAINAGE CANAL POWER-TRANSMISSION LINE FROM LOCKPORT, ILL., TO CHICAGO.

take the line and carry it off to the excellent grounds afforded by the concrete-imbedded poles. The construction described has proven entirely satisfactory, and no line trouble has appeared in five weeks of operation.

SUB-STATION.

In the sub-station each line terminates in a set of bus-bars, to which are connected, through oil circuit-breaker switches, two banks of step-down transformers. These transformers may be operated in parallel by means of an oil switch between

WESTERN AVENUE SUB-STATION, CHICAGO DRAINAGE CANAL.

the two sets of bus-bars. The secondary current passes through similar oil switches to a set of low-tension bus-bars arranged exactly the same as the primary side for parallel operation. From the low-tension bus-bars the distributing circuits pass through oil switches to points of distribution. Each circuit is to be equipped with a total watt indicator, power-factor indicator and integratng wattmeter.

The control board in the sub-station is a duplicate of the panels on the power-station board, and the switching arrangements are identical. A motor-generator unit has been provided to supply direct current for operating switches and lighting the building, and a 1,000-ampere-hour storage battery, to be used in case of emergency, is provided. Motor-driven centrifugal pumps in duplicate are installed for the purpose of supplying cooling water to the transformers.

The sub-station building is an attractive yet dignified structure of concrete. It is 124 feet long, 70 feet wide and 42 feet high.

APPLICATIONS OF THE CURRENT.

The city of Chicago will be among the first users of the current available by the Drainage Canal power development, having contracted to take 7,000 kilowatts. For some time the city electrical department has been busy installing the distributing system from the sub-station, and City Electrician Carroll is now preparing the city lighting plants for the Lockport power. One new transformer station has been built by the city, and in the existing street-lighting plants electric motors will take the place of the steam engines for driving the generators.

Preparations are being made by the Sanitary District to do the pumping for the proposed North Channel by screw pumps driven by slow-speed 450-horsepower motors installed at Wilmette and taking current from the Western Avenue sub-station. Others who will use a considerable amount of the Canal power are the West Park Board, the township of Cicero and the village of Morgan Park. The Sanitary District will receive $15 a horsepower for the current.

PERSONNEL.

Mr. Robert R. McCormick is president of the board of trustees of the Sanitary District of Chicago. Mr. George M. Wisner is chief engineer. The trustees have expended about $4,000,000 on the power development of the Drainage Canal since work was begun in 1904. The electrical plant has been installed under the supervision of Mr. Edward B. Ellicott, electrical engineer for the Sanitary District. Mr. Ellicott has brought to this task the comprehensive resource, the unflagging zeal and the excellent technical ability which have characterized all his work, whether as constructing engineer for a great electrical company, city electrician of Chicago, or chief electrician and mechanical engineer of the St. Louis Exposition. The power station is in charge of Mr. W. C. Robinson.

E. B. ELLICOTT.

ELECTRICAL PROGRESS IN UNITED STATES IN 1907.

[illegible]

I[illegible] the close of the year 1907, the electrical industries show substantial progress. As was generally expected, the great rush of business of the last few years could not last, and now a temporary reaction is being experienced. That this can be of long duration few believe, as the country is prosperous and the necessity for extensions and new projects in all electrical fields is as great as ever. The announcement that some of the Westinghouse companies had applied for a receiver was the cause of general regret. It is expected that the companies will be reorganized and the receiverships terminated in the near future. Except for the reduction in the number of employes of this and other companies and the consequent diminution of output, the natural development of the industry has not been interrupted. New inventions continue to be made and new applications are found for standard apparatus.

THE INSTITUTE.

Early in the year the American Institute of Electrical Engineers was installed in the new headquarters in the Engineering Societies Building at 33 West Thirty-ninth Street, New York city. The first meeting in the auditorium was on January 25th, when Messrs. Stillwell and Putnam delivered a paper on the substitution of the electric motor

Power Board. Control Board. Busbar Compartments.

VIEWS IN WESTERN AVENUE SUB-STATION OF CHICAGO DRAINAGE CANAL POWER TRANSMISSION.

for the steam locomotive. The audience completely filled the large hall and thus indicated appreciation not only of the paper but of the splendid facilities afforded by the new assembly room. The building was dedicated on April 16th and 17th with appropriate ceremonies, consisting of addresses and other exercises. In addition to the facilities provided for meetings, the new building houses the union library of the three founder societies. Since November 6th this has been open evenings, and it is bound to become a factor in the broadening of engineering intelligence.

The growth of the Institute during the last year has been phenomenal. On May 1st there were 4,521 associates and members, as compared with 3,460 the year before, an increase of 29.8 per cent. By October 1st there were 5,089 members, indicating a yearly rate of increase of 30.3 per cent., if the interest continues unabated. At the average present rate of increase there should be 5,877 members on May 1, 1908, an increase for the year of 1,356. This does not include the enrolled students, of whom there are more than 1,000.

The growth is due largely to the activity of the Institute branches and sections. Of the former there are 19, located at the principal educational institutions. There are 18 sections, with headquarters in a number of large cities scattered from Boston to Seattle. Two of the sections, Toledo and Cleveland, have been organized in the last year, as have also the branches at Montana University and the Montana Agricultural College.

The Niagara Falls convention of the Institute was the occasion for the presentation of a bewildering array of papers and reports. On account of the location of the meeting in the center of an important power-transmission district, special attention was given to this subject. The problems of transmission at very high pressures were carefully treated and the discussion clearly indicated con-[illegible] vention manifested interest in such matters as the [illegible] the Code of Engineering Ethics, a most timely compilation of the niceties of business courtesy; and engineering education.

During the year the United States national committee of the International Electrotechnical Com-[illegible] Elihu Thomson as chairman, and with twenty other members. These are all men of achievement, and they have been selected to represent all branches of electrical science and industry. They will supplement the rather accidental international congresses and give stability to the growth of standardization.

[illegible]

It is gratifying to electrical educators to note the increasing appreciation of their work by the profession at large. The teachers also show their desire to improve the methods of instruction to meet the real demands of the time. An important factor in this growing spirit of co-operation is the recognition, by all concerned, of the true functions of a technical training. The Society for the Promotion of Engineering Education, which has for its purpose the improvement of methods and ideals in all lines of technological teaching, has stimulated interest among the teachers and is now endeavoring to come more closely into contact with practical engineers. At the convention held at Cleveland in July, a plan for promoting a careful study of the status and possible improvement of technical and industrial education was formulated. The leading engineering societies were invited to appoint representatives to serve upon a joint committee for the above purpose, and they have since

TRANSMISSION LINES ENTERING WESTERN AVENUE SUB-STATION.

done so. As this committee is to report progress in one year and make a final report in two years, it will undoubtedly begin work immediately.

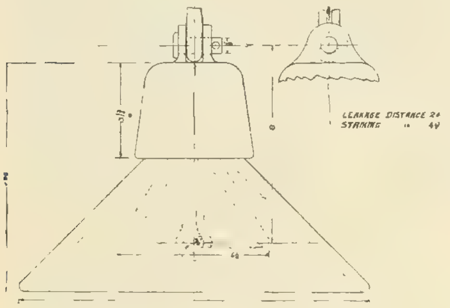
As a result of a recent canvass made by Mr. W. D. Weaver, there appear to be about 9,000 students of electrical engineering in all grades of schools. More than 1,350 were graduated in 1907. About 42 per cent. of these are from first-class schools, 47 per cent. are from schools of average rank, and the remainder are from schools in which the instruction is elementary in character.

In connection with the discussion of higher education, industrial training for young men who can-

not afford the time and money for a college course is receiving consideration. The largest effort in this direction is represented by the Carnegie Technical Schools and Institute in Pittsburg, dedicated with great ceremony on April 11th. In this enterprise $23,000,000 has been invested. The great library and museums are the center for the literature, science and art of the vicinity. As might be expected, these schools are already immensely popular, and their capacity alone limits the number of students registered. This verifies the assertion made during the last year by prominent educators regarding the urgent need for more and better industrial education. At least one state has during the past year seriously taken this matter up and secured expert advice regarding the desirability of expending public money for the purpose.

Many schools were favored in 1907 by gifts and improvements. Mrs. Russell Sage's gift of $1,000,000 to Rensselaer Polytechnic Institute of Troy, N. Y., has resulted in the formation of the Russell Sage School of Mechanical and Electrical Engineering. During the summer the new electrical engineering building of Worcester Polytechnic Institute was completed and the faculty was enlarged at the same time. This school has always been noted for the practical nature of its instruction. The new laboratory and classrooms are admirably fitted for teaching of the best type, and the building is probably the finest in this country devoted exclusively to electrical engineering instruction.

From all parts of the country come tidings of improvement. At Annapolis the electrical course is being reorganized with a view to preparing the cadets for the proper use and application of electrical apparatus. The government engineer school at Washington has demonstrated its usefulness. The new engineering course at George Washington University has passed a successful third year. The graduate engineering school at Harvard has proved popular and timely. All these and many other facts are encouraging for the future of the electrical profession. Research also is not being neglected. On account of the growing pressure upon the funds of the Carnegie Institution, the founder last month added $2,000,000 to its endowment.



ONE SECTION OF THE NEW TYPE OF SUSPENSION INSULATOR FOR HIGH VOLTAGES.

Illumination

One year ago there was a bewildering series of inventions of new light sources, each outdoing its predecessor in efficiency. These inventions led to great activity in the commercialization of the lamps which has proved to be the important illumination problem of the year. It was soon evident that efficiency is but one of a number of important points of merit in light sources. Color, illuminating quality, expense of trimming, cost of lamps and electrodes, adaptability to standard circuits, production of fumes, and other matters required minute attention. During the year the various [illegible] taken possession of their own fields.

The General Electric magnetite arc lamp with iron oxide and copper electrodes has demonstrated its practicability for commercial service, especially for street lighting. It is now being adapted for locomotive and interurban car headlights and will undoubtedly compete with the carbon arc in other fields. Fifteen thousand magnetite lamps are now [illegible] increasing.

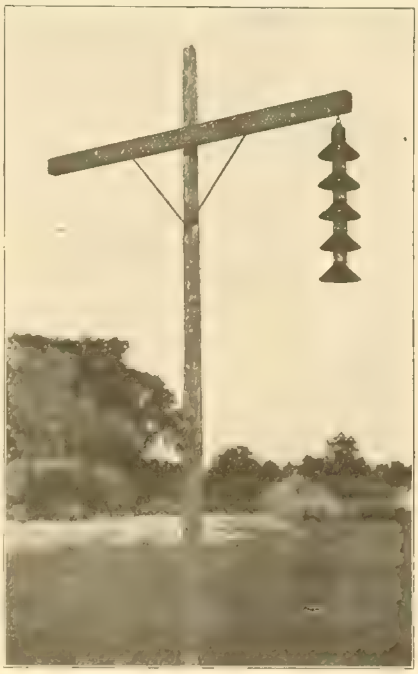
The Westinghouse company has also recently perfected a metallic flame arc lamp on the same general principle. In these lamps the most difficult problem is the disposition of the products of com[illegible] use of skillfully directed air currents the fumes [illegible] duces the necessary air circulation. The slag which accumulates on the lower electrode is jarred off as it accumulates and is caught in a small pan.

The magnetite arc has created a new and unexpected field for the mercury arc rectifier, which has been developed to a satisfactory commercial stage. Obviously, the magnetite arc, having two differing electrodes, requires direct current for its operation. This unfortunate feature renders necessary the use of transforming apparatus, as, in most cases, a direct, constant-current generator would be very objectionable. The mercury rectifier eliminates the commutator and other evils of the direct-current arc machine, and, unless a new form of arc lamp appears in the near future, it will be a part of the standard arc-lamp equipment.

THE NEW CONCRETE-BLOCK POWER HOUSE OF THE WASHINGTON RAILWAY AND ELECTRIC COMPANY AT BENNINGS, MD.

The magnetite arc should not be confused with the flaming carbon arc lamp. The former produces a white light, somewhat less blue, but otherwise not radically different from that of the older carbon arc lamps. While not as efficient as the carbon flame arcs, the metallic flame arc has a better color and is of less intensity. As compared with the ordinary carbon arcs, the efficiency is at least 50 per cent. better. There are no inner globes, and the total expense of trimming is probably not far different in the two cases.

The carbon flame arcs are being introduced in large numbers for spectacular effects. They are placed principally in front of stores to attract attention, and brilliantly illuminate the window displays. The efficiency of these lamps is of the highest, and for the purpose mentioned they are very satisfactory. The yellow color, the necessary frequency of trimming, the fumes produced and the great intensity of the light limit the field of application of the carbon flame arcs.

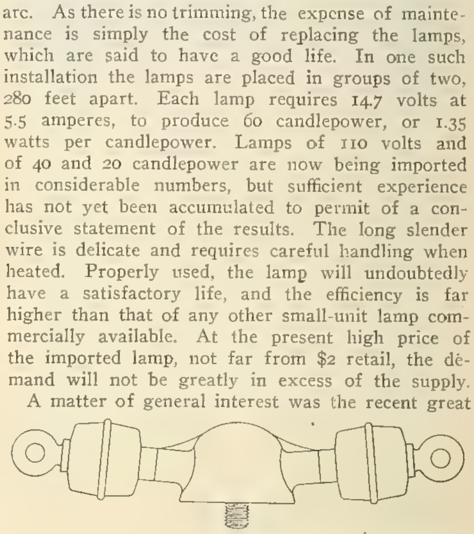


A SUSPENSION INSULATOR FOR 100,000 VOLTS.

Excellent progress has also been made by the incandescent lamp in its several forms. Tantalum lamps are now in general use on direct-current circuits, and they are apparently giving entire satisfaction. At the present price of from 50 to 75 cents they are economical as compared with the ordinary carbon-filament lamp. The manufacturers advertise them as considerably more efficient than the metallized carbon-filament lamps. The life on alternating-current circuits is about one-half that on direct-current circuits, hence the lamps are used principally in isolated plants and on the Edison systems in the very large cities.

Tungsten lamps are slowly coming into the market. Naturally the first lamps manufactured were for series lighting, a larger current and lower electromotive force permitting the use of a comparatively large filament. These lamps are well adapted to street lighting, as the units are of convenient size for uniform distribution and the efficiency is practically the same as that of the enclosed carbon arc. As there is no trimming, the expense of maintenance is simply the cost of replacing the lamps, which are said to have a good life. In one such installation the lamps are placed in groups of two, 280 feet apart. Each lamp requires 14.7 volts at 5.5 amperes, to produce 60 candlepower, or 1.35 watts per candlepower. Lamps of 110 volts and of 40 and 20 candlepower are now being imported in considerable numbers, but sufficient experience has not yet been accumulated to permit of a conclusive statement of the results. The long slender wire is delicate and requires careful handling when heated. Properly used, the lamp will undoubtedly have a satisfactory life, and the efficiency is far higher than that of any other small-unit lamp commercially available. At the present high price of the imported lamp, not far from $2 retail, the demand will not be greatly in excess of the supply.

A matter of general interest was the recent great increase in the demand for standard incandescent lamps, resulting in an approach to a lamp famine. Successful plans for increasing the use of electric light have been exploited, and manufacturers have been overworked to furnish lamps.



SPECIAL HANGER FOR 1,200-VOLT DIRECT-CURRENT RAILWAY CONSTRUCTION.

Among the novelties in illumination, the lighting of the Jamestown Exposition and of Niagara Falls deserve mention. Both of these are notable in the use which has been made of searchlights. Behind the administration building at the exposition a battery of searchlights was located. This threw upward a radial group of light beams which produced a magnificent corona about the dome of the building.

When the mayor of Niagara Falls, in his address of welcome to the Institute, mentioned his plans for illuminating the falls, his audience was somewhat incredulous. However, on September 4th the first exhibition was made. Batteries of 18, 30 and 60-inch projectors were located at various points on the Canadian side, and beautiful effects were produced by throwing white and colored light upon the falls and the spray. This was probably the most extensive use of searchlights yet made for scenic purposes.

The convention of the National Electric Light Association in Washington in June was the most notable and the largest in the history of the organization. The association placed itself on record as being willing to accept the principle of public control of public-utility corporations if applied fairly. It adopted a new standard for street illumination and devoted one whole day to topics connected with the getting and retaining of business for central stations.

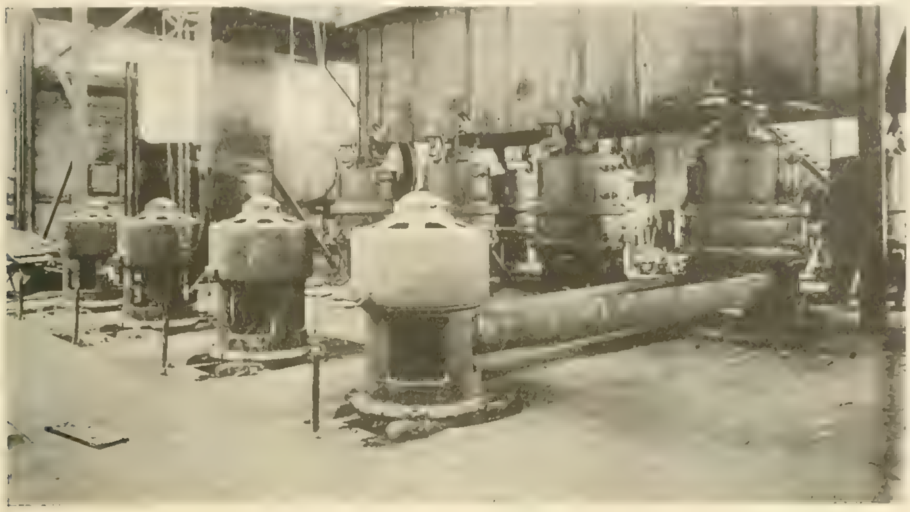
Electric Traction.

Steam-railroad electrification has been one of the absorbing topics of the past year. Whenever and wherever discussed, large and interested audiences were present. As mentioned earlier, the opening meeting of the Institute in the new building was devoted to this topic, and an exceptionally large number of other papers have treated of it.

The subject divides itself naturally into two parts—first, under what circumstances should steam roads be electrified; second, under what particular conditions is the direct-current or the alternating-current motor to be preferred? There has been some criticism on the part of steam-railroad men that electrical engineers are forcing this matter too rapidly. At the same time substantial progress has

been made both in direct-current and alternating-current railroad electrification.

After years of experimentation, late in the spring the New York Central Railroad began full electrical operation on the New York terminal with direct-current locomotives. One of the early passenger runs, on February 16th, was the occasion of a serious accident, in which a score of persons were killed and more than one hundred were injured. The cause of this accident has been variously explained, some experts maintaining that the



ELECTRIC MOTORS DRIVING CEMENT MILLS.

low center of gravity of the locomotive would account for the shearing of the rail spikes, others holding that it was due to excessive speed. The fact is that the train was derailed through spreading of the track. The exact speed may never be ascertained, as witnesses on the train estimate it at from 45 to 80 miles an hour. The superintendent of the road was indicted for manslaughter, and after thorough trial was acquitted early in December. It was shown that all reasonable precaution had been taken by those responsible for the condition of the track and the operation of the road. After more than six months of electrical operation the management is convinced that electrification has resulted in marked increase of efficiency and in financial saving.

The New York, New Haven and Hartford Railroad, which uses the New York Central electrical terminal, has recently established regular service with its alternating-current locomotives. Twelve miles of track, beginning at the terminal, are supplied with direct current at 600 volts from a third rail. More than 22 miles of four-track road is equipped with double catenary trolley carrying 25-cycle current at 11,000 volts. At present 35 93-ton locomotives are used, each being capable of drawing a 200-ton train at 45 miles an hour maximum speed in local service and at 60 miles an hour in express service. While this road has not been in operation a sufficient length of time to permit an estimate of the results, its electrical engineer is convinced that great economy is sure to follow.

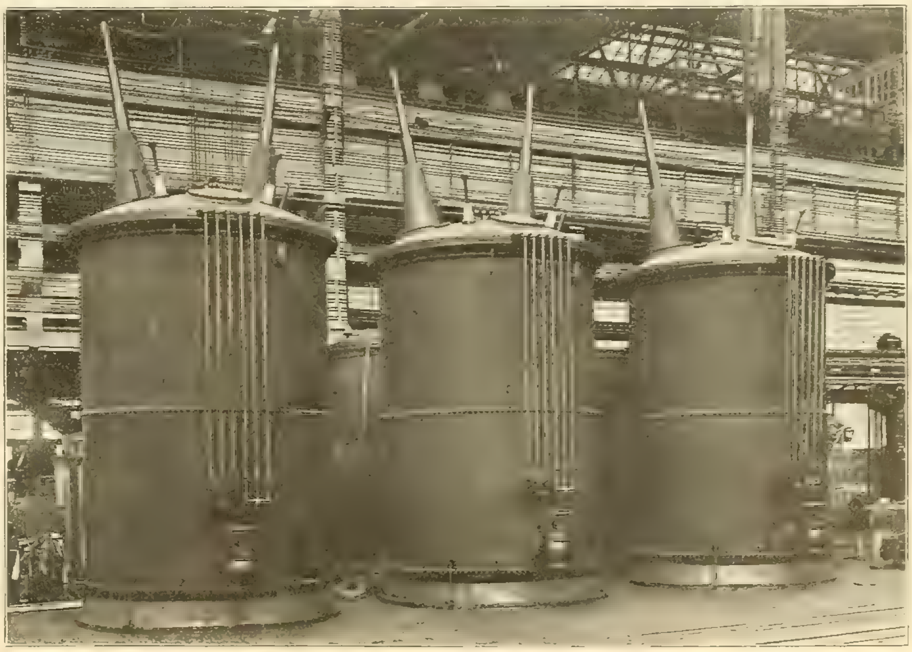
As the chief function of electrification appears to be the increase of capacity, particularly in congested terminals, the results of this stupendous experiment at New York will be awaited with interest. Other roads are already planning to utilize this remedy for congested traffic. The Southern Pacific Railroad is now contemplating the electrification of the Sierra Nevada division, aptly termed by Mr. Sprague the "neck of the bottle." This proposition differs from others, in that it is proposed to handle freight trains weighing 1,000 tons or more over a grade of 1½ per cent. and 83 miles long. The matter has been referred to an advisory board, which will reach a decision in a few months.

The Erie Railroad put into commission early in the year an electrical section, the Rochester division. Apparently this was done to ascertain the facts regarding electrical operation, and thus secure data for future electrification. Trolley construction for 11,000 volts is employed, and, as far as can be learned, the new motive power has given satisfactory results.

Since the pioneer tunnel locomotives of the Baltimore and Ohio Railroad were placed in commission more than ten years ago, this field has been an attractive one for the electric locomotive. The Sarnia tunnel, between Port Huron, Mich., and Sarnia, Ont., will shortly be fully equipped. Trains will be hauled between these cities by [illegible]

The Pennsylvania Railroad, which is rapidly completing its tunnels between New Jersey, New York and Long Island, is experimenting with both direct current and alternating-current locomotives. Sample equipments have been constructed and are now under test. The requirements are severe, necessitating [illegible] decision will be reached in a few weeks regarding [illegible] all-steel construction both for day coaches and Pullman cars.

All of the progress mentioned has been with the series motor. Although abroad the three-phase motor has been developed for traction work to a remarkable degree, it has found little favor here. It is especially noteworthy, therefore, that the Great Northern Railway has selected the induction motor for a mountain division. Its consulting engineer states that the constant-speed characteristics and the possibilities of power regeneration have been important factors in this selection.



SINGLE-PHASE TRANSFORMERS OF 3,750 KILOWATTS CAPACITY EACH. (LARGEST OF THEIR TYPE.)

Aside from locomotive service, the alternating electric-railway motor has made a satisfactory advance during the year. There has been no wholesale changing over to the new form of motor, but such roads as the Pittsburg and Butler Street Railway, the Visalia Electric Company, the Chicago, Lake Shore and South Bend Railway and the Maryland Electric Railway have selected the series alternating-current motor. The Visalia line is the first to employ the low frequency of 15 cycles. In addition to new construction of 13 miles, there are 10 miles of electrified steam track. The line pressure is 3,300 volts.

A year ago the interpole railway motor was in process of commercial application. It is now an [illegible] Central California Traction Company, mentioned in [illegible] ways. These roads will operate at 1,200 volts, and in one case at least the secondary current for the commutating poles will be supplied from a separate exciter at 600 volts. The Indianapolis and Louisville line, although 41 miles long, will be operated from a direct-current station located near the center of the line and without sub-stations of any kind. This indicates the possibilities of direct-current transmission at the higher pressures, the possible range of operation increasing greatly with the 1,200-volt transmission.

The higher voltages, for alternating current especially, have required better insulators, and the manufacturers have met the demand with fair success. Undoubtedly the serious problem at present is the safe and secure support of the slender overhead wires, so that danger may be eliminated and increased reliability secured.

The American Street and Interurban Railway Association closed its second year with a great convention at Atlantic City. A mammoth exhibit covered the Steel Pier and the sessions were extremely profitable. The most noteworthy achievement was the adoption of a Code of Standards for electric-railway equipment, prepared by the Engineering Association. On January 1, 1908, an expert statistician was added to the secretary's force, and a special effort will now be made to secure and arrange a most complete collection of electric-railway data.

Power Generation.

As a prime mover for steam-power stations the steam turbine has demonstrated its superiority and has proved entirely reliable. For the present the limit of size appears to have been reached, not because of the impracticability of building larger turbines, but because there is no advantage in doing so. The Rateau turbine, of the impulse type, has taken its place with the well-known Curtis, Parsons, Allis-Chalmers and de Laval engines. The direct-current generator has been successfully adapted to turbine speeds, and thus a new field is opened up for the turbine. In a recent Institute paper a description of an exhaust turbine installation, along the lines suggested by Mr. H. G. Stott, is described. The plant is that of the Wisconsin Steel Company at South Chicago. A 1,000-horsepower reciprocating engine delivers its exhaust steam into a regenerator or heat-storage reservoir in which the heat is absorbed by a large volume of water. The turbine draws its steam from this at slightly above atmospheric pressure and exhausts into condensers. As the load on the engine is variable, the regenerator is necessary in order to produce a uniform supply of steam to the turbine. The turbine drives a direct-current generator of special construction.

One of the most complete power stations of the

past year is the Bennings (Md.) station of the Washington Railway and Electric Company of Washington, D. C., installed by J. G. White & Co., and described in the Western Electrician of June 1, 1907. Here the engine room presents a particularly neat appearance, on account of the absence of all auxiliaries, which are located on the floor below. The new station is of interest as typical of the present tendency toward compact, neat and simple construction. On account of its proximity to the city special attention has been given to the architecture, which is comparable with the buildings at Niagara Falls.

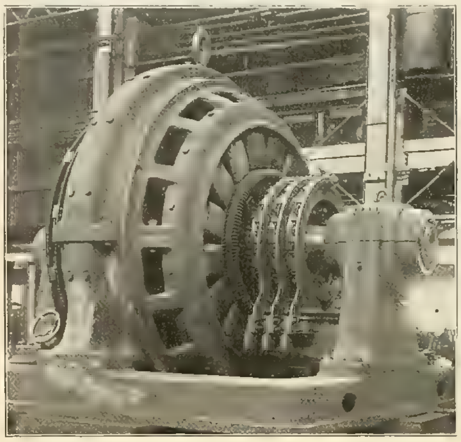
An annual review is incomplete without mention of the plants at the great waterpower center. All of the projects have reached a satisfactory stage and each is supplying its own territory with power. The beautiful building of the Electrical Development Company fulfills all expectations. This company has been during the year supplying Toronto with power. The Niagara Falls Power Company's new plant corresponds in general style with the American power houses. The Ontario Power Company has several units in operation, and is supplying power at Syracuse and at many points en route. The new power house of the Niagara Falls Hydraulic Power and Manufacturing Company is the latest project. Sixty thousand horsepower of units was installed during the year. This will all be used locally.

The gas engine as a prime mover is increasing in popularity, and it imposes special conditions upon generator design. A typical installation containing the largest gas-engine-driven alternators in the world is the Martin Station of the California Gas and Electric Corporation. These Crocker-Wheeler machines have kept in step under the most violent fluctuations of load, and even under back explosions of the gas engines. The Allis-Chalmers Company has delivered two 2,000-kilowatt gas-engine alternators to the Illinois Steel Company, and others to the American Steel and Wire Company and to the Milwaukee Northern Railway. The latter has the largest gas-engine electric-railway power plant in the country. It has at present two 2,000-horsepower units, each consisting of a four-cylinder gas engine directly driving, at 107 revolutions per minute, a 405-volt, 25-cycle alternator.

One of the novel developments in electrical machinery is the combined rotary converter and booster installed by the Westinghouse Electric and Manufacturing Company for the New York Edison Company. The booster is an alternator mounted on the same shaft as the converter and forming mechanically an integral part of it. The booster armature is connected in series with the alternating-current side of the converter between the rotary [illegible] armature winding. It does not therefore require a separate collector and brush-holder mechanism. The direct-current voltage [illegible] raised or lowered by reversing the current in the booster field circuits, [illegible] The device seems to represent a marked improvement over previous methods of converter regulation.

As the generating units in power stations im- [illegible] ments, circuit-breakers, lightning arresters, etc. This [illegible]

creasing pressures. Two Westinghouse devices that deserve special notice are the electrolytic lightning arrester and the automatic synchronizer. The former is familiar in principle, as it was described last year in an Institute paper. It has now been put into service and has been applied up to 60,000 volts. If it proves commercially successful it will mark a real step in a direction in which progress is needed. The synchronizer consists of a contact arm which is oscillated by two magnet coils, the oscillations corresponding to the difference in frequency of the two circuits to be connected together. When the rate is sufficiently slow a contact spring bridges a gap between two contact plates carried by the



The Booster is the Right-hand Part of the Machine.
COMBINED ROTARY CONVERTER AND BOOSTER.

arm. Current flows across the gap from an auxiliary circuit and operates the mechanism controlling the main switch which is thrown in.

POWER TRANSMISSION.

Power transmission continues to develop new problems, particularly as the tendency to increase line pressures continues. While size is of secondary importance, it is interesting to note that the record has been broken again in transformer construction. The Grand Rapids and Muskegon Power Company has purchased a number of 100,000-volt, 3,750-kilowatt capacity, single-phase transformers, the largest yet constructed. It will be but a short time before 100,000 volts will be the standard high line pressure.

The pin-supported insulator is not adapted to pressure much above 60,000 volts, as it is too tall to have the necessary mechanical strength. A radically new type has therefore been developed. This insulator hangs from the cross-arm with the transmission wire at the bottom. It is in sections, each of which may be large enough to withstand 20,000 volts. In one form, described by Mr. E. M. Hewlett at Niagara Falls, the sections consist of separate porcelain dish-shaped disks held together with steel wire loops. These loops, in passing through eyes in the porcelain, link together, giving the name "link" insulator. The Locke Insulator Manufacturing Company has under construction a large number of insulators on this general principle, although differing radically in appearance from those described by Mr. Hewlett.

Several power-transmission schemes have been completed during the past year. One that has attracted attention is the system of the Ontario Power Company. This was fully described by the engineer, Mr. R. D. Mershon, at Niagara Falls. This line will be an important factor in the industrial development of Central New York. Another important new hydro-electric plant is that of the Chicago Drainage Canal, described and illustrated elsewhere in this issue.

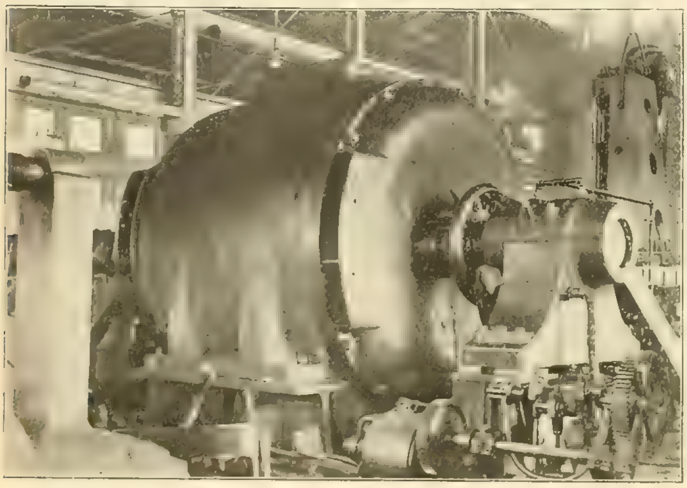
POWER REPRODUCTION.

While less spectacular than some other lines of progress the application of the electric motor to new uses and in growing quantities is having an important bearing on industrial development. Not only are standard motors being largely bought and applied to various loads, but special motors, horizontal and vertical, are being designed. The largest as well as the smallest manufacturing companies are devoting attention to the small motor, even down to one-twentieth horsepower.

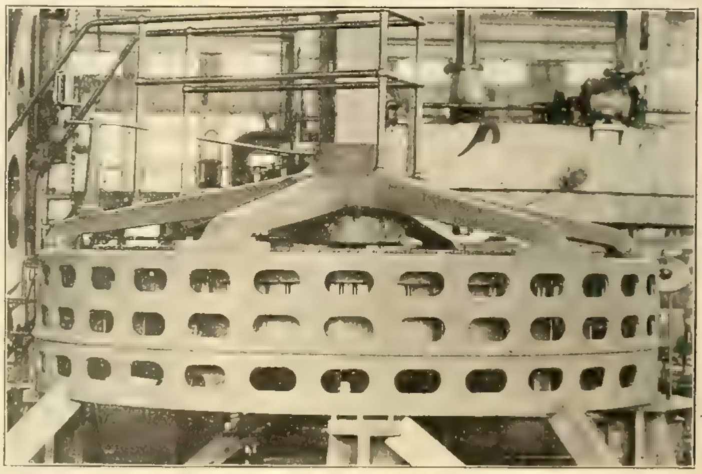
The steel mills present at present an attractive field for electric drive. At the plant of the Illinois Steel Company in South Chicago a 30-inch plate mill has two 2,000-horsepower, 575-volt, direct-current Westinghouse motors direct connected to the rolls and with a speed variation from zero to 150 revolutions per minute. These motors are supplied with current from a motor-generator equalizer set. A 1,300-horsepower induction motor drives a direct-current generator. Heavy flywheels, each weighing 50 tons, serve to absorb energy during light load and restore it when the rolls require extra power. The speed of the equalizer motor is reduced automatically by resistance inserted in the secondary when the load is heavy.

At the same plant is a re-rolling mill direct driven by two induction motors, one with 12, the other with 24 poles. When connected in tandem the capacity is 1,800 horsepower. Separately the 24-pole motor produces 1,200 horsepower. Heavy flywheels are mounted on the motor shafts.

So important has the steel-mill business become that special lines of motors are being designed for it. During the past year the Crocker-Wheeler Company has installed a number of motors of a rugged type, with great commutating ability. In addition to the motors described the Westinghouse Company has equipped several mills. In the last year's review the 6,000-horsepower motor designed by the General Electric Company for the Indiana Steel Company was mentioned. Wherever furnace gas is available there is a field for the electric motor, driven from gas engines as prime movers. The direct-current motor is most readily adaptable to mill conditions, but there is a field for the induction motor, and the two in combination appear to be ideal.



A 3,250-KILOWATT TURBO-GENERATOR UNDER TEST.



A VERTICAL 450-HORSEPOWER INDUCTION MOTOR TO DRIVE CENTRIFUGAL PUMP

TRANSMISSION OF INTELLIGENCE.

From the commercial standpoint the most prominent fact of the year in telegraphic circles was the great operators' strike. After numerous local difficulties in several sections had led to strikes and concessions, and after strenuous efforts on the part of Labor Commissioner Neill to effect a compromise, a general strike of the Telegraphers' Union was declared early in the summer. All commercial operators of both companies were affected and for a short time business was seriously interfered with. The companies soon restored their service to a remarkable degree of efficiency under the circumstances. The companies apparently have been

victorious in the struggle, and business is now transacted as usual. Public sympathy does not seem to have been very strong in favor of the strikers.

The strike is said to have had a stimulating influence upon the automatic high speed telegraph development. In August the Postal company added to its Rowland equipment the Chicago-St. Louis and New York-Philadelphia lines, having had the Boston-New York line in successful operation for a year or more. This is a very significant situation. Apparently the Delaney system is to be tried upon a large scale as it is now being exploited commercially. The general plan is to connect the large cities by trunk lines, over which the messages will be sent at high speed and received on chemical tape. From the main centers they will be distributed by the most convenient and economical means.

After years of experimentation, commercial transatlantic service by radio-telegraphy has been established. On Friday, October 18th, 14,000 words were transmitted by the Marconi company between the two coast stations—Glace Bay, Nova Scotia, and Clifden, Ireland. The messages are carried at much lower rates than over the cables, and there is no reason to believe that sufficient business will not develop to keep the plants busy continually.

Radio-telegraphy on land is also making substantial progress. For example, in Alaska, when conditions are especially adapted to this means of communication, regular business has been conducted for some time. At present the United States Signal Corps is extending the equipment to cover Safety Harbor, St. Michael, Fairbanks, Circle and Valdez.

In automatic telephony some interesting improvements are reported. The perfection of the new line switch is one. By its use the number of first selector switches in an exchange is reduced 90 per cent. The space occupied by a complete exchange is less than one-quarter of that formerly required and the total number of working parts and consequent cost of maintenance correspondingly reduced. Common battery for transmission has been made a permanent feature of the automatic system, and all switchboards installed during the year have been of the common-battery type. No extra battery is required, the regular operating battery being used for supplying current to the transmitters as well as for operating the switches. The demand for party lines in connection with the automatic system has resulted in the perfection of the four-party selective ringing system, which employs the well-known "harmonic" principle of selection. The four subscribers on a line have different numbers and only the bell of the subscriber called is rung. Another new feature is the "district station," the object of which is to reduce the cost of construction of a cable plant 50 to 75 per cent. by employing trunk lines only to serve the different districts comprising an exchange. Switchboard units, small and compact, and which require practically no attention, being supervised from the central exchange, are installed in the center of the different districts or suburbs, these units being connected to the main exchange by the requisite number of trunk lines.

Radio-telephony is now an accomplished fact and is in regular use. The 16 battleships of the Pacific fleet, which recently sailed on its long voyage, are equipped with the De Forest system. In general this differs only in detail from the radio-telegraph system. The underlying principle consists in the production and transmission of high-frequency oscillations which form the foundation of the sound waves. They are of much higher frequency than the sound waves and are produced by an alcohol flame shunted across the terminals of a direct-current generator, in series with which are capacity and inductance. Variations in the strength of the oscillations corresponding to the sound waves, are superimposed upon the oscillations by a microphone in the circuit. They are received on the "audion" receiver described by Mr. De Forest in an Institute paper last year. The utility of this invention is obvious, especially as installed on the fleet.

Summary and Conclusions.

As a whole the year 1907 has been as fruitful in substantial results as any of its predecessors. Especially in the commercial application of scientific discoveries and inventions has the development been most marked. In spite of financial and industrial disturbance, real and substantial results have been secured.

The commercial interests have lost a commanding figure in the death of Colonel Eugene Griffin. So also has the scientific and teaching fraternity in the death of Prof. C. P. Matthews. America loses also a firm friend in Lord Kelvin, who passed away on December 17th at the age of 83 years. It is a coincidence that at this time the ocean cable system, to which he devoted some of his best energies, has a rival in the wireless system, to which, however, he gave a cordial welcome.

ELECTRICAL ENGINEERING IN GREAT BRITAIN IN 1907.

[illegible]

WHILE there are [illegible] advances to be chronicled for 1907 the position of affairs from the [illegible] point of view has not differed much from 1906, and the same combination of circumstances continues to exist which was the primary [illegible] of the commencement of the stagnation which has been reflected from year to year during the past three or four years in the accounts of several of the leading British manufacturing firms. A new demand for electrical machinery has been developed in Lancashire and Yorkshire by the increasing inclination of mill owners to adopt electric driving, but this class of business is by no means a monopoly of any particular firm or firms, and there is little likelihood of enhanced prices. Foreign competition is still a serious factor, and one which some chairmen of companies have been endeavoring to bring to the notice of the government, with disappointing results. Most people seem to be agreed that a national association should be formed for the purpose of ventilating the grievances and obstructions under which the electrical industry here now suffers, but it would appear impossible to set the thing going. One leading firm writes me as follows: "With regard to the condition of the market generally, the home trade has been fairly satisfactory in the amount of orders received, though prices are severely depressed. We have been fortunate in the development of our export business, and during the year have done by far the largest export trade we have ever been able to reach."

Electric Lighting.

Of a large number of matters of technical interest the attention bestowed upon metallic-filament lamps and the question of light standards generally stand out prominently. In the same category, arc lamps have been much improved and many new types have been put upon the market. In January an able paper by Mr. James Swinburne, F. R. S., before the Institution of Electrical Engineers, dealt with the new incandescent lamps from a broad viewpoint generally. The interest then aroused seems to have continued unabated throughout the year. Mr. Swinburne is an ardent advocate of the policy of large light units, and in this way he believes that the metallic-filament lamp will not decrease the output of generating stations, for consumers will prefer the larger amount of light given out by such lamps for the same current consumption to reducing the quantity of light for economical reasons. Generally speaking, this may be a quite good prophecy, but against it must be set the fact that several station engineers have been constrained to earmark the use of metallic-filament lamps as the source of a diminished output. Of course, this may have been [illegible] voltages upon the various supply networks. So [illegible] lamps, to find out the voltage existing in the particular locality and to make the lamps accordingly, but stamping them for the nominal voltage. Trade jealousies would appear to stand in the way of any close co-operation between the makers, but a strong effort is being made to improve matters by the formation of a Society of Illuminating Engineers, the moving spirit in which is Mr. Leon Gaster, who has borrowed the idea from the United States after a visit there last year.

Several other papers followed that of Mr. Swinburne, mostly emanating from the National Physical Laboratory. In conjunction with these was issued a standard specification for carbon-filament lamps by the engineering standards committee, which was the work of the special standards sub-committee presided over by Mr. R. T. Glazebrook, F. R. S., the director of the National Physical Laboratory. The standard candlepowers specified were 8, 12, 16, 25 and 32, the standard pressures 110 and 220 volts, and the useful life 400 and 800 hours, which is to be applied to both pressures. The specification details the tests to be made to batches of lamps in the proportion of five per cent., and generally goes into great detail.

Coming to the more practical side of the question, mention may be made of the very extended use of Osram lamps for street-lighting purposes. One firm also introduced an entirely new metallic-filament lamp which was said to give from 50 to 60 candlepower on 100 to 130-volt circuits with an efficiency of one watt per candle. These lamps cannot, however, owing to the fragility of the filaments, be used in any other position than the vertical. It was further declared that the average life was from 800 to 1,000 hours with practically no depreciation in candlepower. So far as any extended application goes, tantalum and Osram lamps at present hold the field, and are used in very large numbers.

Among the features in connection with improvements in flame arc lamps are the use of pure carbons, with a consequent white light, in contradistinction to the yellow light so characteristic of flame arc lamps generally. This, however, is not becoming general, but is peculiar to one type of lamp.

In connection with the experimental scheme of

This is the Largest "Scissors" Crossing in any of the Tubes.
GREAT NORTHERN, PICCADILLY AND BROMPTON "TUBE" RAILWAY, LONDON.

arc lighting in the city of London, in one portion of which the lamps are suspended in the center of the roadway from wires attached to the buildings, a new type of magazine arc lamp is used. The scheme in question is the outcome of a persistent agitation on the part of the two electric-lighting companies serving the City, to be allowed to demonstrate what is possible with modern arc lamps. The history of street lighting in the City of London dates back to the early Brush days in the '80's, when the then engineer to the City Corporation insisted upon a basket-pattern lantern with frosted glass, which had the effect of considerably reducing the effectiveness of the lamps. These lamps are in existence today, and the price originally charged was naturally a high one. For a long time one of the City supply companies, at any rate, has been anxious to modify the original agreement, both in the matter of light and of price, but the gas companies two years ago secured the ear of the Corporation and were successful in ousting the electric light from certain streets. After further perseverance, however, the electric-lighting companies early this year were allowed to prepare a scheme of experimental lighting by means of flame arc lamps which will continue throughout the winter. The price is £17 10s. per lamp, all costs being borne by the companies.

The Blondel enclosed arc lamp, recently patented in this country, has now been put upon the market. This lamp is said to be an improvement upon that of Bremer, patented in 1900, in that it provides suitable draft devices for facilitating the circulation of the gases to such an extent that no deposit of any importance can be formed on the globe until after long periods of working.

Another lamp with several distinguishing features is a flame arc lamp by the British Thomson-Houston Company in which the principal parts are gunmetal castings and brass tubing, with phosphor-bronze fittings. The "economizer" is a metal casting. A permanent magnet is also used to provide the magnetic field for steadying the arc. The same firm has also introduced a long-burning twin-carbon lamp, the claim being for 100 hours or so without attention. An improvement in an already established lamp, the Magnet Juno, has been the substitution of an electromagnet for the original hot-wire arrangement for striking the arc.

These constitute the leading improvements in arc lamps, but several other new types and modifications have been patented, although they are not yet upon the market.

The Moore vacuum lamp made its appearance in this country during the year and was exhibited for some time in London. A factory has also been started up for the manufacture of a new leading-in wire for incandescent lamps. This conductor con[illegible] copper and enamel glass, which, when melted together, is said to be amalgamated, as it were, and not merely in juxtaposition.

Power-station Design.

[illegible] power-station work, while all large [illegible] as a general rule, included steam [illegible] there have been a few exceptions, notably the installation at the power [illegible] Great Western Railway Company in [illegible] large alternators and still larger possibilities in the way of future de[illegible] engineer [illegible] adopt reciprocating engines.

[illegible] turbine, and the application of these machines to exhaust-steam working. Willans & Robinson, who are [illegible] part in the development of the Parsons turbine, have evolved a new method of shrouding the blades, and this has so improved the efficiency of working that Messrs. Parsons have also adopted the method. Willans & Robinson have also introduced a mixed type of turbine, mainly for use in mines, iron works, etc., which uses live steam economically during the night and exhaust steam during the day. The fact that a large proportion of the engines at present working in collieries and iron works are working non-condensing, has opened up a field for the steam turbine which can utilize the exhaust steam without increasing the coal consumption. It is said that whereas a steam turbine of comparatively small size, working with 140 pounds steam pressure, a moderate superheat and a vacuum of 28 inches, will take about 20 pounds of steam per kilowatt-hour, an exhaust-steam turbine working with steam at atmospheric pressure and exhausting into a condenser maintaining a similar vacuum of 28 inches, will give a kilowatt-hour for an expenditure of 40 pounds of exhaust steam. Several 1,000-kilowatt machines of this type have been erected in South Wales and two of 1,350 kilowatts each, the latter being the largest machines of the class yet designed, are being erected at Middleborough.

It is of interest to note that the Glasgow Corporation all but purchased a 3,500-kilowatt Zoelly turbine, but after a deputation had visited the works in Switzerland, where this type is made, it was decided not to go in for what was more or less an experiment, owing to the fact that no machine of this size was actually in operation.

The Curtis turbine makes progress, and interesting tests were published of a 1,000-kilowatt machine supplied to the Lancashire United Tramways Company which gave results well in advance of the guarantees and entitled the contractors to substantial bonuses. A fine performance by a Parsons turbine installed at the power station of the Newcastle Electric Power Company gave a steam consumption of slightly over 13 pounds per kilowatt-hour as the result of a number of tests on a 3,500-kilowatt machine.

In my article last year mention was made of the introduction of the Peebles-La Cour motor converter, and the very high efficiencies guaranteed by the makers. This machine consists of an induction motor and a rotary converter mounted either upon a common shaft or upon rigidly coupled shafts having the winding of the rotor of the motor and the armature of the converter connected up in parallel. There have, during the year, been installed for the Manchester Corporation three machines, which, to the best of my knowledge, are the largest converting units yet manufactured in Great Britain. These machines were originally rated at 1,500 kilowatts each, but in practice they have continuously carried a load of 1,900 kilowatts without exceeding the temperature rises ordinarily specified for continuous running.

Regulation of Power Factor.

An important detail in power supply which has received some attention is the regulation of power factor, and Mr. Fedden, the chief electrical engineer to the Sheffield Corporation, has been prominent in the study of this problem. The following extract from a paper read by one of his staff at the summer meeting of the Incorporated Municipal Electrical Association will explain what is being done in this matter:

"The machine about to be installed on the Sheffield system is required to relieve the plant and [illegible] the excessive amount of idle current which sometimes occupies them. It will be situated at the old generating station at Sheaf Street and will serve to keep the trunk mains from Neepsend loaded at a power factor approximately equal to unity. It will be of 600 kilovolt-amperes capacity, and, in order to keep the starting current low, it will be started by a small induction motor, and switched into parallel on attaining synchronous speed in the same manner as an ordinary generator. A power-factor meter is to be provided, so that the effect which the machine is producing may be read at intervals. The cost of the machine, with the necessary switch gear and accessories, will be about £800, and it would appear that the cost of running the machine for a year would not exceed £200. For this sum, plant and mains to the extent of 420 kilowatts will be liberated. Extra plant to this amount would cost £5,000, without buildings or mains, and the capital charges alone would be £300. These approximate figures serve to give some idea of the improvement it is hoped to effect by the installation of the machine."

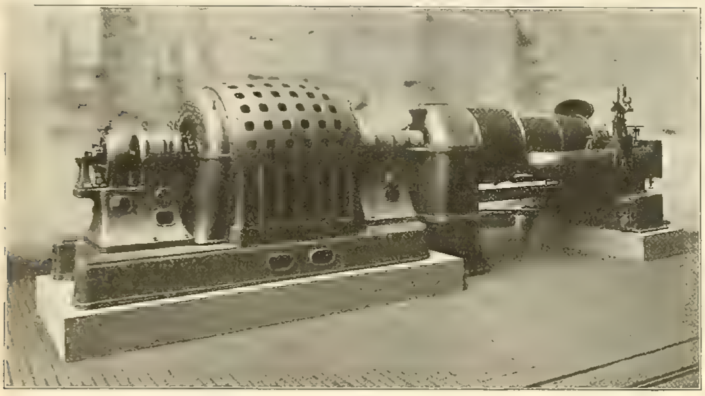
The introduction into this country of the Moscicki condenser, which has been designed with the same object in view, was also made at about the same time the above paper was read.

Current Supply from Power Stations.

Several large supply stations have been put into operation during the year, the three most important ones all being in the vicinity of London, viz., the Kent Electric Power Company, South Metropolitan Electric Light and Power Company and the Marylebone Council. The Kent company comes within the category of bulk-supply companies, and although originally sanctioned in 1902, it has only just started up. It has a very promising area in the southeast corner of England, and a start has been made with a couple of 1,500-kilowatt Parsons turbo-generating sets. The South Metropolitan company is an old provisional order undertaking, which, like many other of the original lighting companies, is rapidly developing a larger area, and acquiring a power load of considerable dimensions. In pursuance of this policy a new power house has been erected at Greenwich.

The works erected by the Marylebone Borough Council are interesting mainly from the antecedent history. Anxious to get rid of the company supplying this area, the Borough Council decided to purchase the undertaking before the company's franchise expired, and after arbitration proceedings was greatly surprised at the arbitrators' award of $7,250,000 as the purchase price of an undertaking upon which less than half this sum represented capital expenditure and the remainder compensation for good-will and future profits. However, the Council bowed to the inevitable, and has now erected an up-to-date station. There are five 2,000-kilowatt turbo-generator sets of the Parsons type, and the equipment as a whole is most modern.

Outside London, the progress of electric power supply in its special application to the "bulk" supply companies has to be viewed with somewhat mixed feelings. The Newcastle company is pursuing the even tenor of its way, and additions are being made both in territory and load with a regularity which testifies to the soundness and wisdom of the management and engineers. In Lancashire and Yorkshire, the power companies, equipped with Curtis turbo-generators, although making slow improvement, are not experiencing anything approaching a boom, and no start has yet been made in erecting additional power stations. The original intention of power-company promoters of supplying many hundreds or thousands of square miles from one power house placed more or less in the coal fields, is now being abandoned in favor of a number of stations dotted about the area, each with a



2,000 KILOWATT TURBO-ALTERNATOR BUILT FOR SYDNEY, AUSTRALIA.

ELECTRIC LOCOMOTIVE FOR METROPOLITAN RAILWAY, LONDON.

certain prescribed limit of operation corresponding with the economical limits of transmission. The York lime company has entered into an arrangement with a company for the erection of a calcium carbide works next to the power station to which power will be supplied only at times of light load. If this scheme matures, there will be the twofold advantage in it of filling in the valleys of the power company's load curve and of helping to revive a dying industry, which has, during recent years, largely transferred itself to the Continent, owing to the lack of cheap power.

In South Wales an unfortunate position has been reached in that the South Wales Electrical Power Distribution Company, unable to fight against the competition of private plants in the collieries there, was forced to reconstruct, at considerable financial loss, and to sell the whole of its generating stations either to separate companies or to the local authorities. The main power stations have been purchased really by the consumers, and there will be co-operation with the original company.

In London the electric-lighting companies, hitherto disunited by petty jealousies and handicapped by the inconsistency in their methods of opposing the power schemes, have collected their scattered forces and will, next session, petition Parliament for the establishment of a joint committee, drawn from the various companies, which shall acquire all the existing undertakings and carry on one comprehensive scheme.

[illegible] [illegible] plant [illegible] [illegible] England.

[illegible]

A rapid [illegible] place in the [illegible] and manufacture of electric cranes, and an illustration is given as typical of the work in this direction. The great crane shown in the picture was made by Stothert & Pitt.

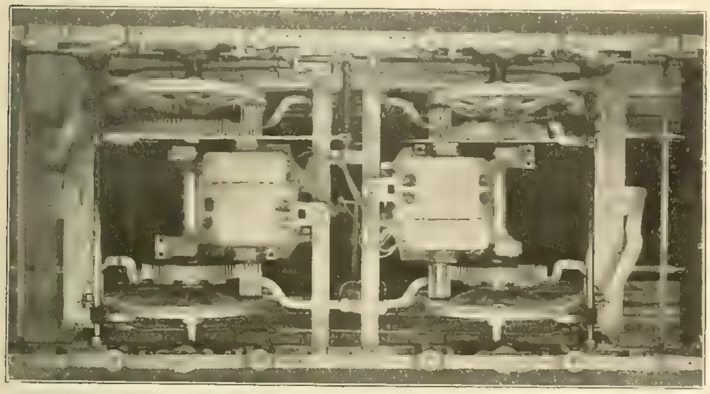
Quite a unique installation of electric pumping plant in a mine was completed in the autumn at the Lindal Moor Mines in the Barrow district. The mines exist for the extraction of iron ore, and in several of the pits pumping operations ceased in December, 1903, owing to breakdown and [illegible] the pumping plant then existing being insufficient to cope with the inrush of water. At the time the pumping operations ceased the maximum inrush of water reached nearly 7,000 gallons per minute, though the normal dry-weather flow only amounted to about 4,000 gallons per minute. Great difficulties were experienced in designing pumps which could be efficiently handled in the very small shafts, which varied from five feet three inches by three feet five inches to eight feet four inches by six feet. Eventually a special arrangement of high-speed centrifugal pumps, direct-coupled to electric

[illegible] plant installed, although it is within the area of a power-supply company.

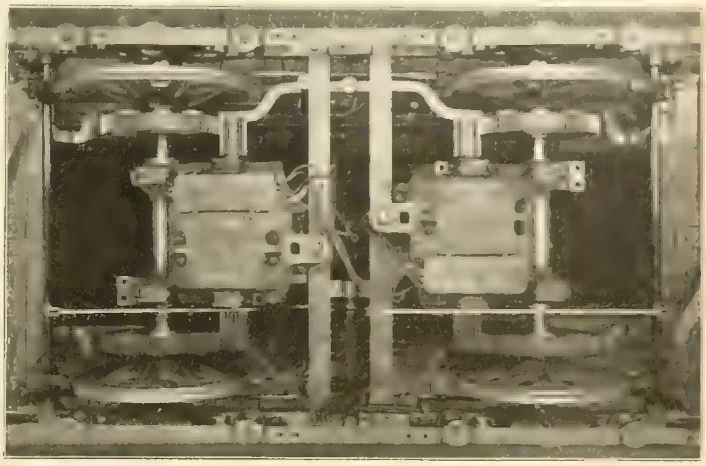
Recent statistics go to show that by the end of March next year there will be about 28,000 horsepower of motors running in cotton mills, and great activity now prevails in the Lancashire and Yorkshire districts. Although the figure given is small [illegible] States, yet it must be remembered that it is the [illegible] progress is comparatively rapid.

[illegible]

London has been most prominent in the matter of new works, for no less than three new tube railways have been completed and put into operation, viz., the Great Northern, Piccadilly and Brompton Railway, which now gives a direct connection between the north and west of London; the Charing Cross, Euston and Hampstead Railway, which links up directly the city and the pretty Hampstead suburb; and the extension of the City and South London Railway from Islington to Euston, which now fulfills the special function of conveying passengers arriving by the three main line termini



Position of Wheels and Gears on Four-foot Gauge.



Wheels and Gears on Gauge of 4 feet 8½ inches.

EXTENSIBLE-AXLE TRUCK FOR ENGLISH ELECTRIC RAILWAYS OF VARYING WIDTH.—NOTE ADJUSTMENT ON PINION.

Of more than ordinary interest is the acquisition by a London firm of the British rights of the Thury high-tension direct-current series system of power transmission, a long paper upon which was read before the Institution of Electrical Engineers in the spring.

Municipal Ownership.

A glaring case of municipal mismanagement occurred at Woolwich, where the accumulated losses were found to amount to over $50,000, necessitating a heavy tax rate to make good, and the condition of the undertaking generally was such that Sir Alexander Kennedy, when called in to advise, could see little prospect of a remunerative undertaking being evolved for many years, owing to the uneconomical manner in which the works and system generally had been planned originally. Another case occurred at Monmouth.

A redeeming feature has been the keenness with which Local Government Board officers have inquired into these matters. It is worthy of record, however, that a more enlightened attitude is being acquired by local authorities toward electric power companies, and several instances have occurred in which municipalities having their own electric works have contracted to take an auxiliary supply from their quondam enemy, the power company.

Increasing Use of Aluminum.

The high price of copper during the middle of the year was the signal for some activity in placing aluminum cables upon the market. The Aluminum Corporation, which has set up works during the year in North Wales, has installed some interesting machines for aluminum production, several of which are driven by induction motors from the mains of the North Wales Power Company. These are 1,000-kilowatt units, consisting of an induction motor and two direct-current generators, the interesting feature of which is the very low voltage. The full output is given at 75 volts, so that enormously heavy currents have to be handled. Several more units of this size will be driven by a further hydro-electric development in North

motors, was devised. In two of the pits which are inclined at an angle of 40 degrees, two pumping sets have been installed, each capable of delivering 4,000 gallons per minute against a total head, including friction, of 395 feet. Each of the motors direct-coupled to these pumps is capable of a continuous output of 750 horsepower when working on a circuit of 3,000 volts, 50 cycles per second, and the speed of the combined sets is 1,485 revolutions per minute. In the two other shafts two vertical sinking pumps have been provided, each capable of raising 1,000 gallons per minute against a head, including suction, delivery and pipe resistance, of 680 feet. These motors have an output of 315 horsepower at 1,480 revolutions per minute. The motors are of special design for working under the abnormal conditions and are constructed with particularly narrow dimensions to admit of their passing down the narrow pumping ways available. A special feature of the installation is that the high-tension current of 3,000 volts is taken directly to the motors without intervening transformers, a special power house having been erected and overhead transmission lines employed for conveying to the four pits being dealt with. The whole of the control of the pit motors is from the power house. Another feature is that the cable for each of the motors is wound round a drum and is paid out as the pumping plant is lowered as the water level is decreased. It is anticipated that the cost of this pumping plant will be repaid by the valuable minerals which are in the pits and which will become available now in a very short time.

I have previously mentioned the increasing use of electricity in cotton and other mills where the peculiar conditions prevailing are now better understood by electrical engineers than used to be the case. Three very large installations of this type now being carried out are the Thor Spinning Mills with 90,000 mule spindles, the Arc Ring Spinning Company with 60,000 ring spindles, and the Falcon Spinning Company with 82,000 mule spindles. The aggregate horsepower of three-phase motors required for these mills alone amounts to 3,500 horse-

in the north of London over to the main southern lines.

The City and South London extension is upon the three-wire direct-current system, which stands alone as an example of this system and is unique in that both from the engineering and financial points of view this undertaking—the first tube railway to be established in London—has maintained an exceptionally uniform success, the only fly in the ointment being the operation of the London County Council tramways directly overhead for a considerable portion of the route at fares which a commercial undertaking operating under the special conditions of a tube railway finds it exceedingly difficult to compete with.

The other two lines mentioned have been constructed upon the standard adopted by the Underground Electric Railways Company of London, and generally are replicas of the Baker Street and Waterloo Railway, opened last year. The supply of power is obtained from the Lot's Road generating station which deals with the whole of the Yerkes group of tubes and also the District Railway.

An economic question upon which the success of the railways depends is that of fares, for since the late Mr. Yerkes originally formulated his ideas the conditions of London traffic have changed in a most remarkable manner. I remember well Mr. Yerkes' scorn and disgust when he was seeking parliamentary sanction for taking over the lines five or six years ago that such a city as London should still have horse-drawn omnibuses. Well, we still have them today, but Mr. Yerkes naturally was quite unable to foresee the enormous development of mechanically driven omnibuses which, although they have probably not been successful either financially or from the engineering sense, yet have provided a means of communication which has sadly militated against the anticipated success of tube railways, and they have come into being at a quicker rate than the latter. Consequently, when the new tubes got into working order it was quickly found that over a good portion of their routes a compe-

tition was being carried on which could only be obviated by arrangement, and due in a large measure to the tact of Sir George Gibb (Mr. Yerkes' successor) this has now been brought about with some hope of success.

Another factor in this problem is the rapid progress which the London County Council is making in the extension and conversion of its undertaking. After many years' striving a new line has been opened over Westminster Bridge, giving the first direct tramway connection of this character, while probably before this article appears a through route will be inaugurated which will make possible communication between the northern and all the southern suburbs.

Another feature of the position in London has been the appearance at last, upon a commercial basis, of electrically driven omnibuses which, from æsthetic reasons, were a success before they actually appeared. The company operating these buses is the much-maligned one which issued a prospectus early in the year. The effect of the criticism has been exceedingly beneficial in many ways and there is now every prospect of the venture being a commercial success. The company is working with batteries consisting of 44 two-volt cells of 500 ampere-hours capacity, and it has been ascertained that the mileage which these batteries can run is equal to 36 miles after allowing for 30 per cent. reserve. The power house and system of the Great Western Railway Company, with its comparatively small reciprocating sets, was recently described at length in the Western Electrician and needs no further mention here.

The provincial tramway systems have gained notoriety by an exceptionally long series of accidents to runaway cars, and considerable attention has been directed to the evolution of a brake which will obviate skidding. A committee formed by the Tramways and Light Railways Association and assisted by the Board of Trade has been investigating the question and inspecting many types of brakes. One of the most successful was that devised by the tramways department of the Leeds corporation, and it has withstood some severe tests. This particular type involves the dispensation of brake shoes acting on the carwheels. The general principle of the brake is that the drag of the electromagnets or main track shoes is utilized to press auxiliary track shoes on the rails instead of on the wheels. The brake can also be operated mechanically.

One of the greatest drawbacks to intercommunication between tramway systems here has been the number of different gauges adopted. Although the majority of systems are on the standard gauge of 4 feet 8½ inches, there are quite a considerable number of 3-feet 6-inch and 4-foot systems, and apart from laying two tracks on one of the systems, the only other way of permitting intercommunication was by a truck with movable wheels. Mr. John Spencer, the tramway manager to the Bradford corporation, has had this problem under his particular notice in trying to arrange intercommunication with Leeds, where the gauge is 4 feet 8½ inches against 4 feet at Bradford. An extensible gauge truck designed by him has now been running over the two sets of lines for several months and a permanent service has been arranged for. This has involved the use of a fixed axle and extra long pinions. Of course the brake shoes had also to be arranged so that they would slide with the wheels.

In addition to the surface-contact tramway line now under construction in London, parliamentary powers were obtained during the year for the adoption of the Dolter system at Oxford, but the conditions of the money market at present prevent the promoters from carrying their scheme into effect.

The electric locomotive shown in one of the illustrations is one of a number supplied to the Metropolitan Railway Company for hauling freight trains, but they are also employed for drawing some of the passenger trains composed of compartment carriages which the company does not yet see its way open to throw out of service. Each locomotive, supplied from a 600-volt circuit, can haul a passenger train weighing 120 tons at a speed of 35 miles an hour on the level. The total length is [illegible] of these locomotives and also those of the "tube" train shown in the open was supplied by the British Thomson-Houston Company.

[illegible]

Writing more than a month after the official in- [illegible] transatlantic service, one is justified in saying that it has not come up to the anticipations held out. No private messages are yet accepted, and it is on but rare occasions that messages are to be seen in the papers transmitted by this method. The blame for the present position is placed by the company upon the shoulders of those in charge of the land lines, and from the statements made it would appear that no effective transatlantic wireless service can be looked for until the Marconi Company possesses an extensive network of private land lines.

In the meantime the Amalgamated Radiotelegraph Company, owning the Poulsen patents, is pushing ahead with its station, also on the west coast of Ireland, which is ultimately intended for a transatlantic service. The output of the station is said to be about 15 kilowatts. The British Poulsen patents were transferred to the Amalgamated Company early in the year, and the same company also owns the British De Forest patents. Mr. Maskelyne, who also is the inventor of a wireless system, is the technical director of the company. The assertion of this company, that it is able to prevent interference with its messages by outsiders, seems to have been amply supported by numerous tests made in the presence of leading wireless experts here.

The deliberations of the committee appointed by the government to consider as to the advisability of confirming the Berlin wireless convention of 1906 were the means of throwing much light upon wireless telegraphy generally, and as a history of the whole subject the proceedings were invaluable. All the British delegates had returned from Berlin firmly convinced that adhesion to the convention was the correct policy on the part of Great Britain, and it therefore came as no surprise that the efforts of the Marconi Company as the only opponent to this policy were unavailing. Arrangements were made, however, for compensation to the company if, under certain conditions, damage to its business could be shown as the result of three years' working of the convention.

Telephony.

Two transfers of municipal telephone undertakings have taken place, viz., Brighton to the Postoffice and Swansea to the National Telephone Company. Portsmouth and Hull now remain as monuments to the inefficiency of the principle of municipal telephones enunciated in the Act of 1899, and it is safe to assume that even if these undertakings do not capitulate before, their licenses will not be renewed when they fall in. The Postoffice telephone system is following the lines of development originally laid out for it and exchanges have been opened in a number of suburbs. Large extensions are being carried out at the central exchange, which deals with the City area, and the erection of a new plant on the river side at Blackfriars is being rapidly proceeded with.

The National Company also changed over from an old to a new exchange in one of its most important districts in the west end. Co-operation between the Postoffice and the National Telephone Company, as contemplated by the agreement of 1905, is being strictly carried out, and for this reason opponents of the new measured rate of charging for telephone service have been deprived of the one-time useful appeal to the government in such matters.

An important decision was given during the year to the effect that private telephone wires come within the monopoly of the postmaster-general and as such must be licensed. This covers such lines as those between, for instance, a man's private house and his factory, or between two factories of one firm when these lines are used solely for the business of one firm.

The Telegraph.

Telegraph lines to the north of Scotland have again been the subject of deputations to the postmaster-general, but chambers of commerce and local authorities throughout the kingdom have yet to learn the futility of attempting to hurry government departments. At the same time commercial considerations come into play in the matter which the advocates of unlimited extension seem to overlook. Very considerable progress has been made with the trunk-line system of the country during recent years and the engineers to the Postoffice are fully alive to the telegraphic requirements of the nation.

The Pacific cable continues to be the white elephant which it was always predicted it would be, and the loss for the year ended March last amounted to $275,000. This has to be made good in varying proportions by Great Britain, Canada, Australia and New Zealand.

A telegraphic legal decision of some importance was the upholding of the validity of the Brown submarine relay patent.

Colonial.

Important electrical developments during the year have taken place in Australia. In January the South Australian government approved a proposal for the purchase of the Adelaide tramways from the six companies owning them, and in March a check for about $1,500,000 completed the bargain. A tramway authority has since been formed to co-ordinate the different systems and to manage them as one undertaking.

TRAIN AT TERMINUS OF CHARING CROSS AND HAMPSTEAD "TUBE" RAILWAY, LONDON.

Another proposal of the South Australian government is for the conversion of the steam railroads to electric traction, and for this purpose the services of Mr. C. H. Merz were secured. Mr. Merz is famous for his London electric-power scheme of three years ago, and he also was responsible for the conversion of the first main-line steam railroad in Great Britain to electric traction. He is now in Australia engaged on this work.

The Sydney corporation has added two 2,000-kilowatt Willans-Dick-Kerr generating sets to the plant at the power station, and these machines, one of which is shown in an illustration, may be said to constitute the latest practice here in turbo-generator design of their class. The sets generate three-phase current at 5,200 volts and 50 periods per second at a power factor of 0.85. The governor is electrically controlled.

The application of electricity to mining has been very prominent, mainly by reason of the great prejudice which would seem to exist against it, and a special commission has been investigating the matter. In New South Wales, where electricity has been applied to colliery work to some considerable extent, a good deal of opposition has been met with to the introduction of electric coal cutters on the ground of danger.

In South Africa, having absorbed the only companies likely to compete with it, the Victoria Falls Power Company has a free field before it, but at present there is no intention of constructing a

power station at the falls. Tenders have been let, mostly in Germany, for the plant for an additional steam generating station, and there is every indication that this will be the company's line of action for the present.

Extensive additions are contemplated to the municipal tramways and lighting systems at Durban. The electric tramways at Johannesburg were put into operation and a large number of smaller plants have been completed.

In India work is progressing favorably upon the Mussoorie hydro-electric scheme, which is in the hands of British contractors. The government of Bombay has sanctioned a power scheme for that district and electric lighting and power systems are being erected at Delhi, Madras and Cawnpore, most of the other large towns being already provided for in this respect. A most promising feature of the industrial future of India is the fact that natives are now beginning to initiate schemes and in addition provide the necessary capital for them, all of which has hitherto been left to "foreigners."

Not a great deal of trade has been done with Canada, but mention may be made of the unsuccessful efforts of a British syndicate to secure the contract for the Winnipeg power scheme. The cheaper postal rates for trade literature has resulted in huge quantities of trade literature being sent into the country, and the effects of it will no doubt be seen later.

MISCELLANEOUS.

Considerable interest has been aroused by the experiments of Mr. B. H. Thwaite in the application of electricity to plant growth. Mr. Thwaite has had a glass house at the Royal Botanical Gardens placed at his disposal, and his method includes not only the stimulation of plant by the application of electric currents to the soil, but the use of slowly moving arc lamps whose rays are focussed upon the plants through water screens. It is an attempt, in fact, to reproduce nature artificially, for the arc lamps are a representative of the sun.

Among a few other matters which may be mentioned are the establishment of a professorship of engineering at Oxford University and the publication of a set of draft regulations by the Home Office regarding the use of electricity in factories which have been so severely criticized that at the moment of writing the final regulations have not been issued, although the draft was prepared many months ago.

ELECTRICAL PROGRESS OF 1907 ON THE CONTINENT.

By [illegible]

ON the Continent electrical matters have made very satisfactory progress during the last year, and the [illegible] different fields.

The erection of hydraulic plants in the regions where waterpower [illegible] noticeable features, and some of these plants have an exceptional size. Norway and Sweden are countries where we find a great development in this direction. In Sweden the electric-railroad question is probably as near solution as in any other country, and the state, which controls the lines, is taking measures to operate all the railroads in the country upon the electric system. The same applies to Switzerland, another country where waterpower is abundant, and at present the Federal Council is also very favorably disposed toward using electric traction upon all the lines in Switzerland, having appointed a commission to look into the matter, and the rights for a number of falls have now been purchased as a preliminary measure.

In Germany, Italy and Spain a number of electric railroads and tramway lines have been built during the year. Switzerland is probably one of the most active countries in this direction on account of its waterpower supply, but we also find that both hydraulic power and electric traction are well developed in France, especially in the Mediterranean region.

At Paris the construction of the Metropolitan subway in its new sections has led to some interesting engineering work, where the lines are taken under the bed of the Seine. The great St. Denis plant, which will be the largest steam-turbine station in Europe, has the first portion now operating, while the remainder is in construction. Steam turbines of the Curtis system are used in a number of large plants in France, having been introduced by the Thomson-Houston Company.

In Germany there are now many plants which use the Brown-Boveri turbines, and these have also been installed in other countries. One of the newest types is built by the Augsburg-Nuremberg Machine Company, while the Siemens-Schuckert concern is constructing the Zoelly turbine.

As to radio-telegraphy, we also note a very good [illegible]

[illegible]

[illegible]

[illegible] Swiss-Italian frontier. Connected with the plant will be an extensive network of pole lines which will cover a part of the Lombardy district and will distribute current in the different localities within a radius of a hundred miles. A considerable proportion of the output will be used for motors. The Brusio station will contain six groups of turbines having a capacity of 3,000 horsepower each, coupled to three-phase alternators. Before the plant is finished it will have six other turbine units added, and this will give it a total of 36,000 horsepower.

The Trezza plant, located on the Adda River, also in the north of Italy, when completed is to have 10 principal turbine groups containing alternators of 1,000 kilowatts each, making a total of 10,000 kilowatts for the plant. The Italian firm of Riva, Monneret & Co., install six of these turbines, while the remainder are supplied by the Escher-Wyss Company of Zurich. The head of water is six meters. Of the three-phase type, the alternators deliver 13,500 volts and work at 42 or 50 cycles. Connected with the plant is a reserve steam plant of some size. There are two main pole lines in use, and one of these goes as far as Monza, not far from Milan, 18 miles distant. The second line passes through the province of Milan, covering the country for about 25 miles.

Sweden is to have one of the largest hydraulic plants in Europe, placed at the Tröllhattan Falls, and as now laid out it will utilize about 75,000 horsepower. In this case the turbine groups are to be of 10,000 horsepower each, and a power line will be built from the station to the city of Gothenburg, lying some 45 miles off. Current for lighting and power in the city will thus be secured, and it is expected to operate a number of electro-metallurgical plants for the treatment of iron ore.

Among the largest plants which are to be erected in Switzerland I may mention the turbine station located near the town of Bale, at Angst, on the upper Rhine. Not long since the Cantonal Council voted a credit of about $2,000,000 for this purpose. On the Rhine will be constructed two separate stations, which lie below the present Rheinfelden plant. Each of the stations will be laid out for 25,000 horsepower, and one of them will be operated along with the Rheinfelden plant in order to increase its capacity. The second plant will supply lines passing through the Bale canton for various localities. Using a 12 to 24-foot head of water, there will be 10 turbines erected at present, and the entire plant will provide about 100,000 horsepower eventually. The first part of the work calls for 30,000 horsepower.

Geneva is taking measures to erect a new plant on the Rhone in addition to the already existing Chèvres hydraulic station in order to secure the needed current for the city and the surrounding localities. It is to be situated on the Rhone not far from where it flows out of Lake Leman, and like the former plant it will use low-pressure wheels with a head of water varying from 40 feet down, but having a large capacity. Some 10 or 12 main turbine groups will be installed with 5,000-volt alternators. One peculiarity to be noticed is that the turbines will be built double, and there are two separate wheel chambers. But one of these will be used during low water. The pole-line is to run for a long distance and will be operated at 25,000 volts.

The city of Berne now has one of the best current supplies in Switzerland, and two separate hydraulic stations are now in operation. One of these is located on the Aar and is known as the Matten plant. It operates on a 20-foot head of water. On the Kander River is a large station which runs upon a 190-foot head of water, and at present is equipped for 6,500 horsepower, containing five principal groups. A part of these sets have 4,000-volt alternators and the remainder use direct-current

150-TON ELECTRIC CRANE IN A SHIPBUILDING YARD NEAR GLASGOW.

generators. A part of the lines near the plant are operated on 4,000 volts, but the long-distance lines use step-up transformers which deliver 15,000 volts.

The Kubel plant of Switzerland has been increased several times, and with the newly added machines it will now reach a capacity of 12,000 horsepower. At the same time a reserve engine plant adds about 4,000 horsepower to the above. But it is proposed to enlarge the plant still further

GENERATING ROOM IN OLTEN-AARBURG (SWITZERLAND) HYDRO-ELECTRIC PLANT.

by an extensive piece of hydraulic work which will involve an outlay of $500,000. For this purpose the Monäsch Mountain stream is to have an ironwork dam placed upon it, in connection with an artificial lake which will be formed, and the latter will serve to keep up the regular flow at the low-water periods. The present plant lies near the town of St. Gall, in the northeastern region, and is in the center of a populous county.

In the Olten-Aarburg hydraulic plant, which is illustrated herewith, there are installed eight alternators of the Brown-Boveri pattern. The six machines which occupy the middle space are of the vertical-shaft type and deliver 5,000 volts on the two-phase system. Here the rotating internal field is mounted on the shaft of the turbine, the latter being placed in a chamber below the dynamo room. These machines give 600 horsepower, as also the two horizontal-shaft alternators at each end of the hall. The current from this plant is sent over a widespread area and is used in many small industries or private shops, such as are characteristic of Switzerland.

The French company known as "Energie Electrique" has been extending its operations in the coast Alps region on the Mediterranean and now possesses a very extensive network of hydraulic plants and overhead lines which is without doubt the most important in Europe. Current is distributed along the coast at Marseilles, Nice, Monte Carlo and other large centers. One of the most recent of these plants has been erected at Pataras, [illegible] River, where a head of water of 270 meters is secured. The turbine house contains at present four Escher-Wyss turbine units of 1,000 horsepower, using 600-kilowatt alternators of the Thomson-Houston build, which work at 12,000 volts, three-phase, and are coupled directly upon the pole-line.

[illegible] plant of same size is erected by the Westinghouse Company and it operates on [illegible] using the power [illegible] The water is brought to [illegible] long and a head [illegible] In the station [illegible] group of 1,400 horsepower and two exciter groups. The alterna- [illegible] 600 volts

Steam-turbine Plants.

One of the most recent steam-turbine plants in France is the new station which is erected at Nice by the Gas and Electric Company. It is equipped with two Curtis turbine-alternator groups, supplied by the Thomson-Houston Company and built at the Paris factories. The two main groups in the dynamo room are each formed of a turbo-alternator of 800 kilowatts capacity, delivering three-phase current at 10,000 volts and 25 cycles. The turbines are of the four-stage Curtis type with vertical shaft and operate at 1,500 revolutions per minute.

The new Bergamo plant in Italy will use Westinghouse steam turbines, built at the Havre works of that firm. A 1,500-kilowatt unit will be the first installed in the plant and it runs at 1,600 revolutions per minute. This group contains a three-phase alternator of the company's build, which delivers 8,000 volts and operates at 50 cycles. Leblanc condensers are used in this case and the steam is supplied from Babcock & Wilcox boilers.

Since the erection of the first part of the new St. Denis steam-turbine plant in the suburbs of Paris it has been in very successful operation, delivering two-phase and three-phase current upon various circuits within the city, such as the Metropolitan subway and some of the city lighting mains. At present the station is being increased and when entirely finished it will be undoubtedly the largest in Europe, as it will contain no less than 12 main turbine-alternator groups of 6,000 horsepower, making a total of 72,000 horsepower, together with rotary-converter, booster and other groups, also a large outfit of storage batteries. The station is arranged so that the main dynamo room, which is 550 feet long, will be supplied from three separate boiler plants ranged along the side at the proper intervals. Behind each of these will be a corresponding coal-storage building, provided with a very complete conveyor system for delivery to the furnaces.

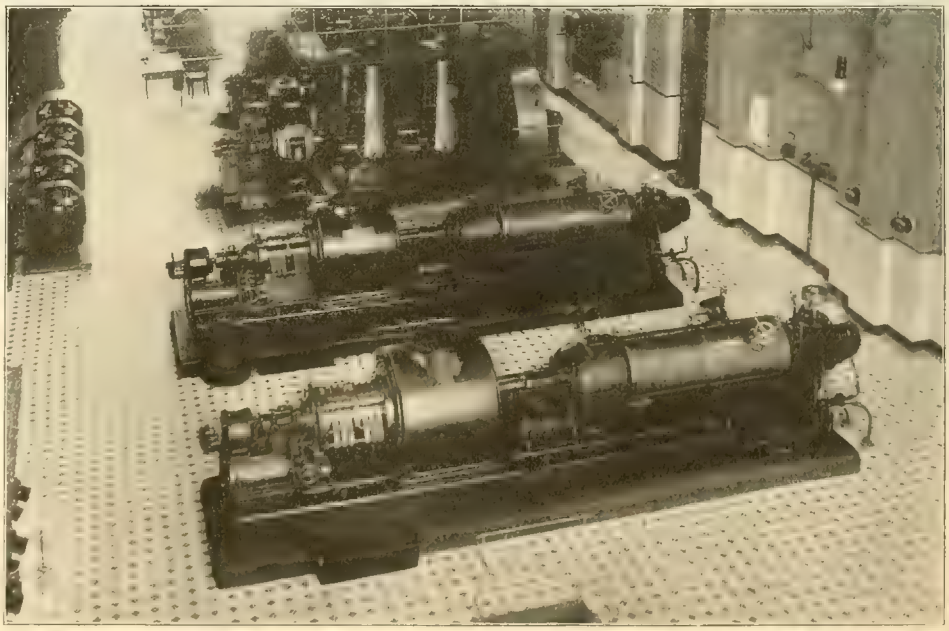
One of the well-known German manufacturers, the Augsburg-Nuremberg Machine Company, is one of the most recent to enter the steam-turbine field. The machine consists of a number of steam disk wheels, each mounted in a separate chamber. A series of six or more chambers forms one-half the turbine and is separated from a like half by a central bearing. These machines are built in sizes varying from 500 up to 3,000 horsepower.

In the Pforzheim station of Germany have been installed the two Brown-Boveri steam-turbine groups which are shown. The machines in this case are of the direct-current type and are designed to produce a current of 200 to 260 volts, with a capacity of 400 kilowatts. The turbines are of the company's standard type for the 600-horsepower size.

Electric Railroading.

Among the single-phase electric railroads which are completed or in project is to be noted the Vienna-Baden interurban line, which is equipped on the trolley system, using a bow trolley. On the line are now running 15 motor cars and 20 trailers. The motor cars have four motors rated at 40 horsepower each and using single-reduction gearing. The two motors of each truck are always coupled in series and the two sets are connected either in series or parallel.

A new type of electric locomotive has been built by the Alioth firm of Switzerland and it is now on trial in France upon the Paris, Lyons and Mediterranean Railroad. Current is taken from an overhead wire which is fed from a single-phase circuit, but a converter set carried on the locomotive is used to give direct current for the motors. Some 2,000 horsepower is given by the latter. Should the trials prove successful it is proposed to use the locomotives upon the new Lötschberg railroad section in Switzerland, and in this case there would also be 20 of this type constructed for the French railroad for the southern coast section running from Marseilles to the Italian frontier.



DIRECT-CURRENT 600-HORSEPOWER TURBO-GENERATORS IN PFORZHEIM, GERMANY.

The first step in the use of electric traction upon the entire railroad system of Sweden has been taken upon the Stockholm-Jarfva section. After a long trial it was decided to put the electric trains in regular service on this line, after which it will be extended further. Single-phase locomotives or motor cars are used for the trains in this case. Parliament voted a credit some time ago for the purchase of hydraulic rights for the sum of $1,400,000 to begin with, and already the state has pur-

chased many large waterfalls in order to secure current for the railroads. It is estimated that the first expenses for hydraulic plants and pole line would be $17,000,000 for operating all the railroad in Sweden. The net profit over the use of coal figures about $140,000 annually.

In Switzerland the matter of transforming the railroad lines throughout the country is also well advanced. The government has appointed a commission for this purpose composed of leading railroad officials, engineers and electrical manufacturers, and this body has been at work drawing up the financial and technical reports upon the project, taking into account the successful working of the Simplon line and also the experiments of the Oerlikon Company on the Seebach-Wettingen section. The proposed length of railroad to be transformed is about 2,000 miles, and the power needed would be 100,000 kilowatts. In the Tessin canton alone a hydraulic power of 40,000 kilowatts can be secured and the remainder can be easily obtained in different localities. Such lines would no doubt be operated on the three-phase system.

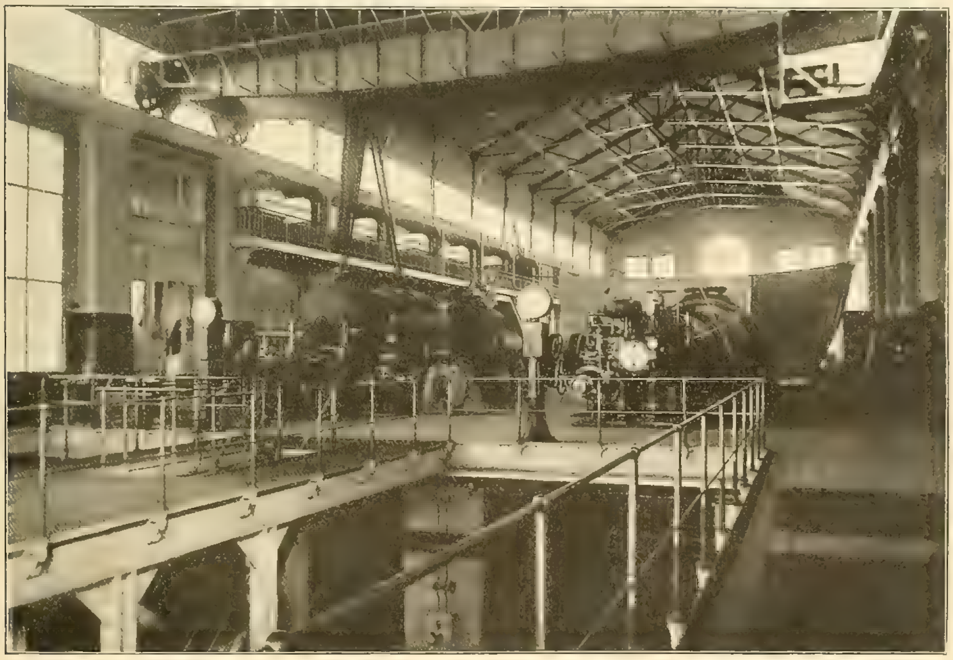
On the Simplon line are now running two new electric locomotives, built by the Brown-Boveri firm. They contain four axles which are all coupled together by driving bars, and two of the axles are driving axles. The whole weight of the locomotive is used for adhesion by this arrangement. Two motors of the three-phase type are employed, each of these giving 650 horsepower. By changing the fields four speeds can be obtained for the motors. A bow or rod trolley is used upon an overhead wire and there are two transformers mounted on the locomotive, the secondaries of which can be varied by the controller. These locomotives weigh about 72 tons each.

The work on the new subway lines of Paris is now being carried on very actively. There are two sections of the line which have a special interest, owing to the engineering work which is involved. One of these is the new part of the Metropolitan subway which crosses the Seine not far from Notre Dame. As a bridge could not be built here, the system of metallic caissons is employed, and the road runs under the river bed. In the river are sunk a number of caissons having the same inside section as the above tunnel, and the latter is thus continued across the river. A difficult piece of work was the sinking of the immense caissons which form the above stations on the bank of the Seine and in the island.

One of the largest and [illegible] Milan. A new [illegible] general character of the trolley cars. These lines have been installed by the French Thomson-Houston Company and are operated by the Societe Italiana Edison. The system of lines which radiates from the center of town [illegible] many points [illegible] around the city at some distance from the center.

THIRD RAIL ELECTRIC RAILROAD AT THESEUS STATION, NEAR ATHENS.
With a glimpse of the "glory that was Greece" in the background.

The electric railroad which runs from Athens to the port of Piræus is now running very successfully, and I give an illustration which shows the Thesens station on this line, just outside of Athens, and also the type of train which is adopted. Installed by the Compagnie Thomson-Houston, the road is operated on the 500-volt third-rail system, and is a short one, being about six miles in length. A large generating plant has been erected not far from the city in order to provide the current for the road as well as for the lighting of the city and the surrounding region.



ERECTING THE STEAM TURBINES IN THE GREAT ST. DENIS PLANT IN THE SUBURBS OF PARIS.

A different piece of work is being carried on where the North-South subway crosses the Seine at Place de la Concorde. The Berlier tube system is used here and the tube is run under the bed of the river on the shield system, using compressed air to prevent the water from leaking in. Built of circular cast-iron sections, the tube is over 500 meters long and carries a single track, and there are two such tubes placed side by side, coming together at each end in the usual double-track tunnel.

ELECTRIC LIGHTING.

In electric incandescent-lamp lighting the metallic filaments seem to be occupying the different manufacturers at present, and the tantalum lamp is gaining ground of late both in France and in Germany. At Paris the tantalum lamps are to be frequently seen for inside lighting. The Siemens-Schuckert Company has found a new method of [illegible] filament instead of a metal base or metallic oxide [illegible] an osmium lamp, it is found to answer very well for the tungsten filament.

It appears that the use of the metallic filament lamp is leading to the substitution of the 25-candlepower lamp for the 16-candlepower type, but on the other hand the new lamps must come down in price considerably before they will have the best success. This seems to be only a question of time, however.

One of the recent arc lamps to appear is the "Siva," and it will work on either alternating or direct-current circuits, being coupled in series or used singly. According to Professor Wedding's tests the lamp requires one watt per candlepower.

Recent experiments show that the magnetic oxide of iron can be used instead of carbon to produce the arc, and it gives twice the light for the same power. Magnetic oxide is compressed into a thin iron cylinder and is placed opposite a copper electrode. The light is of good quality and is steady and takes 0.3 watt per horizontal candlepower.

Mercury-vapor lamps are coming into use for outside lighting, especially electric signs or transparencies, and also in some cases for inside lighting. At the Paris Automobile Show I had occasion to note the tasteful illumination of the portico of the Grand Palais and also a part of the interior. In factory lighting a good example comes from Vienna, where the lamps are placed upon the ceiling. The floor space is 650 square meters and there are 12 lamps in use with reflectors. The mercury-vapor lamps are very economical, as they take only 7.1 watts per square meter floor space, while the 24 arc lamps which were formerly used took 24.4 watts.

WIRELESS COMMUNICATION.

During the year a great advance has been made in radio-telegraphy, and the most recent achievement is the sending of messages across the Atlantic. As to the progress of the work upon the Continent this seems to be most active in Germany, owing to the efforts of the Telefunken Company, which is installing many stations in this and other countries. Among these the great station of Nauen is the best known. With its ironwork tower of triangular section and 100 meters height and a very complete station outfit of high power it is now able to reach long distances such as 1,500 miles to the steamship Bremen on the voyage to New York, mainly over land, and 800 miles over land to St. Petersburg. The station equipped by the same company at Vladivostok can reach about 700 miles. A great number of vessels of the German navy now carry this apparatus.

[Continued on page [illegible]]

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DATES AHEAD.

FOLLOWING its annual custom, the Western Electrician devotes a large part of the space in this first issue of the New Year to articles reviewing the electrical progress achieved during the year 1907. There is the usual table giving the Western Electrician's Estimates of the Value of Electrical and Auxiliary Manufactures in the United States during the last year, compared with preceding years, while competent writers record at some length, with illustrations, the advances made in the electrical industries in the United States, Great Britain and colonies, and the Continent of Europe. The Business Review is a symposium of a large number of letters, giving the impression of first-hand observers on the business situation. In view of the conditions which prevailed during the closing months of the year these records of experience and expressions of opinion are of more than usual interest. The year's showing in electrical exports is given due attention, and there is a carefully written and profusely illustrated account of the interesting power development on the Chicago Drainage Canal; also a brief outline description of the large new Quarry Street power house now building in Chicago, an illustrated article relating to the up-to-date plant of a public-service corporaion in Salt Lake City, and many other features of timely interest.

Resulting from the financial depression of the last quarter of the year, the electrical industries, in common with all others in the United States, experienced a check. As shown by the figures given in the table on the opposite page, the decrease in the value of electrical and closely allied manufactures in this country in 1907, compared with 1906, was 10 per cent. But the total is still larger than that for any year previous to 1906, the figures being: 1907, $315,920,000; 1906, $351,010,000; 1905, $268,075,000, the last being the largest total up to that time.

It is evident that the electrical business of the first three quarters of the year was equal to, or very likely larger than, that for the corresponding period of 1906. The fact that the slacking off in October and succeeding months did not affect the total more than 10 per cent. shows that the last year, taken as a whole, was a successful one for the electrical industries. It was, in fact, the second best year which the country has ever known.

Increases in the value of the production of incandescent lamps, electric-heating devices, fan motors and the like indicate that the central stations had a remarkably good year. The items showing a decrease are principally those that relate to new construction. It is probable that the taking up of delayed projects and new work will be gradually resumed in 1908, while the public-service companies, with their constant demand for machinery and supplies, will of course continue to do business without interruption.

It is gratifying to note the fact that the calendar year 1907 made a record for itself as witnessing the greatest valuation of electrical exports in the history of the United States. The value of electrical exports from this country in 1907 (with December estimated) was $17,477,263, compared with $16,655,510 in 1906 and $13,057,677 in 1905. As the value of electrical manufactures decreased while electrical exports increased, it is clear that the proportion of domestic electrical manufactures exported has risen considerably. This is pleasing, although this proportion is still far from being what it should be. If the business depression will rouse American electrical manufacturers to put some small proportion of the brains and energy they lavish on the domestic market into the export trade, the money stringency will prove to be not an unmixed evil.

Interesting tables are given on another page showing the destination of electrical exports. British North America remains our best customer, taking goods valued at $2,667,905 in the 11 months ended November 30, 1907. Mexico is second with $2,179,777, while it will surprise some persons to learn that Brazil is third with $2,114,014. Next in order is the United Kingdom with $1,933,179, while Japan comes fifth with $1,[illegible], and South America (except Argentina and Brazil) with $885,107, France with $830,110 and British Australasia with $643,810 stand as given. The Chinese Empire is down at the other end of the list with $59,467, showing where some missionary effort could be well expended in 1908.

In electric lighting the new metallic-filament lamps are making good progress, while the newer forms of arc lamps have come into more extended use. But the old carbon-filament lamp is still in demand, which is partly due to the higher prices asked for the tantalum, tungsten and other lamps of like characteristics. The National Electric Light Association adopted an entirely new standard for street illumination at its 1907 convention, and the Illuminating Engineering Society held its first convention. An attempt has been made to transplant the latter society in England, but with no great success, owing to the jealousy of the electrical and gas interests and the conservatism of the electrical men themselves.

The electrification of steam railroads continues to attract a great deal of attention. Much valuable information on the subject has been brought out by the reports before the American Institute of Electrical Engineers and other bodies of the actual operation of former steam railroads which have been electrically equipped. Among the new projects is one to "electrify" the Sierra Nevada division of the Southern Pacific. The single-phase system is in extensive use, and the 1,200-volt direct-current system was put on trial during the year. The American Street and Interurban Railway Association has made a beginning in the standardization of electric-railway apparatus.

Electrical machinery continues to increase in size. In the new Quarry Street station in Chicago, for instance, it is expected to install this year a turbo-generator unit having a maximum continuous capacity of 14,000 kilowatts. The vertical-shaft rotary converter has made its appearance in large units, and another new machine is the combined rotary and booster. Gas engines are forging ahead in electric-plant work, and made in units of steadily increasing size.

As the voltage of transmission in hydro-electric plants is constantly tending to rise, improvements have been demanded in insulators, resulting in a new link-suspension type that may replace the pin insulator for very high potentials.

Copper was erratic during the year, being a part of the time very high in price and after that the lowest in years. This uncertainty had an unfavorable effect on electrical consumption. Considerable aluminum was installed for electrical conductors during the year.

There was less activity in general telephone construction in 1907 than in 1906. Important improvements in automatic telephony are reported. The wireless telephone was put into service on shipboard, and is reported as workable over moderate distances. In radio-telegraphy the event of the year was the establishment of a transatlantic press service, which, however, appears to be defective in reliability as yet. The great strike of telegraph operators in the United States was lost by the men, although the companies suffered a large loss in revenue. The use of machine telegraphs is increasing.

Praise is due the government for its effective work in testing materials and machinery in the important work of conserving the nation's natural resources.

Renewed attention was paid during the year, both at home and abroad, to the production of nitrogenous compounds by utilizing the nitrogen of the atmosphere by electrical processes.

Science has lost its brightest ornament in Lord Kelvin. Another event of unusual scientific interest was the award of the Nobel prize in physics to an American citizen for the first time. Professor Michelson of the University of Chicago was formally invested with this honor in Stockholm last month for his work in the measurement of the wave lengths of light.

Mention must not be omitted in closing of the International Electrotechnical Commission, which was organized during the year. The American committee consists of 21 members, and the commission should do good work in furthering standardization.

STATISTICS OF ELECTRICAL MANUFACTURES.

Below are given in detail the Western Electrician's estimate of the value of the electrical and auxiliary manufactures in the United States for the year 1907, with corresponding figures for the four preceding years. As was to be expected, the total for 1907, $315,920,000, does not equal the aggregate for the record-breaking year 1906, when the value of electrical manufactures in this country reached the highest figure in the history of the industry. However, the total for 1907 is by far the largest of any year except 1906. The decrease from 1906 to 1907 is a little less than 10 per cent.

While there is this decrease in the aggregate and in most of the items, some of the entries show satisfactory gains. It is to be remembered that for three quarters of the year the volume of electrical business was very large. It is evident that had it not been for the check caused by the financial depression of the last quarter the electrical manufactures in this country for 1907 would have equaled in value those of 1906 and perhaps exceeded them. Prices as well as volume of goods affect the value expressed in dollars, and the prices obtained for electrical apparatus in the year just closed have been good.

The figures seem to show that the decline has been in new construction rather than in existing central stations or other electrical plants, which have done a good business, generally speaking. [illegible]

On the other hand, [illegible] that the great activity of many central stations in [illegible] netite and carbon flame arc lamps it is likely that the discrepancy would have been more pronounced.

Gas engines show [illegible] per cent. increase, although reciprocating steam engines fell back somewhat and steam turbines are stationary. Waterwheels also show a creditable gain. A number of very large gas engines for driving generators were manufactured during the year, which partly accounts for the increase indicated.

It will be noticed that a substantial increase is shown in electric-lighting fixtures. Part of this is due to the extension of electric lighting, but it is also true, apparently, that fixtures have been estimated too low in the past. One fixture man, indeed, thinks that the total value of fixtures produced in the country in 1907 was $30,000,000, of which he does not hesitate to ascribe 40 per cent. [illegible]

[illegible]	[illegible]	[illegible]
Prime movers	27,400,000	27,750,000
Telephone apparatus	21,000,000	28,500,000
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Poles, etc.	5,125,000	7,500,000
All other [illegible]	[illegible]	[illegible]
	[illegible]	[illegible]

As in former years, these estimates, made by the Western Electrician, are based on underlying estimates furnished by men who have expert knowledge of the various branches of the electrical and closely allied industries. Blank forms are provided for this purpose, and after eliminating all estimates evidently based on misunderstanding of the inquiry there remained for this year's report 95 estimate sheets furnished by as many persons connected with the leading electrical manufacturing enterprises of the United States. To these gentlemen, whose assistance enabled it to present the figures given, the Western Electrician returns its very cordial thanks.

WESTERN ELECTRICIAN'S ESTIMATES OF THE VALUE OF THE ELECTRICAL AND AUXILIARY MANUFACTURES IN THE UNITED STATES.

Articles.	For the Year— 1903.	1904.	1905.	1906.	1907.
Arc lamps and appurtenances	$ 2,025,000	$ 2,200,000	$ 2,600,000	$ 3,225,000	$ 3,150,000
Auxiliary steam plant for electrical installations, such as pumps, condensers, separators, feed water heaters, injectors, piping, etc.	1,950,000	2,300,000	2,725,000	3,275,000	3,100,000
Bells, buzzers, push-buttons, call-boxes, annunciators	800,000	900,000	1,000,000	1,250,000	1,300,000
Belting used in electrical plants	575,000	500,000	550,000	450,000	425,000
Boilers for electrical plants (water-tube)	4,500,000	5,600,000	6,750,000	7,500,000	6,000,000
Boilers for electrical plants (other than water-tube)	2,000,000	2,800,000	2,850,000	2,750,000	2,500,000
Cables, underground, aerial and submarine	19,700,000	16,500,000	17,750,000	22,000,000	18,000,000
Carbons for lamps, batteries, brushes or other electrical purposes	2,600,000	3,100,000	3,000,000	3,500,000	3,500,000
Cars and trucks for electric railways	7,500,000	7,500,000	8,000,000	11,750,000	8,650,000
Circuit-breakers	1,200,000	1,350,000	1,450,000	1,700,000	1,675,000
Conduits (underground) and similar material	2,350,000	2,650,000	3,300,000	2,900,000	1,700,000
Conveyors, coal and ash, used in electrical plants	750,000	800,000	900,000	900,000	775,000
Cranes and hoists, electrically operated	4,750,000	3,875,000	5,250,000	6,750,000	5,850,000
Dynamos and motors, including parts of machines, boosters, balancers, rotary converters, motor-generators, etc., and all motor applications, such as in automobiles, not specifically enumerated in this list	52,000,000	51,000,000	60,000,000	74,000,000	62,500,000
Electroplating and other electrolytic apparatus not elsewhere specified	300,000	250,000	800,000	1,000,000	1,000,000
Electrostatic machines, induction coils, medical sets, etc.	425,000	550,000	575,000	550,000	500,000
Elevators, electric (mechanism only)	2,000,000	2,000,000	4,350,000	5,500,000	4,675,000
Engines, gas, gasoline or oil, used to drive electrical machinery	1,500,000	1,800,000	2,500,000	3,500,000	4,300,000
Engines, steam (reciprocating), used to drive electrical machinery	16,500,000	14,500,000	13,350,000	13,500,000	12,000,000
Fans, electrically operated and direct-connected	1,450,000	1,200,000	1,375,000	1,575,000	1,850,000
Fire-alarm apparatus, also burglar alarms, crossing indicators, etc.	950,000	1,100,000	1,400,000	1,850,000	1,850,000
Fixtures for electric lighting	4,250,000	4,125,000	4,750,000	5,300,000	7,500,000
Fuses	250,000	300,000	650,000	900,000	1,200,000
Glassware, electrical	450,000	600,000	700,000	900,000	1,450,000
Heating and cooking apparatus, electrical	325,000	425,000	650,000	850,000	1,100,000
Incandescent lamps (carbon or metallic filaments)	5,400,000	5,750,000	6,625,000	8,600,000	10,000,000
Instruments for measurement and meters of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc.	3,850,000	3,850,000	4,200,000	5,000,000	5,000,000
Insulating material, fiber, tape, etc.	1,400,000	1,600,000	1,800,000	2,300,000	2,850,000
Insulators (glass and porcelain)	1,900,000	1,550,000	1,700,000	2,100,000	2,000,000
Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, outlet boxes, etc.	1,950,000	1,975,000	2,250,000	3,000,000	3,500,000
Lightning arresters	470,000	450,000	500,000	525,000	500,000
Mercury-vapor lamps	30,000	60,000	125,000	350,000	450,000
Nernst lamps	450,000	425,000	880,000	950,000	950,000
Poles and wire towers, cross-arms, brackets and pins	4,700,000	4,850,000	5,400,000	7,500,000	5,125,000
Primary batteries	775,000	800,000	1,200,000	1,825,000	1,800,000
Radio-telegraph and radio-telephone apparatus	250,000	380,000	400,000	475,000	425,000
Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail-bonds, etc.	2,150,000	1,900,000	2,200,000	3,000,000	4,000,000
Rheostats, car controllers, motor starters, etc.	3,400,000	2,850,000	3,250,000	4,600,000	4,750,000
Shafting, pulleys, clutches, etc., used in electrical generating plants	400,000	285,000	750,000	800,000	725,000
Sockets, switches, cut-outs	3,675,000	3,800,000	4,150,000	5,500,000	5,500,000
Steam turbines used to drive electrical machinery	1,200 000	2,500,000	4,000,000	8,000,000	8,000,000
Storage batteries, including those used in automobiles	5,000,000	5,000,000	6,200,000	6,950,000	6,200,000
Telegraph instruments and apparatus	200,000	265,000	300,000	375,000	475,000
Telephones, telephone switchboards and distinctively telephonic apparatus	19,500,000	17,200,000	19,200,000	28,500,000	21,000,000
Third rail for electric railways	500,000	715,000	750,000	950,000	750,000
Transformers, stationary	4,500,000	4,450,000	5,175,000	6,850,000	5,500,000
Waterwheels, used to drive electrical machinery	1,500,000	1,230,000	1,700,000	2,750,000	3,100,000
Welding apparatus, electric	....	....	95,000	110,000	120,000
Wire, bare	18,350,000	18,000,000	20,000,000	33,000,000	27,000,000
Wire, rubber covered	8,250,000	8,200,000	11,000,000	14,000,000	16,500,000
Wire, weatherproof	9,000,000	8,500,000	9,500,000	15,000,000	15,000,000
Wire, all other electrical	2,700,000	2,500,000	3,500,000	4,625,000	4,150,000
Miscellaneous, including switchboard frames and panels, signs and flashers, automatic stokers for electrical plants, wire guards, electrical tools and toys, projectors, solenoids, igniters for gas engines, waterwheel governors for hydro-electric plants, voltage regulators, electric drills, commutator compounds, lamp adjusters, shade holders, etc.	2,150,000	3,500,000	4,000,000	6,000,000	4,000,000
Total	$234,750,000	$230,510,000	$268,075,000	$351,010,000	$315,920,000

Electrical Exports for 1907.

The total value of electrical exports from the United States for the calendar year 1907 is the greatest on record, exceeding by over $800,000 the figures for 1906. While a substantial gain is shown, the proportion of increase as compared with the last two years is not nearly so large. Statistics of electrical exports by months as compiled by the Bureau of Statistics, Department of Commerce and Labor, are not yet available for the month of December. An estimate for December, added to the official figures for the other 11 months, brings the value of electrical exports for the year 1907 to $17,477,263. In 1906 the total value was $16,655,510; in 1905, $13,057,677; in 1904, $11,039,758, and in 1903, $9,856,047.

In comparing the 1907 figures (for 11 months) with those for the corresponding period of 1906 it is interesting to note that the export of goods classified as electrical appliances, which includes telegraph and telephone instruments, fell off from $7,553,111 in 1906 to $7,209,844 in 1907, while the exports of electrical machinery increased from $7,638,898 in 1906 to $8,897,419 in 1907.

The following table shows the 1907 electrical exports from the United States by months (December estimated):

Exports by Months for 1907.

Month.	Appliances.	Machinery.	Total.
January	$674,367	$ 903,082	$1,577,449
February	599,855	561,672	1,161,527
March	590,999	919,825	1,510,824
April	583,780	748,618	1,332,398
May	619,393	800,566	1,419,959
June	754,276	1,080,960	1,835,236
July	694,938	886,057	1,580,995
August	810,301	930,492	1,740,793
September	648,513	598,855	1,247,368
October	690,898	767,016	1,457,914
November	542,524	700,276	1,242,800
December	*620,000	*750,000	*1,370,000
Total	$7,829,844	$9,647,419	$17,477,263

*Estimated.

The following tables show the destination and value of electrical appliances and machinery exported from the United States in the 11 months ended with November, 1906 and 1907:

Electrical Appliances.

Exported to—	11 Months Ended November, 1906.	1907.
United Kingdom	$1,974,139	$ 863,079
Belgium	184,299	139,052
France	54,443	75,126
Germany	280,777	345,156
Other Europe	163,130	135,743
British North America	1,040,914	1,272,328
Central American States and B. Honduras	156,381	227,364
Mexico	911,502	707,106
Cuba	533,665	358,227
Other West Indies and Bermuda	33,916	52,959
Argentina	326,872	179,207
Brazil	709,982	1,163,206
Other South America	418,878	703,901
Japan	238,110	467,895
British Australasia	172,689	164,164
Philippine Islands	122,086	103,009
British Africa	68,522	69,342
Other countries	162,806	182,980
Total 11 months	$7,553,111	$7,209,844

Electrical Machinery.

Exported to—	1906.	1907.
United Kingdom	$1,118,765	$1,070,100
France	246,065	763,984
Germany	95,728	85,062
Other Europe	427,271	346,808
British North America	1,761,292	1,445,577
Central American States and B. Honduras	36,754	89,452
Mexico	953,241	1,472,671
Cuba	136,681	63,991
Other West Indies and Bermuda	4,664	19,072
Argentina	[illegible]	164,616
Brazil	[illegible]	950,808
Other South America	134,823	181,206
Chinese Empire	23,269	59,467
British East Indies	[illegible]	232,982
Hong Kong	17,143	8,892
Japan	927,025	1,222,065
British Australasia	[illegible]	[illegible]
Philippine Islands	64,701	62,136
Other Asia and Oceania	[illegible]	30,422
British Africa	[illegible]	[illegible]
All other Africa	[illegible]	58,012
Total 11 months	[illegible]	$8,897,419

[illegible] exports for the month of November, 1907 [illegible] value of [illegible] compared [illegible] for November, 1906. The decline [illegible] electrical appliances, the [illegible] from [illegible] in November, 1906, to $542,524 this year. Electrical machin- [illegible]

[illegible] principal purchasers of electrical appliances and machinery from [illegible] 1907:

Appliances—British North America, $114,803; [illegible] and British Honduras, $18,448; Japan, $12,523; Ar- [illegible]

Machinery—Japan, $144,259; Mexico, $134,567; British North America, $92,896; United Kingdom, $55,129; Brazil, $49,486; France, $38,696; Argentina, $30,430; British Australasia, $28,076; Philippine Islands, $10,239.

American Association for the Advancement of Science.

The fifty-eighth annual meeting of the American Association for the Advancement of Science was held this week at the University of Chicago. There was present an exceptionally large attendance of members of the association and of many affiliated associations that held their meetings at the same time. The first general session was held in Leon Mandel Assembly Hall in the forenoon of December 30th. It was opened by the retiring president, Dr. W. H. Welch, who, in an appropriate address, introduced the new president, Prof. E. L. Nichols of Cornell University. Dr. George E. Vincent cordially welcomed the association to the University of Chicago, and former Congressman George E. Adams, on behalf of the local committee, welcomed the scientists to the city.

Mr. Adams in his address referred to the recent criticism of philanthropists who had given freely to the upbuilding of higher educational institutions and defended the men who had through this means done so much for the advancement of science and of scientific methods. Professor Nichols, in his response, paid a tribute to Chicago for the appreciation by her people of the work of the association and spoke of the high honor recently bestowed upon one of the members of the university faculty, Professor Michelson, and of other elements making the university eminently suited for the place of holding the meeting.

At the adjournment of the general session came the organization of the several sections of the association. Section D, Mechanical Science and Engineering, met at 11 a. m. on Monday in Cobb Hall. The first paper read was by Prof. A. H. Blanchard of Brown University, on "Experiments with Tar and Oil on the Highways of Rhode Island." In the afternoon there was a joint session of Section D with Section A, Mathematics, and with the Chicago Section of the American Mathematical Society, the topic for discussion being "The Present Status of the Teaching of Mathematics to Engineering Students." In considering the subject as taught in this country, Prof. E. J. Townsend, University of Illinois, spoke of the importance of mathematics in engineering, and laid stress on the method of teaching it from an engineering viewpoint. He presented statistics showing the time given to the different branches of mathematics in 17 of the leading technical schools of the country. Prof. Alex. Ziwet, University of Michigan, after comparing the schools of this country with those of Europe, gave a survey of mathematical work in the technical schools of Germany.

Mr. C. F. Scott of the Westinghouse Electric and Manufacturing Company spoke from the manufacturer's point of view. He discussed the use of mathematics as means to accomplish the end. The man most valuable to the engineer is the one who knows the uses of mathematics, the kind of mathematics to use, and possesses the skill to use mathematics. Few in research work use deep mathematics; many use elementary methods, and a great many do not use mathematics at all. His opinion was, taking all into consideration, that the graduate should know where to find and how to use the mathematics which he is likely to meet in the engineering field.

President R. S. Woodward, Carnegie Institution, thought that more time should be given to the elements of mathematics and to elementary work in mathematics. He suggested the applications of mathematics to problems of everyday life. He said that the staffs of technical schools were becoming filled with inferior men, the best men going to the more promising field of practical work, and entered a plea for the increase of salaries sufficient to retain the abler men in the technical schools.

[Further reference to the meeting of the American Association will appear in the Western Electrician of next week.]

A New Use for Telephones.

[illegible] comes the news that the minister of the navy has ordered the equipment of all sub- [illegible] with detachable telephone buoys. In the last few [illegible] a number of submarine disasters have occurred which have resulted in the loss of [illegible] of lives. These buoys are to contain telephones connected by [illegible] cable to the craft. They will be so arranged that in case a submarine vessel goes to the bottom and is unable to rise a buoy will be loosened by the imprisoned crew and sent to the surface to attract attention and summon help. Persons attracted to the buoy can then talk to the men below, learn their exact predicament and the best way of overcoming it.

The New Quarry Street Power Station of the Commonwealth Edison Company.

Owing to the demands of its steadily increasing business, the Commonwealth Edison Company of Chicago is building a large new generating station on the South Branch of the Chicago River, directly across the stream from the large Fisk Street station. This new station is known as Quarry Street station, and the piling is now in for the whole building. The eventual capacity of the plant will be 84,000 kilowatts in six turbo-alternators of 14,000 kilowatts each, supplying 9,000-volt, three-phase current at 25 cycles. At present the building contractor is at work on the first half of the building. Two of the very large units which will be characteristic of Quarry Street were originally ordered for delivery in 1908, but recently it was decided to install only one of these in 1908, the second coming in 1909. The portion of the building now under way will have a capacity for three units.

Owing to its smaller size, the plan of the Quarry Street plant has been changed somewhat from that of the Fisk Street station. The boiler room is parallel with the turbine room, instead of the lines of boilers extending at right angles to the turbine room, for each unit, as is the case in Fisk Street. There is no separate switch house as at Fisk Street. Architecturally the building differs from the great station across the river, yet when completed the group of buildings will form a harmonious whole.

It is the present intention of the Commonwealth company to complete the Quarry Street station to its ultimate capacity before adding to Fisk Street, which has still room to expand. In round numbers the present capacity of Fisk Street is 140,000 horsepower. Ultimately it is to be capable of supplying 250,000 horsepower. But before that limit is reached Quarry Street will be brought to its full capacity and probably another generating station about equal to Quarry Street in size will be built.

Shepley, Rutan & Coolidge are the architects for the new building; the Great Lakes Dredge and Dock Company did the piling; the Wells Bros. Company is the building contractor; the General Electric Company will supply the steam turbines and electrical equipment; the boilers will be furnished by the Babcock & Wilcox Company; Sargent & Lundy are the mechanical engineers, while the engineering staff of the Commonwealth Edison Company is planning the electrical engineering.

Street Lighting in 1907.

By Albert Scheible.

In street lighting the year 1907 was notable for the special-display features adopted by associations of merchants in various cities for making their streets conspicuously bright and attractive at night. The mode of lighting used for this purpose varies from arches spanning the street and studded with incandescent lamps to clusters of incandescents on ornamental poles, or to closely spaced arc lamps. The latter include even the flaming arcs, whose use for street-lighting purposes is prohibited by the intense downwardness of the lighting distribution, unless the lamps can be placed much closer together than the usual spacing of street arcs. The coming year will undoubtedly bring further developments in this extra-gorgeous lighting of business streets wherever the merchants can be "enthused," and this phase of street lighting promises a considerable addition to the revenues of our central stations. Tungsten and allied high-efficiency lamps will be tried for street lighting in residence districts, and flaming-arc lamps will be more extensively used, perhaps in connection with reflectors or refractors for distributing the light over a wider area.

As for the needed materials, the past year has seen the development of a decidedly higher type of both insulating and supporting devices than those formerly used, and during the coming season these newer standards will undoubtedly replace the old ones for the better class of construction work.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XLIX. Storage Batteries.

APPLICATIONS (CONTINUED).

The reasons which have been given for using storage batteries in isolated plants apply equally to their use in central station work, particularly where the load consists chiefly of incandescent lamps. In such a station a storage battery can also be effectively used for maintaining an approximately uniform load on the engines, for carrying a maximum load, and in some cases to furnish energy during part of the night when the generators are shut down.

Storage batteries are also sometimes used in sub-stations which are charged from the main station. This makes it possible to use smaller feeders, because these feeders can be made to carry a practically constant current and do not have to be large enough to carry the maximum current, which may be several times the average current. It makes no difference to the generating machinery, of course, whether the battery is located in the generating station or at some local center a considerable distance away.

Another use for storage batteries is for transforming current. It is possible to charge a number of cells in multiple and afterward connect them in series to be discharged, or vice versa. For example, five sets of 50 cells each could be connected in parallel and charged on a 110-volt circuit. After being charged the five sets could be connected in series, and this series would give a discharge current of 500 volts. The discharge current would, of course, be but approximately one-fifth of the charging current, as the number of watts would be practically the same whether discharged at 100 or 500 volts.

The result is similar to what is obtained with the use of an alternating-current transformer, but this method of transforming with storage batteries is impracticable for most cases, as the losses amount to upward of 20 per cent., and the same results can be much more economically obtained by the use of a motor-generator. The method described, however, has been employed for securing various voltages for testing purposes where but very little current is required.

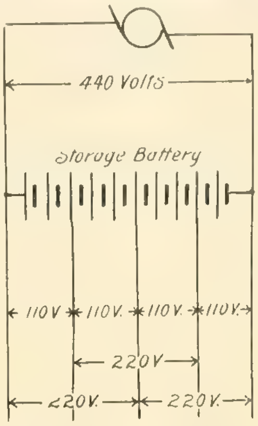
Storage batteries have also been used for supplying three-wire or five-wire systems of distribution, using only a single generator. In a three-wire system the batteries are connected in series, the number of cells being used corresponding to the voltage of the outside wires of the system. The battery can be located at a point distant from the station, if desired, and charged by a generator of corresponding voltage. The three-wire distributing system can be taken off between the outside terminals of the battery and the middle battery.

A similar arrangement is shown in accompanying diagram for a five-wire system. The battery in this case would consist of 220 cells connected in series and charged from a 440-volt generator. In this case the inside wires of the five-wire system would be taken off at three points of the battery so as to include 55 cells between each pair of wires, thus giving 110 volts current between each of the adjacent wires, or 220 volts current between the outside and the middle wires. If the battery were located at some distance from the station, this would effect considerable saving in copper, as only the two wires from the generator are needed to connect the generator with the battery at the point of distribution.

Storage batteries are used in a number of different ways in street-railway work. They may be used in the station for helping out on peak loads, although in most cases the peak loads on railway work are not so pronounced and do not occur with the same regularity that they do in lighting stations. Storage batteries are frequently used in railway sub-stations, both for the purpose of permitting the rotary converters to be shut down during the hours of light load, and also to assist the converters in time of very heavy load.

Another use of storage batteries in railway work is to connect them across the circuit at a point in the system where considerable drop in voltage occurs during heavy loads. When used in this way the battery is said to float upon the line. During times of light load the voltage is normal, and the battery is being charged. When an unusual load occurs the line voltage will drop considerably and at such time the battery discharges into the line, thus assisting the load and preventing too great a drop in the line voltage. The use of batteries is frequently made in locations where the feeder capacity is too small for the maximum load. Where such a location is at considerable distance from the station it is sometimes cheaper to install a storage battery than it is to supply sufficient copper for auxiliary feeders.

Besides the uses of storage batteries already described, there are numerous other uses which would require too much space to explain. In both telephone and telegraph systems, the use of primary batteries has been widely superseded by storage batteries. The latter requires smaller space than the primary battery, their first cost is lower, and the expense of maintenance is very much less.



FIVE-WIRE DISTRIBUTION FROM ONE DYNAMO BY USE OF STORAGE BATTERY.

AUTOMOBILES.

Storage batteries are also considerably used for the propulsion of automobiles, although their use in this service is limited to cities where the grades are not severe, the roads are good, and charging stations are conveniently near by.

The electric automobile is superior to any other kind for runabout service in cities, because it is almost entirely noiseless and is entirely free from explosive gases and their accompanying odor. Electric automobiles are also extremely simple to operate, generally requiring but one control lever for starting, varying the speed, stopping and applying the brakes. They are not, however, well adapted for long-distance tours, as the capacity of the battery which can be carried is rather limited, and is generally only sufficient to carry the vehicle from 25 to 40 miles under favorable conditions of road. They are also not well adapted to hilly countries, as in climbing steep hills the battery is discharged at such a high rate that it depreciates very rapidly.

Where lead cells are used it is customary for 40 cells to be carried in the vehicle, which may be divided into two groups of 20 cells. These are connected in parallel, giving about 40 volts for low-speed running, and are then shifted to a series connection giving 80 volts for full-speed running.

The greatest objection to storage batteries for vehicle propulsion is their great weight. In the average electric automobile the battery comprises at least one-third of the total weight of the vehicle, and any increase in the battery capacity adds correspondingly to the total weight of the vehicle.

MISCELLANEOUS USES.

Storage batteries are also used with most all systems of electric train lighting. In some cases the batteries are charged from generators mounted upon the car axles, and in other cases by small isolated plants located in baggage cars. The generator is also sometimes connected to the locomotive, but in any case a storage battery for each of these systems is desirable, as otherwise the lighting would be interrupted whenever the train came to a stop or when the locomotive was disconnected from the train.

Storage batteries are also very useful in laboratory work, on account of the ease with which different currents and voltages may be obtained by connecting the storage batteries in various combinations, between full multiple and full series.

[*To be continued.*]

NOTE.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Use of Overhead Trolley.

[illegible]

[illegible]

The principal [illegible] as to the extent [illegible] many, Great Britain, [illegible] Hungary, Switzerland, Mexico and Spain.

Machines for Three-wire System.

D. R. M., Elgin, Ill. [illegible] volt Edison dynamo and [illegible] shunt motor. I want [illegible] wire system of 110 and 220 [illegible] motor running in parallel with the dynamo? If not, what changes will have to be made?

ANSWER.

The two machines on a simple Edison three-wire system are not run in parallel but in series. The negative terminal of No. 1 machine is connected with the positive of No. 2 machine and the neutral wire is run from the point of connection. It is essential that the machines be of the same voltage and desirable that they be of the same size. The 500-volt motor might be run as a 110-volt dynamo by reducing its speed and field current, but it probably would not run in a stable manner—i. e., load changes would markedly affect its voltage. Its capacity, already small, would be also much more reduced, even if it were rewound for 110 volts.

Electric Resonance Formula.

C. F. W., New York, N. Y., questions the accuracy of the critical formula for electric resonance:

$$2\pi f L - \frac{1}{2\pi f C} = 0$$

He says the formula seems absurd, because, according to it, if L is reduced, C must be increased. This is contrary to the statement that, when resonance exists, the inductance (L) just neutralizes the capacity (C). In other words, this is the same as saying that if two opposing forces destroy each other and one of these is reduced, the other will have to be increased to still maintain the balance.

ANSWER.

The inquirer loses sight of the fact that inductance and capacity are not forces but merely passive properties of circuits due to their geometrical shape and the media surrounding them. On account of these properties of different circuits the electromotive forces required to send alternating currents through them do not agree with the electromotive force that would be required for this purpose if resistance alone were present. The component electromotive force required to overcome inductance is $2\pi f L I$; that to overcome the condenser effect or capacity is $\frac{I}{2\pi f C}$; when these electromotive forces are equal they will exactly neutralize each other, since one lags by 90° and the other leads by the same amount. Resonance then results.

It must be noted that the reason C is in the denominator arises from the fundamental formula of a condenser or electrostatic field that the charge $Q = CE$, from which $E = \frac{Q}{C} = \frac{I}{2\pi f C}$, since the current $I = 2\pi f Q$. These points are made clear in any good book on alternating currents. In Franklin and Esty's "Elements of Electrical Engineering," Vol. II, pp. 74-79, a good discussion of resonance with mechanical analogies is given.

Evening Work at Lewis Institute.

Beginning January 6th and lasting 10 weeks, the winter term of the evening course of instruction in electrical engineering will be a pronounced feature of the school life of Lewis Institute, Chicago. There are three courses, each extending over a school year. The first relates to engineering principles of electricity, the second to direct-current motor and generator testing and the third to alternating-current transformers and transmission. Two lectures a week are given in each course, and the school is open from 6 to 10 p. m. on Monday to Thursday evenings, inclusive.

Prof. P. B. Woodworth, professor of electrical engineering at Lewis Institute, is proud of the evening work, and well he may be, for there are about 400 practical men, none under 25 years of age, taking the courses.

BUSINESS OF THE YEAR 1907 IN REVIEW.

Even with the check due to the financial depression of the last quarter, the electrical business of the United States for the year 1907 was very large. The uneasiness that was first manifested on a wide scale in October has passed away largely in electrical circles, and the year 1908 is faced with confidence. However, the year brought its own vicissitudes, as everybody knows, and for that reason the subjoined letters reviewing the business situation will be read with more than usual interest.

American Electric Fuse Company, Muskegon, Mich. (Frank G. Jones, president): The best year's business this country has ever enjoyed started the year 1907. A few stock gamblers in New York upset the credit fabric of that city and the echo of the shock was felt in every corner of the United States. It is unfortunate that there are so many timid people in the world. These timid people hid their money, fondly deluding themselves with the idea that they were safe in doing it; and business has suffered a depression everywhere in consequence. When the timid, thoughtless depositors have learned that their money will be safe in the banks, and when they have learned that keeping it out of the banks hurts them as much as anybody else, we will experience a resumption of business on a large and profitable scale. What this country needs is a little nerve and backbone infused into a few hundred thousand of its citizens who are fortunate enough to have money to deposit in the banks, but who have lacked the courage or good sense to leave it where it is absolutely safe. We are optimists, and don't believe the country is "Going to the dogs." There is nothing the matter excepting a lack of confidence, which is totally unjustified. We expect that people will get back to their senses shortly after January 1st, if not before. We then look for a business compared to which all previous records will seem insignificant.

Allis-Chalmers Company, Milwaukee (W. H. Whiteside, president): It is daily becoming more apparent that the general business of the country has not been so seriously injured by the recent sudden financial depression as the public has been inclined to believe. And I am firmly of the opinion that the thing now most necessary is to loosen the chains of conservatism and give courage an opportunity to assert itself and make advances consistent with the general prosperous conditions and well-distributed resources of the country. As the production and use of basic machinery, such as prime movers for the generation of power, is a very potent and a leading factor in our commercial activities, very naturally it is one of the first lines of business to be affected when the pendulum swings from optimism to pessimism, and likewise the first to feel the effect when the change in sentiment again manifests itself. The number and character of inquiries which our offices, located in the principal commercial centers of the country, have recently been receiving convincingly demonstrate a return of confidence, and bear evidence that not only a diversified but a large volume of business will be offering ere the middle of the first quarter of 1908 has been passed. The outlook is distinctly encouraging.

The Arnold Company, Chicago (George A. Damon, managing engineer): In line with the unparalleled activity in all industrial branches, the amount of engineering and construction work done by The Arnold Company during the year 1907 in electrical, civil and mechanical fields, was far in excess of that of the previous year. The work included the design and construction of railroad shops, hydro-electric plants, transmission lines, irrigation projects, interurban railways and industrial plants. During the latter part of the year, however, the general business depression was felt both in the decrease in the amount of new business coming in and very recently in the temporary cessation of some of the work under construction. The prospects for the year 1908 are good. A fair amount of work is now under way, the completion of which by itself will assure a good year's business. In addition to this, the completion of projects, which, while temporarily held up, must soon be completed, may be counted upon with a fair degree of assurance in the business for the coming year. A reasonable amount of new business is now under advisement, but with the present unsettled conditions any estimates as to the percentage of this work that will become active during the coming year would be mere conjecture.

Beardslee Chandelier Manufacturing Company, Chicago (Frank S. Beardslee, president): Referring to the lighting-fixture industry and the manufacture of electric and combination fixtures, so far as we have been able to judge, the year 1907 has been a banner year for building and consequently the best year so far experienced in the lighting-fixture line. There have been numerous electric-lighting plants installed in many of the smaller towns, and electricity seems to be more in use than formerly, in some instances on account of lower prices, but in most instances on account of the better effects that can be had with the lighting fixtures, especially where the art-glass domes and other similar features are used. There never was a time in the history of the business where such attractive designs have been placed on the market, and the fact that they are eagerly sought and purchased is proof that they are appreciated. Another item to be taken into consideration is the matter of decorations of rooms, which last a great deal longer with the use of electric light than with any other method of illumination, which is in itself a great saving and tends to make electric lighting more popular. Owing to the slight financial stringency, which has rather unsettled the market for the last two months, the trade will probably be a little slow in the early part of 1908, but as there are bountiful crops we think the coming year will be a good substantial one, and probably in the end will equal if not surpass the year 1907 in the manufacture and sale of electric and combination fixtures.

Blake Signal and Manufacturing Company, Boston, Mass. (E. J. Burke, president): We are pleased to say that, while the size of individual orders fell off considerably during 1907, as compared with 1906, on the other hand, the increase in the number of customers, increase of our foreign business, and new lines which we got out during the year, put our gross sales for 1907 above those of 1906. Also, collections have been just as good. With regard to the year 1908, we do not expect to see any great boom in trade, but expect a steady and healthy increase all along the line, and business generally on a much sounder basis than it has been for more than a year.

Bristol Company, Waterbury, Conn. (H. P. Dennis, Chicago): The Bristol instruments have become so popular and our sales this year have increased so rapidly as to render the erection of a new factory necessary. This structure is now nearly complete, being 53 by 193 feet and three stories high. It will enable us to double our output so as to keep pace with the orders that are flowing in. As for the future, we have the utmost confidence that sound business methods and the ability to give value received will bring prosperity to our company and any other concern that transacts business on this basis.

Buckeye Electric Company, Cleveland, Ohio (L. P. Sawyer, secretary and treasurer): During the last year the Buckeye company, and, I believe, all other manufacturers of incandescent lamps, has been doing a largely increased business over the year 1906. This increase of business was undoubtedly due to the greater activity of the electrical companies, co-operating with the electrical trade in general, for the good of the entire business. I believe we have all, in the last year or two, been working under what may be called abnormal conditions, and that up until the last few months these conditions were not fully realized. Now that they are realized, however, it is my opinion we will all benefit from the realization. We would, for a short time, feel the setback on account of the past financial conditions; but these conditions have been largely cleared away, and I think 1908 will find us on a surer and better basis than ever. I do not look for what might be called the abnormal increase of business in the electrical industry, but I do look for a conservative increase, and an increase that will put us on a sounder basis than has been the case the last two years. It seems that conservatism will be the general watchword for 1908, applying this to the general trade as well as to the manufacturers; and conservatism, with the proper amount of enthusiasm and energy, will mean much better conditions for the entire industry. The great strides made by the manufacturers of lamps in the last year will undoubtedly mean much to the general lighting trade, and in adjusting ourselves to a more conservative basis it will be well for everyone to adjust himself to the new era in incandescent lighting created by the lamp manufacturers in the last 12 months. Briefly, I believe the general outlook for 1908 is good and that a normal increase will be the result shown at the end of another twelve months.

Case Manufacturing Company, Columbus, Ohio (Z. D. Allison): With regard to our business for 1907, this has been the best year in the history of this company, our shipments being more than 50 per cent. greater than last year, which was the largest year's business up to that time, and while we realize that just at present the placing of orders for manufactured material has been practically suspended, we believe that before the new year has been fairly launched the railroads and large corporations, on whom we as manufacturers depend, will begin to place orders which have been held up, owing to the present unsettled conditions in the financial world, conditions which appear to be rapidly clearing and which will disappear completely with proper assurances from Washington. As for ourselves, we have made extensive improvements during the present year and will continue our policy of expansion for the coming year to meet the demands which we feel confident will be made on all manufacturers, with even normal conditions, in order to overcome the loss occasioned by the period of relaxation that has existed for the last few weeks. These statements are based on the fact that of our inquiries, which had been coming in at a rate equal to three times the number of last year, and much greater in volume, more than 90 per cent. were sidetracked, and orders are being held up for the present. Summing up the whole situation in a few words, we expect a greater prosperity in the future than we have had in the past, and we propose to discount the future by equipping to meet our expectations.

Chicago Fuse Wire and Manufacturing Company, Chicago (W. W. Merrill, secretary): We have had a prosperous year, but in relation to 1908 we do not feel certain what it may bring forth. We believe it depends entirely on whether confidence is restored and upon the amount of construction which will be done. We are inclined to be optimistic, however, and do not think that the present condition can last much longer.

Chicago Pneumatic Tool Company, Chicago (C. B. Coates, electrical engineer): The business in portable electrical tools of this company has been exceedingly satisfactory during the year 1907. We have added very largely to our line of electrical tools, and the sales have been fully up to our expectations. We look for a very good business in 1908, and feel that the demand for this branch of our product is rapidly increasing.

Clay Products Company, Chicago (Frank W. Darling, sales manager): In normal seasons, on account of the proportionately high freight rates, the conduit market for any manufacturer of clay conduit is restricted to a radius of a few hundred miles from the plant. The past year has been a notable exception in this regard and due to very interesting causes. During the year 1906 the demand for clay conduit was greater than the supply. During the winter of 1906-1907 it seemed that the demand would be as great in 1907. To meet this expected demand the manufacturers accumulated large stocks of ware in their yards. The money rate of 1907 and the failure of a number of public-service corporations, working on eastern capital, to float their paper, put a sudden stop to construction improvements. This was especially so in the East. As a consequence the eastern manufacturers felt forced to find a market, and dumped their supply of conduit on the less-affected western market. This not only ran the price down, but resulted in an over-supply and severe competition. If the year had not been prolific with the birth of new companies demanding a large amount of underground construction work, it would have been a disastrous season for conduit manufacturers. As it is, it has been an exceptional season for the sale of a superior quality of ware. The shortage in 1906, having drawn out a great deal of previously rejected material which short-sighted manufacturers sold in the place of first-grade ware, educated the consumers to the necessity of buying guaranteed ware. This resulted in greatly increased sales to the producers who were willing to sell conduit strictly on its merits and guarantee every piece. The Clay Products Company has increased its capacity 25 per cent. and has run at full capacity since March 1st to date without being able to place any reserve stock in the yard. The outlook for 1908 is exceedingly bright for western manufacturers of conduit, in spite of the prognostications for tight money. This season's purchasers of eastern conduit have suffered severely from breakage on the long shipments and will not make the mistake again. The education of the electrical trade has passed the initial stage, and it is no longer necessary to demonstrate that the cheapest construction for new lines is underground; it is a necessity now and not an experiment. Experience has taught western consumers that it is economy to increase the initial expense a little by getting clay conduit and saving maintenance for years to come rather than buy a cheaper conduit form and build the line of concrete with high maintenance cost. Many corporations postponed underground work until copper should reach a purchasable price and cannot wait much longer, even if the price of cable is not greatly reduced this season. All of these favorable factors and more are substantiated by the many inquiries and orders for spring deliveries which are being received now from public-service corporations throughout the West and Southwest.

Columbia Incandescent Lamp Company, St. Louis, Mo. (A. C. Garrison, president): We are able at this time to state that 1907 has been very much the best year ever enjoyed by this company in respect to its volume of business.

Cooper Hewitt Electric Company, New York, N. Y. (A. D. Childs): During the business year of 1907 the Cooper Hewitt Electric Company has made a very appreciable advance in the field of industrial lighting. By the first of January, 1907, after having had the Cooper Hewitt mercury-vapor lamps on the market for over three years and a half, the field for this lamp has become very care-

fully defined. In actual commercial installations the quality and efficiency of the light, both in cost for current and cost for maintenance, were very clearly defined. Commercial installations in mills, drafting rooms, machine shops, foundries, [illegible] printing plants, etc., had by January, 1907, been thoroughly tried out, and extensive re-sale orders for more lamps from firms who had used the light, and new orders from firms in similar lines of business, showed conclusively that the early estimations of the value of this light were more than confirmed. This last year the sales of these lamps have increased very considerably along the lines mentioned, and at the same time new fields have been entered. Among these new fields may be mentioned the lighting of silk mills, where it was at first thought that the changes of the colors caused by the Cooper Hewitt lamps would preclude the use of the light. Actual use found that the change in the colors was not by any means detrimental. The performance of the Cooper Hewitt lamp and the length of the useful life of the tubes have been shown to have exceeded in both respects the expectations and guarantees made in regard to the life of the tubes. The latter part of this year a new and more improved type of auxiliary has been made for the lamps, and with the result that the appearance and performance have been greatly improved. The new auxiliary is simple in construction and readily installed. The form of this new auxiliary is modeled, generally speaking, on the form of the standard arc-lamp housings.

Dean Electric Company, Elyria, Ohio (F. A. Cornell, publicity manager): We entered our third year during the slight uneasiness that seemed to affect the electrical trades in the winter of 1906-1907. In accordance with our policy, "The Harder Business Comes, the Harder We Go After It," our sales forces and advertising appropriations were then enlarged. We corralled those orders the faint-hearted producers lost in the belief that "Nobody's buying," and we have held the business. 1907 has been remarkable with us—October was our best month. The year shows such a gain over 1906 that we have been forced to double our plant, remodernize our equipment and organize another branch house. The factory sales force alone has been increased by 40 per cent. The usual winter "lid" on outside construction work has given us a welcome chance to get out several important improvements and new patterns. We confess a slight slump the last six weeks. But we are glad to run our plant full time and work up a complete stock for quick deliveries. Hard times! Not here! We're running a night shift three evenings a week. And orders! We find them—good ones. Our collections are tiptop.

Dickinson Manufacturing Company, Springfield, Mass. (Kurt R. Sternberg, manager): We are glad to state that the year 1907 has been a good year as far as our firm is concerned. We have increased the sale of our insulation specialties considerably, and are dealing with the largest firms in this country who are using standard composition goods for electrical purposes in place of hard rubber and porcelain more and more. We believe that our great country has resources enough to overcome the present money stringency, and though in the last month or two deliveries have been slow, we believe that the year 1908 will be a banner year for the electrical trade in general. This is our honest opinion, and we are glad to send you these few lines to show your readers that we are convinced that 1908 will be a prosperous business year, especially for the electrical and allied industries.

Duncan Electric Manufacturing Company, Lafayette, Ind. (Thos. Duncan, manager): The business enjoyed by the Duncan Electric Manufacturing Company for the year 1907 has exceeded all past records, having increased 61 per cent. over the year 1906; and if we accept the prospects for the ensuing year as represented by the number of contracts which we now have for meters, we hope to do still better. Our product is now being exported to every country of note, and the good reports which we receive concerning its dependability secure us in the belief that the year 1908 is going to be exceedingly prosperous for the Duncan company.

Excello Arc Lamp Company, New York (O. Baerwinkel, secretary and manager): In reviewing the flaming-arc-lamp business of the year 1907, we find that use of this novel and much-talked-of illuminant has been made where efficiency and power of light is a matter of consideration. Flaming arc lamps, which, when introduced, were looked upon as almost a luxury, rapidly became a necessity, owing to their advantages. The fact that the numerous lighting companies and large industrial concerns have adopted them after trials with other illuminants, should be a clear proof of their merits. At the same time the year 1907 has taught that the flaming arc lamp constructed on "cheap" lines is useless for all practical purposes, owing to its unreliability. We are told, and feel, that the Excello remains the standard flaming arc as before. The outlook for the year 1908 seems to us bright enough to confidently expect even larger sales than [illegible] year 1907, the results [illegible] satisfactory to the company.

Fort Wayne Electric Works, Fort Wayne, Ind. (J. S. Hunting, [illegible]): [illegible] the year 1907, [illegible] the electrical [illegible] has been a very [illegible] will not be as large as it promised to be during the early part of the year. The volume of business, however, the first of the year, was so large, even with the falling off during the latter months of the year, that the close will be reasonably satisfactory. The financial difficulties which the country has been experiencing during the last few months have curtailed purchases, particularly in the line of new enterprises requiring the sale of bonds or other securities. Many customers have doubtless been harboring their resources in an endeavor to prepare as much as possible for any unforeseen emergencies. These and many individual reasons have contributed very largely to the falling off in business the last few months. It is difficult to make a very definite forecast of the business of 1908, but I believe there is little doubt that it will show a very marked decrease over 1907. Much, however, depends, I think, upon the general financial situation, as a considerable amount of new business is entirely dependent upon the ability to market bonds.

General Electric Company, Schenectady, N. Y. (B. E. Sunny, vice-president, Chicago): The business for the first eight months in 1907 was heavier than ever before. During the last four months, however, the sales have fallen off sharply, so that 1907 will show less gross sales than 1906. The indications are that the sales for 1908 will be anywhere from 25 to 40 per cent. less than 1907. At least 50 per cent. of the purchases of electrical apparatus must be paid for from the proceeds of the sale of bonds and stocks, or loans, and the financial situation is such at the moment, and the condition is likely to remain for a good many months, that neither bonds nor stocks can be sold, and there is little or no opportunity to borrow. Almost the entire volume of business will be missing for a time, perhaps until after the presidential election. In the meantime the public-service corporations—railway and lighting—continue to do a satisfactory business, and it is not expected that there will be anything like the falling off in the business of these companies that there has been in the manufacturing companies.

Gregory Electric Company, Chicago (A. O. Kuehmsted, manager sales department): The year 1907 has been an exceptionally good one with the Gregory Electric Company, our sales being far in advance of any other previous year, the increase being fully twenty-five per cent. over the best year we have had previously. Our business has not been affected by the panic as much as a great many other lines; in fact, we believe it has rather helped us. Collections slowed up for two or three weeks, and orders fell off for about the same length of time, but we are again getting our usual share of orders and do not feel that we have any larger proportion of accounts which need close attention than at any other time, since our business is conducted very largely on a cash basis, and we sell very little to small supply dealers and construction firms. The outlook for 1908 appears promising to us also. We have bought heavily during the recent flurry and believe we shall be able to satisfactorily dispose of everything in the near future. This country is a large one, and we feel that somebody wants our goods somewhere. We issue a Bargain Sheet, which goes out monthly to every central station in the country, from which these people order the machinery we list, and we find that we are turning our stock practically every sixty days, which shows to us that people will buy if they can get the right article at the right price. We do not feel any alarm whatever, and are running on full time as usual. We also believe that if manufacturers in general will go ahead as though nothing had happened every trace of the panic will have disappeared within sixty days, and we feel confident that there is a demand for goods and machinery of all kinds, which cannot be filled when factories are shut down.

International Electric Meter Company, Chicago (J. S. Jackson, sales manager): To our direct-current line of instruments we have added a new design of alternating-current instrument which has given the best of results. We have every reason to believe that our business will increase many times that of the last year. As an evidence of what we believe to be our increasing prosperity we are preparing to install ourselves in a much larger factory in the near future.

Kellogg Switchboard and Supply Company, Chicago: Looking backward over the sales record of the past year shows that the business of this company has been characterized by a strong, healthy tone, which gives assurance of sound conditions for the months to come. The volume of trade early in 1907, both in common-battery and magneto apparatus, was good and continued longer than usual. The customary quiet months of midsummer were in a degree more active than in the previous year, while [illegible] encouraging for an excellent season. All in all, [illegible]

Lombard and Replogle Engineering Company [illegible] during the year has been filled to overflowing with work. We had great difficulty in keeping from getting more than three months behind with our orders. During the past two months, however, we have not received so many orders, although several unexpected contracts were closed and some duplicate orders were received. [illegible] development with us, it can hardly be considered a comparative year. The indications are that the coming year will give us more [illegible] work that we can do, even though we doubled our capacity during the last six months. This company is building water-wheel governors that are used mainly in electric power plants. We have been developing a new series of governors consisting of five types of machines during the past year. These machines are purely mechanical and are designed by Lombard and Replogle after their many years' experience in governing waterpower plants.

H. M. Loud's Sons Company, Au Sable, Mich. (H. Kimball Loud): The cedar pole market has been very quiet with us all through the year. We do not know what we can expect for 1908, but if the demand is anywhere near normal there will certainly be a scarcity of material, as there is very little cedar being put in by the producers this winter. Our recent experience would indicate that business is starting up, and we expect to enter upon the year of 1908 with a fair degree of confidence.

Mechanical Appliance Company, Milwaukee, Wis. (F. H. Petrie, secretary): The past year has been an exceedingly fortunate and prosperous one for manufacturers of small power units, especially those who have given attention particularly to the direct application of same to various forms of machinery. The late financial unpleasantness instead of diminishing business along this line has apparently had the effect of stimulating same, which is not an occasion for surprise in view of the fact that users generally are coming to the understanding that the best preparation for hard times is that which prepares them to take the fullest advantage of the increased volume of business which is bound to follow, while at the same time effecting an immediate saving in operating expense. This feature in itself, regardless of any other, carries with it the promise of a greatly increased volume of business with the improved conditions which are bound to come with the new year, and we are counting on a much better business, not only in volume but in point of profit, during the coming year than we have ever had.

Mica Insulator Company, New York (E. C. Wood): We are pleased to say that the volume of our business during the first 10 months of this year was very satisfactory. In common with other concerns in the electrical or allied industries we have noticed a lessening of the high-pressure conditions which have prevailed for the last two or three years. We, however, look forward to renewed activity in the early part of the year 1908, when financial matters can be restored to their former condition.

Pass & Seymour, Inc., Solvay, N. Y. (John W. Brooks, general sales manager): While we do not expect that our business for 1908 will increase to the same extent that it has in the past, yet we believe that the business will be healthier and that all lines of electrical industry will experience a steady, conservative increase.

Peirce Specialty Company, Elkhart, Ind. (C. L. Peirce, Jr., president): In reviewing the various features of our business for the year just closed, the most interesting deduction, and the one most clearly set forth by the development of our business, has been the widespread adoption of better outside construction specifications. A movement to this end has, of course, been on foot for many years. We have all of us preached the doctrine of better first construction, with a view of a lower rate of depreciation and a decreased cost of maintenance. Some of the larger companies were quick to adopt new methods, but in the field generally throughout the country all the preaching which has been done on this subject has borne but little fruit until the last three years, and the year 1907 seems to have culminated in a very general acceptance of the principles set forth. This movement, of course, means much for each company taking part in it, but for the industry at large it means still more, as it betokens a generally healthy condition, which augurs well for the investor, both present and future, and will do much toward increasing the stability of the operating company securities. The actual growth in our sales of construction specialties for 1907 over those of 1906 was 42 per cent., as against a growth of 61 per cent. of 1906 over 1905. In money value, therefore, our percentage of growth in 1907 is not as great as in 1906, but in the number of new accounts or new companies adopting our steel specialties the 1907

growth has been unparalleled, the explanation of the lessened percentage in money value being that the adoption during 1906 was very largely among the larger companies of the country, and ran into large sales, and the new companies adopting the material during 1907 were very largely confined to the plants in the smaller cities.

Rock Island Battery Company, Cincinnati, Ohio (M. A. Loeb, secretary and treasurer): Our business during the year 1907 has been very satisfactory, in fact it has been the biggest business year we have ever had, and while business just at the present writing is a little quiet, owing to the unsettled condition of financial affairs, we believe from the present outlook that the year 1908 will be fully as good, if not better than the past year.

W. H. Schott, Chicago: During the year of 1907 business continued in volume up until the present financial troubles. Since then, however, there has been a marked decrease, but, in my opinion, this will clear away, and I feel that during 1908 the volume of business in central-station heating lines will average better than during the season of 1907. The money required for the building of central-station heating plants is generally obtained in the towns in which the plants are built. The indications are that in the future, or for a time at least, investors will put their money into local enterprises instead of looking to outside investments, due to the fact that recent experiences in outside investments have caused people to believe that local industries that are sound should be taken care of first and then the surplus put into outside channels. The central-station heating business is in better condition today than it ever was, due to the fact that a sufficient amount of time has elapsed since modern plants have been built to demonstrate that they satisfy the public, satisfy the consumer and satisfy the investor, and with the record now back of them, I feel that the plants to be built in the next five years will exceed those built during the last five years.

Shelby Electric Company, Shelby, Ohio (J. C. Fish, president): It looks to us as if, although there is at present a slight dropping off in the consumption of incandescent lamps, things will soon regain their former condition and that we are headed toward the highest peak of commercial supremacy. This dropping off is good for the lamp industry, because it gives us a chance, in all of the different factories, to improve our product and get in better position to meet the demands of the consumers when these demands are made again. There is enough manufacturing capacity now to manufacture 50 per cent. more lamps than can be used for the next five years, and, consequently, while we may have a money famine, a repetition of the recent lamp famine is out of the question.

Standard Underground Cable Company, Pittsburg, Pa. (J. W. Marsh, vice-president and general manager): In our business, as in practically all allied industries, the year just closing records a decrease in volume, although not so large a decrease as might reasonably have been expected from the abnormally high prices of all our raw materials during a considerable portion of the year, followed and accentuated by the disturbed financial situation. In view of the low level of prices now reached by copper, lead, etc., and the postponement of much new work during the current year, I believe there will be a very fair volume of business in the year 1908, notwithstanding it is a presidential year, and that it will come as soon as the improved financial conditions become general throughout the country, as seems likely to be the case in the near future.

Vote-Berger Company, La Crosse, Wis. (M. I. Berger, secretary): The impetus given the Independent telephone companies by the enormous crops of 1905 and the prosperity of a year ago made its effect well known into the summer. Our experience shows that up to September business was far better than ever before. This activity extended to all lines of the telephone manufacturing field—interior telephone systems, rural telephone systems, town exchanges and larger common-battery installations. We have not much to say in regard to the closing weeks of the year, although up to the middle of November our results were gratifying. We confidently expect that the year 1908 will not only show the usual gains made by Independent telephony from year to year, but will, in addition, bring forth the business which under normal conditions would have been handled during the closing weeks of 1907. Judging from our unusually satisfactory two-ball adjuster business, electricians, contractors and electric-light plants have [illegible] 1907 a busy and prosperous year.

Weber Gas Engine Company, St. Louis, Mo. (Louis Bendit, sales manager): We enter 1908 [illegible] of the 24 years [illegible] and the large number of inquiries received in November and December [illegible] and capitalist regard- [illegible] the belief that 1908 will demonstrate that our country, with nat- [illegible] and with annual manufacturing products valued at $15,000,000,000, farm wealth of $7,500,000,000, can't be kept down, but must express the "Law of Progress" in growth and unfoldment. There need be no fear but that our Congress will give us safe and sane legislation that will conserve our best interests. A well-known writer said, "Progress is the law of the Infinite," and 1907 expresses a large measure of growth. The development of producer gas-making equipment and the internal-combustion motor had reached the point that enabled reputable builders of this prime mover to construct and install more power plants than ever before. It has been demonstrated beyond cavil that, with the economical performance of the gas engine and suction gas producer, electric-lighting and waterworks plants can be profitably maintained and operated in the smaller towns and villages, where it has hitherto been impossible, owing to the expensive fuel cost and other operating expenses in the smaller steam plants. Small flour and feed mills, likewise, have been encouraged by this economical method of making power to build new mills and refurnish old ones, and they are successfully operating in competition with large mills. Isolated lighting plants using this twentieth-century marvel in establishments, hitherto purchasers of energy from central stations, have found that the reduced cost for power enhanced their profits.

Wesco Supply Company, St. Louis: The marked success with which we have met has been extremely gratifying, and the word "Wesco" today is one of the existing trademarks of quality and is instantly recognized among the various operating telephone companies as such. We anticipate that the year 1908 will produce the same large volume of increase in the demand for our manufactured product as the year 1907 and preceding years.

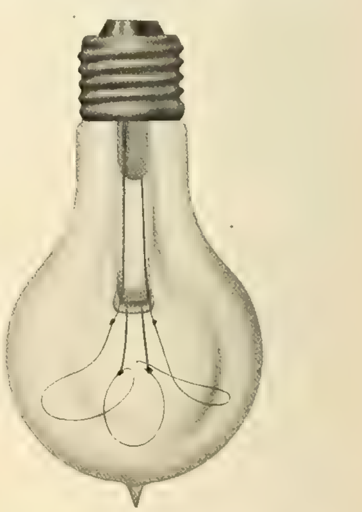
Western Lumber and Pole Company, Denver, Colo. (B. F. Vreeland, president): Business for 1907 has been exceptionally good with us all year, but there has been quite a dropping off in orders since December 1st. There are also fewer inquiries; but we can't complain if we do have dull times for a few months. Pole stocks in Idaho of desirable sizes are low, and prices have hit the bottom, unless it might be on an occasional car of some off size that some particular dealer might have an extra quantity of. We look for prices to advance at least 10 per cent. by March 1st, and more by April 1st, as Idaho stocks are low, and any sort of a demand will spring the price. The consumer who contracts early will, in our opinion, get the benefit. As to Michigan white-cedar poles, we do not look for any stiffening in prices before spring, but by that time prices on the staple sizes, such as traction lines use, should be up. As to outlook for 1908, that depends considerably on the money market, but we look for confidence to soon be restored, as the country in general is in too prosperous a condition to turn backward. However, we have been going too fast, and this check will prove a good thing for business interests in the end. We don't think 1908 will show by 25 per cent. the volume of business done in 1907, but it will be on a more solid basis.

Western Wire Sales Company, Chicago (J. Allen Haines, president): The past year has been one of the banner years in the history of the wire business, notwithstanding the fact that the copper market in the last few months reacted, and since that time has been in a more or less chaotic condition. Our orders indicate that the buyer and the electrical engineer are seeking to use high-grade materials, and we find that specifications are becoming more rigid. Inasmuch as the copper conditions, in a way, led to the present financial depression, it seems to us that the copper industry will be among the last to recover from it. It looks as if the next few months would show a gradual resumption of business, but, at the same time, we do not feel that for many months to come the wire business and the copper market will return to a normal basis.

Wisconsin Engine Company, Corliss, Wis. (C. A. Hamilton, general manager): We are very glad to state that during the last year our business has been very satisfactorily increased, and it is especially gratifying to us to be able to quote as our customers some of the best concerns in the country. We have made it a point to deal, as far as possible, with concerns which appreciate the engineering features of the apparatus which we manufacture, and whose trade will be of assistance to us in securing other business. During the last year we have shipped two large gas compressors having a capacity of 20,000,000 cubic feet per 24 hours to the Carnegie Natural Gas Company. Our list of engine sales for 1907 is too long to be given here, including as it does steam engines of various types, large and small, for many kinds of service, shipped to all parts of the country. Business for the past few months has fallen off considerably, but is now picking up again, and we look forward to very prosperous times in 1908. We see a very decided change in the views which the engineering profession holds in regard to the comparison of the commercial performance of engines with steam turbines. It has long been our contention that the steam turbine, with its much vaunted steam economy, is not a machine for reliable service and long life, and that the test showings of the steam turbine are not nearly obtainable in commercial practice. Developments of the last few months are bringing to light more and more facts in regard to the difficulties experienced with steam turbines. We hope to see the matter fully and openly discussed from an engineering standpoint. We stand ready at the present day to guarantee better results than can be obtained from steam turbines, and have furnished engines in plants where steam turbines have been installed. The steam turbine has been the subject of an unparalleled campaign of exploitation, and the Corliss engine, we believe, has been unfairly disparaged. As to the matter of economical power production, it is our belief that the gas engine, in its present development, is by far the most economical type of prime mover, except in some special cases of waterpower installations. We control the Sargent patents on internal-combustion engines, and are building engines in sizes from 400 to 5,000 horsepower. We have a large number of inquiries for these engines, and are confident that orders will be placed in the very near future, not only with us, but with other concerns, for a very large horsepower.

The "Solar" Incandescent Lamp.

The incandescent lamp with the long, anchored filament herewith illustrated is made by the Solar Glass Company of 319 Superior Street, Toledo, Ohio, a new company formed to manufacture incandescent and arc lamps. It is asserted that the filament is treated by a secret process which adds greatly to its brilliancy, efficiency and economy. The arc lamp which the company is about to introduce is a small one, to burn from 50 to 75 hours without retrimming, and giving 700 candlepower with a consumption of about 2½ amperes.



THE "SOLAR" INCANDESCENT LAMP.

The organizer of the new company is Mr. W. W. Jones, a well-known business man of Toledo. The president of the company is Mr. George E. Dutton, also prominent in Toledo financial circles. The general manager of the company is Mr. E. J. McMullin, who is in active charge of the office and factory. The factory is said to be exceptionally well equipped.

Reliability of Steam Turbines.

After installing an electric generating unit and operating a portion of its plant with motor drive, the Everett Pulp and Paper Company, owner of a large mill at Everett, Wash., recently decided that the advantages of this system warranted it in putting its entire plant on the same basis.

Accordingly the president and general manager of the company, Mr. W. H. Howarth, on his return from an extensive trip abroad, visited the leading industrial centers of the East, accompanied by Mr. T. H. McDonald, his chief engineer, with a view of deciding upon the best type of prime mover to use; and, after observing the operation of various standard machines, particularly in the light of his European experience, Mr. Howarth concluded to purchase a steam turbine, having 500 kilowatts capacity, of the improved type built by Allis-Chalmers Company. During Mr. Howarth's investigation the question most thoroughly gone into was that of "reliability." The builders were able, however, to point to a large number of turbines installed, not only in electric-railway and lighting plants, but also in industrial works of various kinds, ranging from factories, where the load is comparatively uniform and steady, to steel mills, where it fluctuates widely and with great rapidity during continuous 24-hour operation; and the results demonstrated were such as to leave no doubt in Mr. Howarth's mind as to the dependence to be placed on these units, even under the most severe conditions of service.

Light, Heat and Power Development in Salt Lake City, Utah.

With the rapid growth of Salt Lake City and the notable development of mining industries all around it, the demand for power is far exceeding the supply. Many mountain streams are being utilized, and the power is transmitted to varying distances, where it is sold in large or small quantities.

The Salt Lake Public Service Company is erecting at this time a combination of plants consisting of four hydro-electric developments in the mountains, some twenty miles distant, and one steam auxiliary plant, located nearly in the heart of the city of Salt Lake.

The purpose of this article is to describe the steam plant.

BUILDING.

The building is being constructed of brick and steel, with concrete foundations, all on 30-foot piling. The floors and roof are of reinforced concrete and the windows and doors are of metal and wire glass. A fire wall separates the turbine and boiler rooms, also the turbine and high-tension rooms. The front elevation is shown in Fig. 1.

The plant is designed for a capacity of 6,000 kilowatts in six units—four of 1,250 kilowatts each and two of 500 kilowatts each. The station layout as exhibited in Fig. 2 shows the relative location of all the larger apparatus.

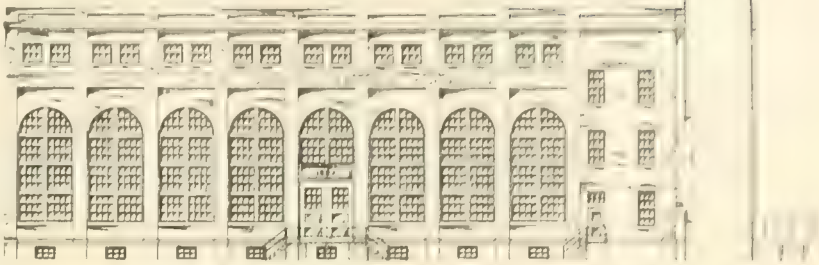


FIG. 1. FRONT ELEVATION OF SALT LAKE CITY POWER HOUSE.

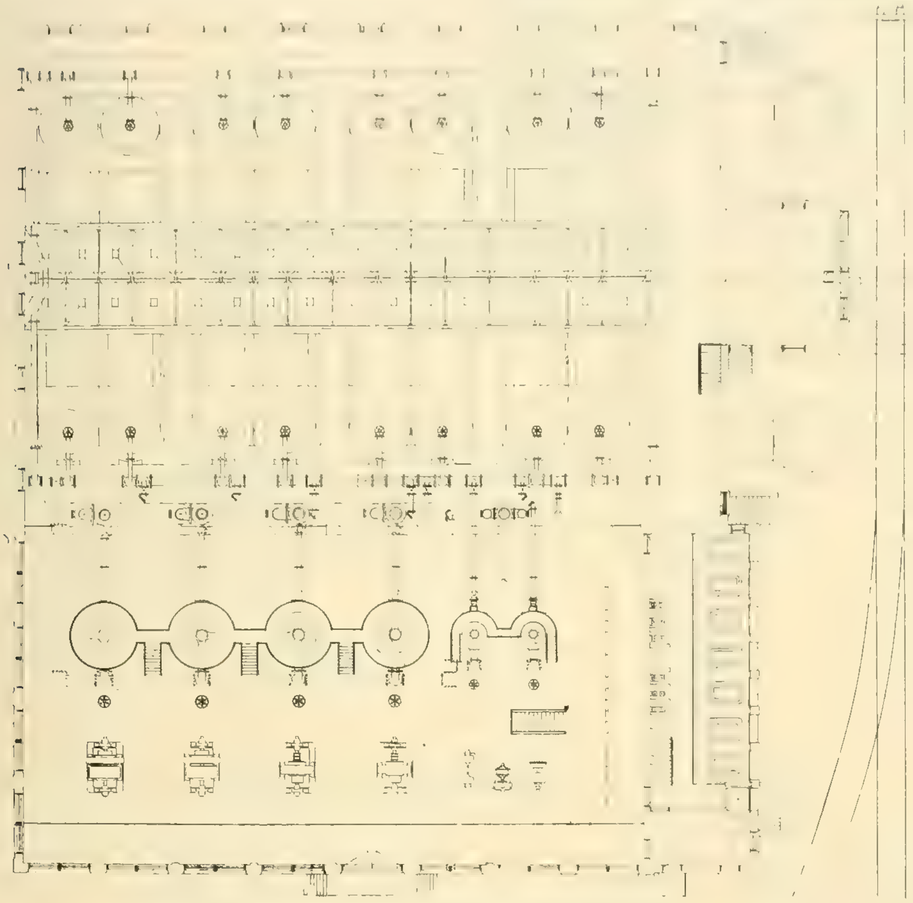


FIG. 2. PLAN OF SALT LAKE CITY POWER HOUSE.

BOILER ROOM.

The boilers are of the Wickes vertical type, set in two rows of eight boilers each, with two boilers in a battery. Rated capacity per boiler is 400 horsepower. Each boiler is equipped with a Murphy automatic furnace, and each battery is separately driven by stoker engine.

Natural draft is obtained by two reinforced concrete stacks 11 feet inside diameter and 200 feet high above grade. Each stack will handle one row of boilers, although they will be cross-connected for convenience in cleaning, etc. Fig. 4 shows one stack just completed. Each row of boilers is being equipped with its own feed-water heater and pumps, and when complete the heaters and pumps will be cross-connected, so as to obtain greatest flexibility. Space is left in rear of boilers for economizers, to be installed later.

The boilers are designed for a working pressure of 175 pounds. On account of the company doing a public-heating business, the ratio of boiler horsepower per kilowatt is somewhat large and also allows for the absence of superheating surface.

A 10-foot basement extends under the entire building so that ample room [illegible] pipes [illegible].

A [illegible] the feed-water heaters [illegible] from heating [illegible] and from which the [illegible] the heaters. This tank will also connect direct to condenser header for emergency. The condensers are of the barometric type and ordinarily supplied by steam pumps placed in basement over cisterns into which are connected artesian wells.

City water at a hydrostatic pressure of [illegible] pounds is brought into the building through large service and so connected that in any emergency an ample supply of water is always at hand.

The transverse section of boiler room is shown in Fig. 5, and the first four boilers erected are seen in Fig. 3.

Coal will be brought to the [illegible] company's private track [illegible] of a possible coal [illegible] months, large storage [illegible] for. The bunkers will hold 1,000 tons. These are above and between the two rows of boilers, and will feed direct by gravity into the furnace hoppers. A switch-back, as shown on Fig. 2, allows for convenient handling of [illegible] ample bin space, will provide for storage of about 12,000 tons.

The coal is delivered from dump cars direct into hopper, from which a short conveyor will carry it to crusher, or to continuous conveyor, if no crushing is required.

The ash will be delivered direct from stokers into a large concrete hopper under the furnaces. From this hopper it will be delivered into a continuous conveyor and carried to concrete ash bin at one end of coal bunkers, from which it will be spouted direct into cars. Figs. 2 and 5 show the general scheme.

TURBINE ROOM

The present installation consists of a pair of 500-kilowatt, two-stage Curtis turbines, equipped with one motor-driven exciter and one turbo-exciter. One or two of the larger generators will follow immediately.

For the direct-current power load a rotary will be installed which, with compensator, will supply the 440-220 direct current. The generators are wound for 2,300 volts, three-phase, 60 cycles, and will operate at a speed of 1,800 revolutions per minute.

The turbines are specially designed to operate in connection with central-station heating and will furnish steam at required pressure from first stage; the second stage is regularly equipped with con-

Fig. 3. Arrangement of Vertical Boilers.

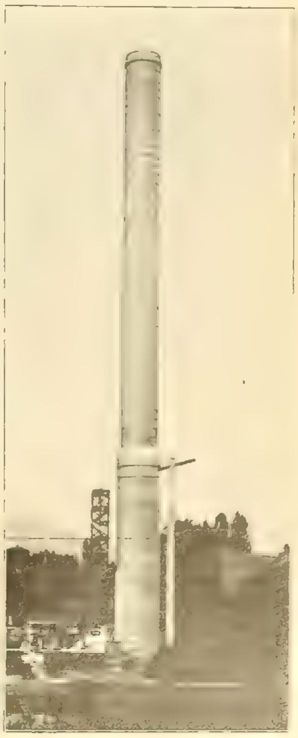


Fig. 4. Completed Concrete Stack.

VIEWS OF SALT LAKE PUBLIC-SERVICE PLANT DURING CONSTRUCTION.

denser and will operate under standard vacuum for the altitude of Salt Lake.

The pressure from first stage leading to heating mains will be controlled with a special reducing valve which is automatic in its action and which closes when, on account of light load on turbine, the pressure in the first stage drops below the required steam-main pressure. The turbines are regularly equipped with oil pumps and static accumulators to handle the step bearings.

A 20-ton three-motor overhead traveling crane will span the turbine room.

STEAM PIPING.

Simple piping design is permitted by the relative location of boilers and turbines. A high-pressure

A tunnel will connect the plant with the center. This tunnel will be of reinforced concrete of special design and will have a space in the clear of five feet wide by five feet high. In this tunnel will be placed all the electric and heating trunk and feeder lines, return lines, high-pressure steam lines and pressure-recording and indicating lines. The electric cables in tunnel will be specially insulated with an asbestos covering for protection against the somewhat high temperature reached during the heating season.

The underground lighting territory is supplied with single-phase primary and three-wire secondary circuits. The city blocks are 660 feet square and the streets are 132 feet wide, so that by Fig. 7

Automatic supply and control of heat over the entire system is obtained by one 16-inch low-pressure steam line, one six-inch high-pressure steam line, one two-inch air line and one 1½-inch pressure indicating and controlling line, all placed in the tunnel before referred to.

When the low-pressure line fails to supply the required center pressure, which may be due to light loads on turbines, the high-pressure line direct from the boilers opens automatically at the plant and supplies the deficit. Either high or low-pressure line may be shut off without interruption in service.

The distributing mains are also thoroughly valved, so that repairs and new connections can be made

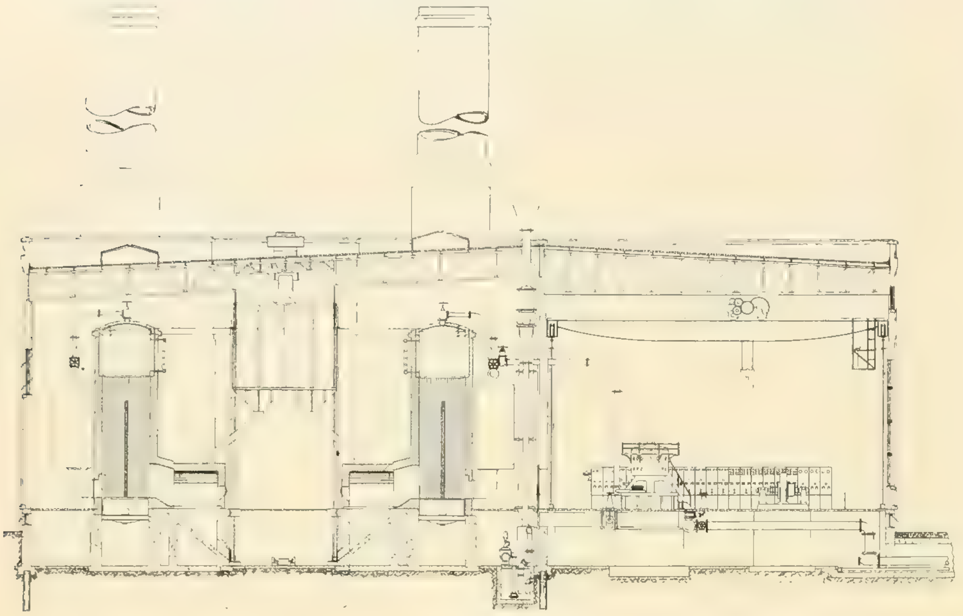


Fig. 5. Transverse Section of Boiler and Turbine Rooms.

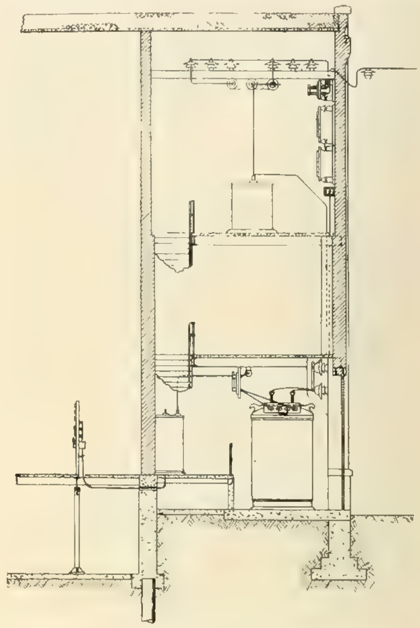


Fig. 6. Transverse Section of High-tension Apparatus Room.

THE NEW POWER HOUSE IN SALT LAKE CITY.

steam belt will, when plant is complete, encircle the 16 boilers. The steam belt will be valved into quadrants, so that any section can be cut out for repairs without interference with regular operation.

The method of installing the steam belt allows for full contraction and expansion of the headers and an easy way for taking off supply lines to the various machines, as well as perfect drainage of any condensation. Each boiler delivers steam through an eight-inch branch, which connects with long radius bend to the 16-inch header, and in each branch will be installed an automatic stop and check valve for protection to boiler or header in case of a rupture in either.

The second stages of the 500-kilowatt turbines will be connected to a twin condenser of the Baragwanath manufacture. The first stages are connected into a common exhaust header, so arranged that the feed-water heater will float with the heating mains, and into this same header all the auxiliaries will discharge their exhaust. A combination back-pressure and relief valve is provided, both in first and second-stage exhaust lines.

SWITCHBOARD AND HIGH-TENSION APPARATUS.

Located on the turbine-room floor, the main switchboard will consist of the regular generator, exciter and feeder panels, together with the panels for receiving the current from the hydro-electric plants.

After leaving the switchboard, the feeder wires lead directly to a tunnel for general distribution, and the lines leading to high-tension apparatus lead directly through fireproof wall into special compartments, as shown in section in Fig. 6. These compartments will contain seven 1,000-kilowatt, 33,000-volt transformers, the necessary oil switches for both the high and low sides of transformers, lightning arresters, disconnecting switches, coils, and a complete bus-bar arrangement for either one or two three-phase, 33,000-volt incoming circuits on either one or both banks of transformers. One spare transformer will be in readiness to throw into the circuit at any time without undue interruption in service.

[illegible]

[illegible]

it will be seen how economy in construction and operation is obtained by running the duct lines close to curb around each block and once across the street at or near center of block.

Transformer manholes are located near center of side of each block, and transformers are put in multiple on the three-wire secondary loop, so that the copper must load equally.

Each block has its own pair of pressure wires leading to station switchboard, thus enabling the operator to determine at all times the characteristics and performance on each individual block, also making perfect balancing and regulation possible.

The alternating-current power circuit will dis-

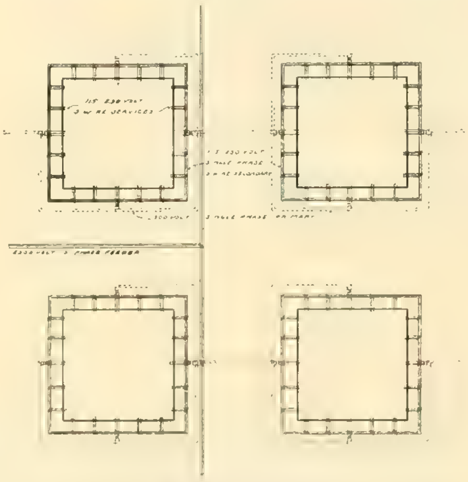


FIG. 7 DIAGRAM SHOWING ARRANGEMENT OF UNDERGROUND LIGHTING CIRCUITS IN SALT LAKE CITY.

tribute straight three-phase, three-wire, 230-volt current and will cover the entire district. The direct-current power circuit will distribute 440-220-volt, three-wire current and will cover the district.

HEAT DISTRIBUTION.

Steam heat will be distributed through a system of mains and laterals. The downtown district will be piped complete and will have the unique feature of having a well-defined center from which all mains run. These mains are so designed as to connect at all intersections, which eliminates dead [illegible] complete balance in pressure

at any time without inconvenience to the public.

A large part of the heating business is so favorably located that the condensation from the radiation will be returned to the plant by gravity. A considerable amount of pure hot water is thus obtained.

An air line supplying 15-pound pressure direct from the plant will be run with every service for the control of the automatic heat regulators.

The entire system, known as the "Schott System," was designed and is being constructed by W. H. Schott of Chicago, with J. C. Hornung as resident engineer in charge.

Preparations for Electrical Show.

For this year's show the management of the Electrical Trades Exposition Company added a large section to the floor space of the 1907 Electrical Show at the Coliseum, Chicago. A much more elaborate decorative and lighting scheme was also adopted. That these added responsibilities were justified is already apparent from the fact that nearly all of the enlarged exhibit space has been contracted for. All of the leading electrical manufacturers and all important branches of the electrical industry will be represented at the show, which will open on January 13th and close two weeks later.

One feature which has not been present at former shows will be a large space in which a manufacturing company will show its large line of electric vehicles. This company will also give demonstrations with a battery-charging outfit.

Convinced that the technical schools are developing many young engineers, perhaps geniuses who need only the stimulus of public competition to attract attention to their efforts, Homer F. Niesz, the manager of the show, has offered prizes aggregating $100 in gold for a competition among the students. The aim is to draw from schools, experimental laboratories and amateur workshops at home models of any electrical contrivances that show talent and thus would excite interest on the part of the professional electrical or mechanical experts. This invitation, which is free practically to all students, has been sent out to schools and colleges all over the United States, and it should be of particular interest to the students of public manual training schools and strictly technical institutions in Cook County.

The terms of the competition and rules of eligibility are simple. There is no expense attached to a nomination for the competition. It only will be necessary for the contestant to send in his name and address by January [illegible] and to state under which of the following headings his device should

be exhibited: (1) Electric light, (2) electric power, (3) heat, (4) electrochemistry and electrotherapeutics, (5) electrical transmission of intelligence, wireless telegraphic, telephonic or power apparatus of any kind, and (6) devices relating to radio-active substances.

Men competent in the various phases of electrical science will act as judges for the competition. In addition to the cash prizes this commission of experts will present certificates to all exhibitors. Further information may be obtained from Mr. Niesz, 1006 Monadnock Building, Chicago.

Electrical Progress of 1907 on the Continent.

[*Continued from page 13.*]

In France some interesting experiments have been made at the military station of the Eiffel Tower, which is in charge of Captain Ferrié. This is only a provisory plant and is equipped with only 12 horsepower. Even in this case the great height of the tower, 300 meters, gives it a long range, and signals are sent to the French war vessels in the Mediterranean at the Toulon arsenal and at Marseilles and also to vessels on the African coast as well as to the shore stations at Casablanca, Morocco and at Bizerta, near Tunis. Should the power of the Eiffel Tower station be increased to 50 horsepower, engineers think there would be no difficulty in signaling across the Atlantic.

A number of stations have been equipped on the French coast. One of these is near Dieppe on the channel coast and the others lie at Havre and Wissant. On the Atlantic the La Rochelle post is one of the newest. The French government has recently been carrying out experiments on the Mediterranan between the vessels of the war fleet and these have been quite successful. Connection is made also to the different coast stations of France and Algeria.

Experiments with wireless telephony are carried on in Italy and in Germany with some success. I may mention the experiments which the Telefunken Company has been making for some time past near Berlin at a distance of 25 miles. Sig. Majorana made some trials of an improved apparatus, working between Rome and the Monte Mario station, at three miles distance. He used a Poulsen apparatus in connection with his newly invented microphone and as a receiver a Marconi electromagnetic detector. The results were quite promising and conversation could be heard very well. No doubt longer distances can be covered.

TELEPHONY.

The Milan telephone exchange is now testing a new conversation register or counter which is placed in each subscriber's circuit. By means of a relay connected in series on the line the counter is operated automatically upon the use of the telephone by a subscriber and is cut off again by a reverse action.

Among the new companies formed in Germany I may cite the Automatic Telephone Syndicate of Berlin, which operates a new system of this kind. Among the members of this syndicate is the Siemens-Schuckert Company.

Among the loud-speaking telephones the Marzi apparatus, which has appeared in Italy, is attracting attention. The Army Department has been trying it and it appeared to work satisfactorily. On the Rome-Florence line some experiments were also made with encouraging results.

Probably the largest telephone exchange yet to be built, at least in Europe, is now in course of [illegible] in Hamburg [illegible] Telephonwerke. It is intended to replace the [illegible] which are now in use in the city and is designed for [illegible] 30,000 subscribers. The leading features of the new plant are the city telephone boards, the suburban department and a very complete electric plant which supplies the current.

Both telephone and telegraph matters are making progress in Italy. Not long since, Parliament voted a credit of $5,000,000 for the postal, telegraph and telephone departments. Of this, $2,400,000 is allotted for telegraph extension and $1,600,000 for telephones.

ELECTRIC RAILWAY IN ONE OF MILAN'S NARROW STREETS.

According to recent figures, there are 85,228 subscribers' stations in the city of Berlin, and the length of telephone wire is nearly 180,000 miles. There are upward of 718,000 conversations per day. On the new Paris-Berlin double telephone line, which is 720 miles long, there are 54 conversations a day. In the whole of Germany the number of telephone employes is 14,527.

MISCELLANEOUS PROCESSES.

In the field of electro-metallurgy there has been a very satisfactory progress during the year. As an example, I may cite the large steel-producing plant which is now in operation near Turin, where there are installed five of the new Stassano electric furnaces. The present plant is located in the Lanzo Valley, some 25 miles from Turin, and is owned by the Alta Italia Company. It is operated on the three-phase system, and at present there are installed two furnaces of 1,000-horsepower capacity, one of 200 horsepower and two furnaces of 100 horsepower. From the largest furnace is obtained a run of five tons of metal. It uses two arcs for the fusion. High-tension current coming from a pole line at 22,000 volts is reduced to 150 volts for the furnaces, which use about 2,500 amperes.

Turning to iron processes, a new electric-furnace [illegible] be employed hitherto, can now be turned to account, likewise the very impure native ore. The [illegible] good quality.

The aluminum industry is flourishing on the Continent, and in most of the leading countries there are electric [illegible] plants in operation. In France two of the leading firms are the Froges and the Pechiney companies, which are increasing their plants considerably. The first of these is erecting a hydraulic plant on the Durance River which gives about 40,000 horsepower, while the latter company expects soon to turn out 4,000 tons of aluminum a year from its new plant. At present it is using 12,000 horsepower from the hydraulic plant at St. Jean. Another concern, the Arve Company, has taken up the manufacture of aluminum at the Cheddes works. A branch from this enterprise has also erected a large plant in the Pyrenees region of France at Auzat. It has a total capacity of 12,000 horsepower, and the company expects to start operations here with 5,000 horsepower in the electric furnaces.

An industry which is very promising is the production of artificial fertilizers in the shape of nitrates by separating the nitrogen of the air. The large plant at Nottoden, equipped on the Birkeland and Eyde system, is one of the most successful in this direction. A new nitrous product, cyanamide of calcium, is also produced for this purpose, and a syndicate of German capitalists has been lately formed for working the process. The promoters are to erect a hydraulic plant in Dalmatia, near the town of Spalato, which is to furnish 25,000 horsepower, and later on they expect to increase the capacity to 75,000 horsepower.

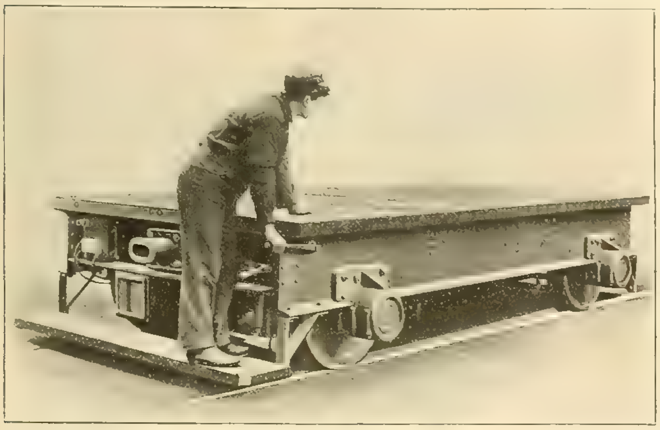
A Storage-battery Auto-truck for Industrial Railways.

Beset by the problem common to all large industrial establishments of transporting material from one part of the works to another in an economical manner, the Westinghouse Machine Company found the most satisfactory solution in storage-battery auto-trucks of its own design and construction.

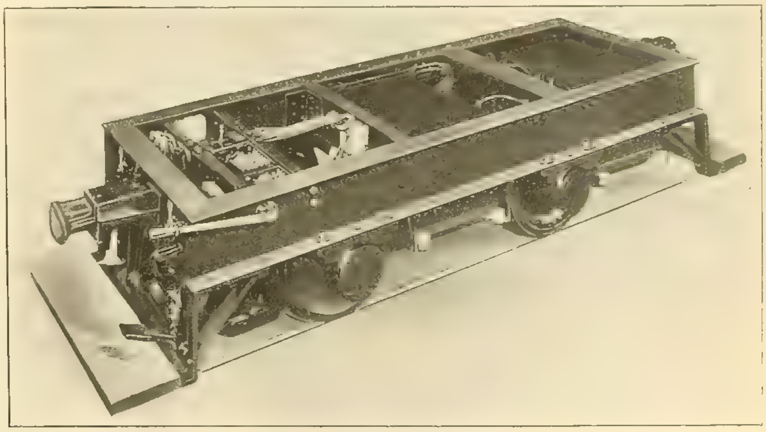
Convinced by the results obtained during several years of continuous service of their fitness for the purpose, the company has put the trucks on the market and is now prepared to furnish them in capacities of from 10 to 40 tons.

When the storage-battery auto-trucks were installed delays of material in transit were practically done away with, and since the trucks furnished their own power the number of laborers required for moving of material was greatly reduced. More important still, there was a marked improvement in crane service, since a crane was no longer needed for transporting castings below 10 tons in weight (the first trucks installed being of 10 tons capacity) from one end of the long shops to the other, driving several cranes before it and putting them temporarily out of commission. When larger switch and voltammeter. A convenient step and their improvement in crane service.

The trucks, though of extremely simple construction, are very substantially made of the best materials. A steel frame, thoroughly braced, is carried on four wheels, the journals of which run in roller bearings. The driving axle or axles, as



Operating End of 40-ton Truck.



Ten-ton Truck with Deck Removed.

STORAGE-BATTERY TRUCKS FOR INDUSTRIAL RAILWAYS.

the case may be, carry the motor or motors, as in street-railway practice. A spring-suspended cradle of angle iron carries the battery trays.

At the operating end of the truck are mounted the controller, brake, charging receptacle, cut-out switch and volt-ammeter. A convenient step and draw-bar head are provided at each end. All the machinery is below the top of the frame and is covered by a heavy wooden deck for carrying the load. This deck is made in sections so that any part of the mechanism is readily accessible. The controller gives four speeds and is provided with operating and reverse levers, which are interlocking to prevent premature reversal, thus protecting the motor and the batteries.

The battery is contained in two or more trays of cells and is of ample capacity for the particular service. It is especially designed to operate at high rates of charge and discharge. Time available for charging during the working hours is usually thrice the period of time that the truck is actually running. Charging is made so simple that the truck can easily be charged during these idle periods.

During a six months' test of the standard 10-ton truck illustrated on page 25 the power required to charge the battery in regular and heavy shop service was accurately metered. It averaged 63 kilowatt-hours per month. At five cents per kilowatt-hour the cost for the current would be only $3.15. The work done was recorded and averaged practically 700 ton-miles per month, the loads running from a few hundred pounds to 15 tons.

These trucks, used as locomotives on a level track and without any weight to secure adhesion, can haul with suitable trail cars from one-half to their full rated capacity as a truck, depending upon the condition of the track and kind of bearings on the cars hauled. By placing sufficient weight over the drivers to secure adhesion they are capable of handling from one to two times their capacity as a truck for a continuous period of not more than five minutes.

Standard trucks are made for six different gauges, namely: 18, 21½, 24, 30 and 36 inches, and 4 feet 8½ inches. For track systems provided with turntables they are made with rigid trucks. Where tracks are installed with curves the trucks for all gauges up to 36 inches are provided with swiveled front axle, permitting free operation on curves as low as 12 feet in radius.

Electric Machinery Company's Alternators.

The chief aim of the Electric Machinery Company of Minneapolis in developing its line of alternating-current generators has been the production of a machine of simple and effective design, having in mind also the item of first cost to consumer and efficient and economical operation. Three styles [illegible] engines; belted or waterwheel type, and the spherical or self-contained design for small plants. Sizes [illegible] ard frequencies are 25 and 60 cycles. The alter- [illegible] losses in copper and iron a flat efficiency curve is secured, giving nearly uniform efficiency over a [illegible]

shaped slots, pole faces and properly proportioned air-gap.

These alternators will operate in multiple with each other without difficulty or objectionable cross currents, provided the angular velocity does not vary more than 2½ electrical degrees from the normal. The construction of the pole face tends to correct variations in angular velocity without objectionable heating. Particular attention is called to the system of ventilation. The revolving field has vents at intervals in the pole-pieces which admit cool air from near the shaft up through the pole-piece inside of the field coil. These vents register with vents in the armature core, which are formed by corrugated spacers which obstruct the air only very slightly. These cooling air currents easily find their way out of the frame through the many openings and carry the heat off that is generated in the windings and core. The tooth supports at the ends of the armature core are also open and afford opportunity for air to sweep by the ends of the cores and between the armature coils. The coils do not lie close to each other, but are open like a grate, and permit air to pass through on all sides of each coil.

The stationary armature and revolving field type of construction is used in all sizes and types of Electric Machinery Company alternators. The stationary armature carries the high-voltage winding. The exciting current of low voltage is carried on the revolving field. This design gives rigid construction for the high-voltage winding. The circular frame is made of cast iron and is of open rigid construction.

The armature core is built up of thin steel segments (A). (See cut.) They are annealed to soften them, japanned on both sides to prevent eddy current losses and then assembled, clamped between rigid clamping rings so that the whole forms a rigid magnetic circle of sheet steel with slots on the inside for receiving the armature coils. Ventilating spaces are maintained at short intervals in the assembled core by an ingenious spacer (R), which it is impossible to displace.

A tooth support (S) is used at the ends of the core to support the teeth and prevent humming and chafing of the coils by the teeth of the laminations.

The armature coils (F) are wound on forms of double-covered wire without joints and insulated entirely before being placed in the slots of the armature core. For any given machine all coils are the same shape and size, so that one coil will replace any other coil in the machine in case of damage. The coils lie in position "spoon fashion," so there is no chance for coils to bear on each other hard enough to endanger the insulation. In case of damage any coil can be removed by lifting the adjacent coils.

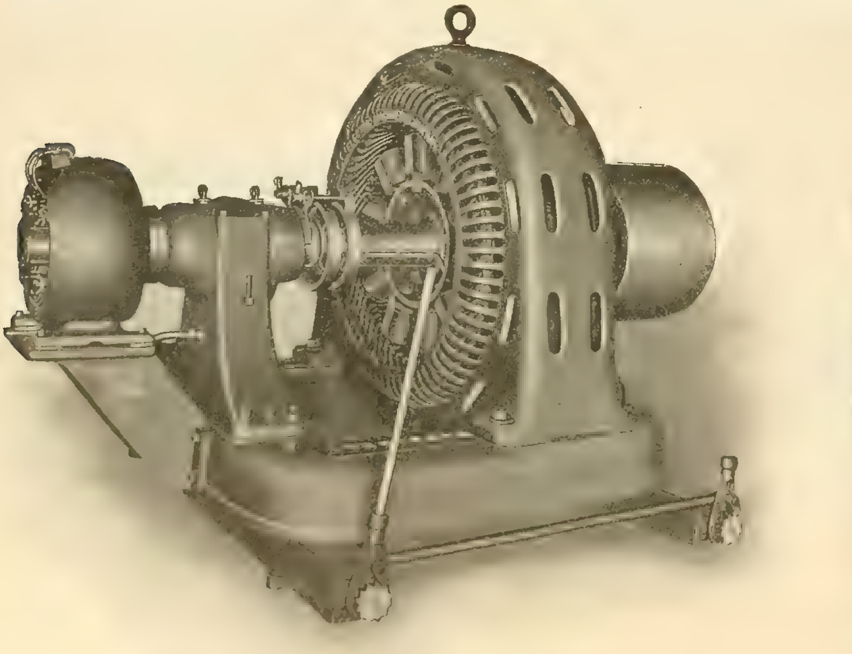
Attention is directed to the type of armature slot (B) used. The top of slot is open and the coil (F), with all its insulation, may be placed in the slot without cutting and splicing the conductors. Coils are squeezed into the slot tight and a composition wedge (E) driven in the nicks (C) near the top of slot which holds the coils absolutely rigid.

The revolving field spider is of cast iron or cast steel of high magnetic quality and carries the poles (O) with the field windings (U). The pole-pieces are built up of sheet steel punchings (I), insuring a uniform high magnetic quality in all poles. In very high-speed machines with few poles, cast-steel spiders with poles cast on are used with laminated pole tips (1) (2). The field coils are wound of double-covered square copper wire (U) for the small-size alternators and of ribbon copper (3) (5) wound edgewise for the larger sizes. Collector rings (Z) are large and heavy, affording plenty of surface for carbon brushes and large wearing depth. They are insulated from each other by large air spaces and from their shaft support by mica rings (6).

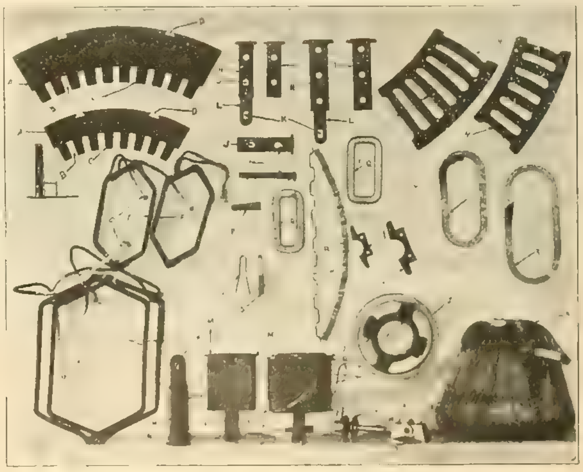
The brush-holder (Y) is of simple design with two brushes (X) bearing at different angles, so there is no tendency for the brush-holder to turn on its supporting stud (W). The brushes (X) are carbon of the highest electrical quality, self-lubricating and of a hard but not scratchy quality.

All fields are so designed that they can be fully excited with a 125-volt exciter. Ordinarily 125-volt exciting current will excite the alternator so as to give full voltage when the alternator armature is carrying full-load amperes at zero power factor.

Any of the alternators may be run in either direction without any change in any part of the alternator. By proper design of armature teeth, pole tips and air-gaps, as well as mechanical construction, quiet running under all loads is obtained.



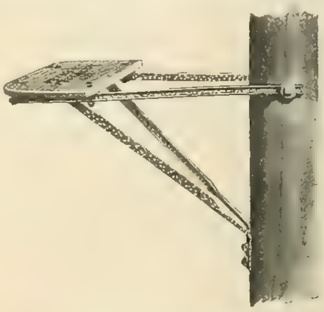
ELECTRIC MACHINERY COMPANY'S ALTERNATOR, WITH EXCITER.



DETAILS OF ELECTRIC MACHINERY COM[illegible]

Peirce Pole Seat.

The accompanying cut shows a new pole seat which has been put on the market by the Peirce Specialty Company of Chicago, and Elkhart, Ind.



PEIRCE POLE SEAT.

It is made of high-class channel steel, which is thoroughly galvanized to protect it from the weather. The seat proper is made of thoroughly kiln-dried and seasoned hard maple which has been soaked in oil to prevent its absorbing moisture and warping.

From the illustration it will be seen that the two channel steel feet are bolted close together on the pole. This method of adjustment forms a truss and is especially strong.

Underground Conduit of Wood Fiber.

Since the manufacture of Orangeburg fiber conduit began in 1893, the market for this product has grown steadily. The character of its material, then a complete novelty, and the success which has been attained by the conduit in practical employment, render it one of the most interesting departures which, in recent years, have been connected with underground construction.

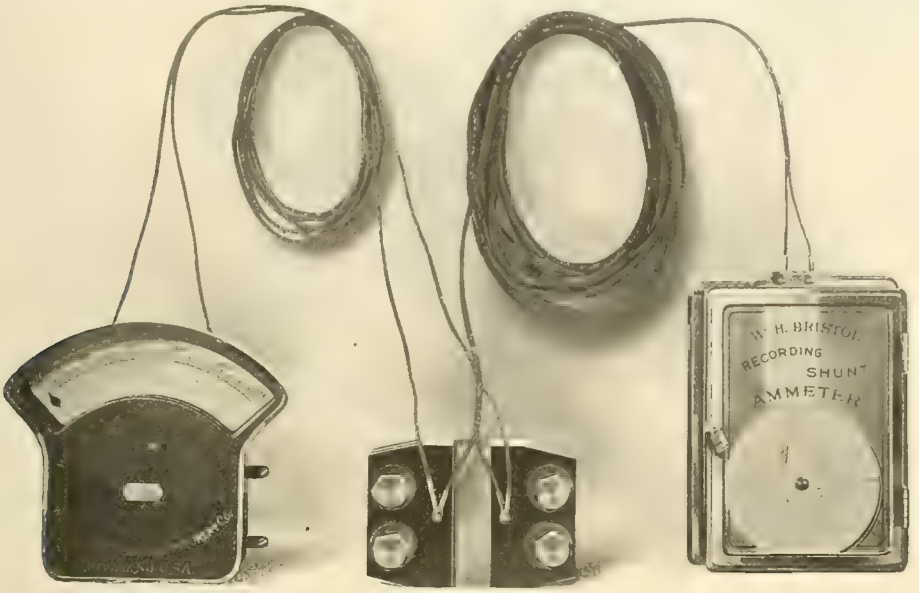
In making the conduit, wet wood pulp, in an excessively thin film, is wrapped under pressure, upon a forming mandrel, the individual fibers becoming inseparably united into a solid and practically homogeneous wall. Taken off the mandrel, the wet pulp structure is subjected to an air-drying process, after which it is placed in a vat of insulating and preservative liquid, which thoroughly permeates the entire structure. After treatment, the walls of the conduit, upon cutting, present a strong resemblance to hard rubber.

Orangeburg fiber conduit is manufactured in socket joint, sleeve joint and screw-thread type. The interior of the duct is finished as a perfectly smooth wall, giving a smooth surface for the draw-

ing in of cables. The ducts are so light that they are usually made in lengths of five feet. A workman can readily carry 50 feet of three-inch [illegible] joint Orangeburg fiber conduit from curb to trench. A like number of feet of clay conduit would weigh over 200 pounds and would be utterly impracticable to handle in this fashion. Orangeburg fiber conduit shows no deterioration from the action of gas; is waterproof and not attacked by acids or alkalies; is unaffected by moist earth and lasts indefinitely underground. It is a good non-conductor. It is now in use in every state in the Union and in many foreign countries.

New Recording Milli-voltmeter and Shunt Ammeter.

Electrical engineers have long felt the need for an accurate and sensitive recording milli-voltmeter which is adapted to practical everyday service as well as for laboratory tests. There has also been a demand for a recording ammeter of the shunt type, which can be connected by leads to the main



RECORDING AND INDICATING AMMETERS CONNECTED TO THE SAME SHUNT.

bus-bar. The shunt system is especially economical where heavy currents are to be indicated or recorded, as the instruments may be located at a considerable distance from the main current, thus saving great expense in carrying the main conductors to the point where the instrument is located.

Recently recording instruments have been designed, the two most important features of which are a sensitive electrical movement of special design, made by the Weston Electrical Instrument Company, and a new recording system using a patented smoked chart, so arranged that there is absolutely no friction between the recording arm and the chart.

These instruments are so sensitive that the recording arm will move over the whole scale for five milli-volts or less, making it possible to accurately record one ten-thousandth of one volt. The graduations on the chart are evenly proportioned over the entire range, the same as on the Weston ammeter, so that even though there is only a small current flowing, the readings may be as readily taken as if the current was the maximum that the instrument would record. This feature will be greatly appreciated, as there are many places where it is desired to install instruments for increasing future demands, and it is important that the records be perfectly clear, even though the loads are very light when the outfit is first installed.

The records are made on a novel semi-transparent smoked chart, which is periodically brought into momentary contact with the end of the recording arm, by means of a special vibrating device. In this way a series of white dots are made on the smoked surface, and these form a continuous line, and a record is thus made without causing any friction between the moving arm and the chart. The rate of vibration of the chart is timed to suit the frequency and range of the variation in the current to be recorded. The usual period of vibration of the chart is once in 10 seconds, but to obtain continuous lines where the fluctuations of the current are quite rapid, the vibrating attachment is made to operate twice every second. When the record is completed the chart is dipped in a simple fixative solution, which makes the record permanent for filing.

The recording milli-voltmeter is in appearance much like the recording ammeter illustrated herewith. A chart taken from one of these instruments in connection with electrolysis surveys of underground structures, which are being conducted by the Electrical Testing Laboratories of New York city, is typical of the clear record the instrument makes. [illegible] the recording arm was the middle of the scale, so that the record might be independent of the direction [illegible] of the current changes from negative to positive during the day. It is expected that by using a number of these instruments, operating simultaneously at different points, stray currents in water and gas mains or in any underground structure may be recorded, making it possible to discover the causes of trouble and how they may be eliminated.

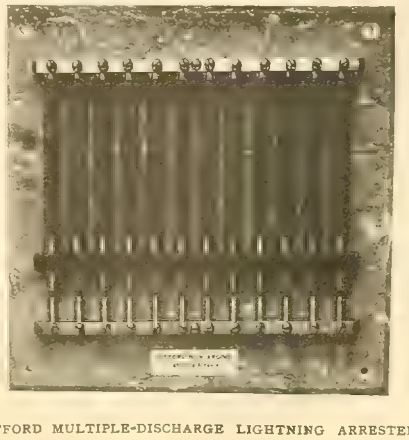
The recording ammeter shown is connected to a standard Weston 10,000-ampere shunt, to which is also connected a Weston indicating station ammeter. This shows that the recorder may be readily applied to any standard shunt which is already in service, without disturbing the indicating instrument at the switchboard. As illustrated here, leads of almost any desired length may be used to connect the indicating and recording instruments to the shunt on the main bus-bar. It is even possible to have the recording ammeter located in the superintendent's office at a great distance from the shunt and the indicating instrument located on the switchboard convenient for the observation of the operator. Such combination outfits could be furnished as units, with leads of the proper lengths to suit the individual cases.

The recording shunt ammeter has been successfully applied for taking continuous records of the current on a large trolley system, where the fluctuations are very rapid and varied as much as 4,000 amperes several times in a minute. The charts for such work as this are made to revolve once in one hour and the vibrator operates twice a second. For preliminary tests the recorders are provided with special fast vibrators for the smoked chart and with a clock movement to revolve the chart once in one hour. But for continuous daily records the standard 24-hour charts are recommended.

These instruments are manufactured by William H. Bristol, 45 Vesey Street, New York city.

Gifford Multiple-discharge Lightning Arrester.

The Gifford Electric Manufacturing Company of Traverse City, Mich., is manufacturing a unique lightning arrester for electric-light and power cir-



GIFFORD MULTIPLE-DISCHARGE LIGHTNING ARRESTER.

[illegible] brass terminals, are carried in a non-conducting [illegible] rack, which in turn carries 12 brass receiving posts, [illegible] air gap. Thus it will be seen that the static dis[illegible]

Tesla Says He Can Telephone by Wireless Across the Pacific.

[illegible]

"I have read with great interest the report in your issue of today that the Danish engineer, Vladimir Poulsen, inventor of the interesting device known as the 'telegraphone,' has succeeded in transmitting accurately wireless telephonic messages over a distance of 240 miles.

"I have looked up the description of the apparatus he has employed in the experiment and find that it comprises:

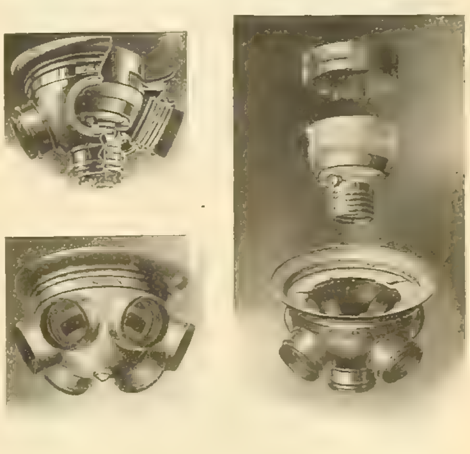
"(1) My grounded resonant transmitting circuit; (2) my inductive exciter; (3) the so-called Tesla transformer; (4) my inductive coils for raising the tension on the condenser; (5) my entire apparatus for producing undamped or continuous oscillations; (6) my concatenated tuned transforming circuits; (7) my grounded resonant receiving circuit; (8) my secondary receiving transformer. I note other improvements of mine, but those mentioned will be sufficient to show that Denmark is a land of easy invention.

"The claim that transatlantic wireless telephone service will soon be established by these means is a modest one. To my system, distance has absolutely no significance. My own wireless plant will transmit speech across the Pacific with the same precision and accuracy as across a table."

Benjamin Separable Wireless Clusters.

The Benjamin Electric Manufacturing Company has produced a new separable wireless cluster for multiple interior service, illustrated herewith, for which several advantages are claimed. There are two principal parts, separably connected, making it possible to attach or remove the body portion or finished part without disturbing the wiring connections. The supporting base and the insulating base carrying the binding screws may be installed without the body portion while a building is being constructed, and the finished part may then be attached when the building is completed.

In this new wireless cluster the body portion is small and the receptacles mounted thereon form



BENJAMIN SEPARABLE WIRELESS CLUSTERS

short sockets with which any standard shade holder may be used. Glassware may be installed or removed without disturbing the wiring connections.

Only two forms of insulating bases are necessary to cover the entire range of lights: The first (type 5) will take any number in the circle from two to six; the other (type 5K) any number with additional center light from three to seven. Since only two forms of bases are required, regardless of the number of lights in question, the proper bases may be installed from among the clusters in stock, and the body portions having the required number of clamp openings may be transferred from other clusters procured later on.

Clusters with center-lamp openings are furnished with three binding posts, whereby the center lamp may be operated independent of the side lights. This three-wire connection may be changed to two-wire by merely extending one of the wires to the additional binding screw.

The device is light in weight, compact and neat. The finish can be made to conform to any requirements, making it especially adapted as center piece for spread-electric or combination fixtures.

A Novel Single-phase Motor Installation.

An interesting example of the application of the single-phase motor to the operation of textile machinery is found in the factory of the Ayvad Manufacturing Company of Hoboken, N. J., manufacturer of "water wings," used by bathers to assist in floating the body. Group drive is used throughout, a number of machines being driven by each motor from countershafts. The electrical installation, consisting of nine single-phase induction motors of a total capacity of 75½ horsepower, was furnished by the General Electric Company. The type of motor used is one recently developed by the General Electric Company for operation on single-phase circuits, and is known as the form "KG." This motor is said to be remarkably free from the defects usually found in single-phase motors and bids fair to become a successful competitor of the polyphase motor in the field of small motor-driven machinery.

The conditions influencing the final decision in favor of the single-phase alternating-current motors in the Ayvad factory were that the factory was located in a part of the city supplied with single-phase alternating current for lighting and that the motors used must operate without affecting the lights on the same circuit; also that all sparking of motors must be entirely eliminated, because in the early stages of cloth manufacture the cotton is in a highly inflammable condition. The factory when in full operation will furnish employment for about 60 persons and will require an average of about 5,000 pounds of cotton weekly.

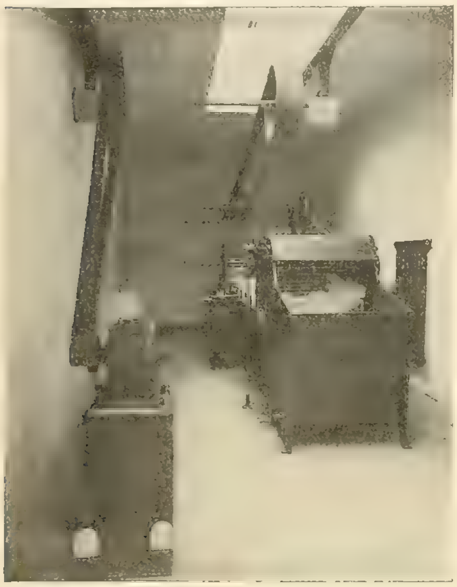


FIG. 1. COUNTERSHAFT CONNECTION TO SINGLE-PHASE MOTOR IN PICKER ROOM OF TEXTILE PLANT.

The view of the "picker" room, shown in Fig. 1, gives the method of countershaft connection to the motor. The power required for running the picker is about 7½ horsepower. Two 10-horsepower motors, shown in Fig. 2, drive separate lines of shafting, from which are driven the carding machines, drawing frames, roving machines and fly frames. In this same room the lines from the power circuit enter through the necessary switches, protective devices, measuring instruments, etc.

FIG. 2. [illegible] FRAME IN TEXTILE PLANT DRIVEN BY SINGLE-PHASE MOTOR.

[illegible]

In the loom room a 10-horsepower motor drives the looms. It was calculated that about 7½ horsepower would be required to drive the looms and a "slasher." This leaves an ample margin in additional horsepower should it be found necessary to install other looms.

A pony cylinder printing press is driven by a five-horsepower motor, which also drives a line shaft from which are driven cutting presses and other special machines used in shaping and finishing the "wings." The printing press is used for printing the design on the cloth and also for printing advertising pamphlets and circulars. On this same floor a three-horsepower motor drives a group of special sewing machines.

FIG. 3. SPINNING FRAMES IN TEXTILE PLANT DRIVEN BY SINGLE-PHASE MOTORS ON THE CEILING.

The entire plant is well equipped, roomy and modern in every respect. While an excellent example of the methods in which single-phase motors may be advantageously applied to the operation of textile mills, it also brings forward to central-station managers the possibilities existing in territories reached by single-phase distribution lines.

Chicago Union Traction Reorganization Effected.

Judge Grosscup of the United States Circuit Court on December 26th ordered a decree of foreclosure and sale of the properties of the Chicago Union Traction Company and its underlying companies. This procedure is part of the modified reorganization plan to which practically all of the bond and stockholding interests have agreed. The sale is to take place at noon on January 25, 1908, at the County Court House, under the direction of H. W. Bishop, who was appointed a special master commissioner by the court.

An order was also entered instructing the receivers of the property to execute to the Chicago Railways Company, the holding company organized to take over the franchise voted by the City Council some months ago, a lease of all the lines of street railways operated by them. The lease is to expire February 2, 1927.

It is taken for granted that the Railways Company will be the only bidder for the property at the sale, and the order of the court is in effect merely a form of a plan worked out for the rehabilitation of the Union Traction system by the Railways Company.

This sale is expected to settle the long-standing troubles of the Union Traction Company, and immediately the plan of co-operating with the Chicago City Railway Company of the South Side for through routes and improved service is to be taken up. Much reconstruction has already taken place. Since June 15th, when reconstruction under the traction-settlement ordinances was begun, the Chicago City Railway Company has laid 31.24 miles of new track at a cost of $1,500,000. New cars to the number of 131, costing $7,000 each, were put in service since the date mentioned, and 75 more are ready to run. New car barns and shops on two sites are nearing completion. One new power house has been completed and work on one or two more may be begun soon. The total improvements may reach $5,000,000.

The Union Traction Company has also been busy making improvements, principally on the reconstruction of track, and its total expenditure on rehabilitation since June may reach about $3,000,000. This company will put about $25,000,000 into new tracks, new cars, etc., within the next three years.

A New Commutator Tool.

The Lofgren Specialty Company of Chicago has [illegible] device for the purpose of [illegible] defective insulation and other [illegible] between commutator bars on dynamos and motors. The tool, herewith illustrated,

A NEW [illegible] TOOL.

is very durable, being constructed of solid steel and it is nickel-plated.

The blades or cutting members are made from the best grade of tool steel and highly tempered. There are three of these blades of varying thicknesses, so that by using one or a combination of two or more, any thickness of mica which is met with can be readily taken in.

Electric Light and Power Rates in Minneapolis.

The rate controversy between the Minneapolis General Electric Company and the city authorities received consideration by a special committee of the City Council a few days ago. Reports to the committee were made by a number of consulting engineers and all the reports were quite favorable to the company.

Mr. Charles L. Pillsbury, who worked independently of the company, said that the investment, on which reasonable net earnings should be allowed, he figured at $4,500,000. He allowed 12 per cent. for net earnings. The total annual expenses he placed at $543,211.14. Of this amount the fixed expenses are placed at 60 per cent., or $325,926.68, and the variable expense at $217,284.46. The total output of the plant is 20,676,037 kilowatt-hours, and the fixed expense per kilowatt-hour is placed at 1.576 cents, the average variable expense per kilowatt-hour generated is 1.050 cents, or a total expense per kilowatt-hour generated of 2.626 cents. The total amount of all expenses per kilowatt-hour sold he placed at 3.2825 cents.

Mr. Pillsbury advocated a differential system of rates based on the "load factor" of the customers, which, if correctly calculated, would meet the conditions of equitable and just rates more than any other system yet devised. He stated that the "ready-to-serve method," by which the customer pays a certain fixed charge per month plus a low rate per kilowatt-hour, meets the above conditions perfectly, and is scientifically correct. The basic rates which he calculated are computed on this principle.

This system, however, results in a high minimum charge in case of no use of current and in a high equivalent rate per kilowatt-hour in case of "short-hour" use. He therefore advocated that the City Council protect the "short-hour" consumers by fixing a reasonable limit on the maximum equivalent rate per kilowatt-hour, even though such customers be served at a loss to the company. The maximum demand in the case of residences, he claimed, should be fixed at 50 per cent. of the connected load. For the year 1908, Mr. Pillsbury contended, the maximum lighting rate should be fixed at 10 cents net and the maximum power rate at 6¾ cents. These lighting rates are to include free installation and renewal of the ordinary clear glass carbon-filament incandescent lamp.

Prof. D. C. Jackson explained that the theory of the whole "ready-to-serve" proposition is that the peak load is lessened when inducement is made for customers to take more power and run longer hours. Both Professor Jackson and Mr. Pillsbury indorsed the "ready-to-serve" system and practically the rates which have been proposed by the Minneapolis General Electric Company in its new schedule.

GENERAL TELEPHONE NEWS

C. C. Pflug has been made manager of the Salina Telephone Company at Friend, Neb.

The Missouri and Kansas Telephone Company will put in improvements at Garnett, Kan., to cost $15,000.

William D. Dunsmore, general manager of the Oskaloosa (Iowa) exchange of the Home Telephone Company, has resigned and will be succeeded by George Gordon.

Prof. Dugald C. Jackson of the Massachusetts Institute of Technology arrived in Chicago on December 19th and after a conference with Commissioner of Public Works Hanberg and City Comptroller Wilson agreed to act for the next few weeks as the city's consulting expert in putting into operation the new ordinance of the Chicago Telephone Company.

Instead of an aerial cable to connect Natchez, Miss., and Vidalia, La., by telephone, across the Mississippi, the Cumberland Telephone and Telegraph Company has installed two sub-aqueous cables covered with a composition of rubber. These cables are in the way of an experiment, and if they work satisfactorily others will be installed. There has been no cable service between these two towns since February of last year.

The executive committee of the International Independent Telephone Association met in Chicago on December 29th and made final arrangements for the annual convention to be held in the Coliseum January 21st to 23d. The executive committee is composed of President Theodore Gary, Macon, Mo., chairman; W. B. Woodbury, Detroit; O. C. Snider, Kansas City, Mo.; James B. Hoge, Cleveland; N. Bandy, Des Moines, and Walter Doolittle, Lafayette, Ind. A big gathering and interesting meeting are assured.

CORRESPONDENCE.

Continental Europe.

Paris, December 20.—A new section of underground conduit road has been recently opened for service in Paris. The Thomson-Houston system is used in this case, such as is now in use on several other lines in the city. The new section starts from the central part of town at the Place du Chatelet, near the Seine, then crosses the river not far from this point, passing by Notre Dame and then proceeding through the southern part of the city along the Avenue d'Ivry and the Ivry Gate. From here the line passes for some distance into the suburbs. On the suburban portion of the road the trolley system is employed, as is usual for all the electric lines which leave the city.

At Trieste, Austria, the Isonzo company is taking measures to erect a hydraulic plant of some size upon the Isonzo River, and has chosen a point lying between Serpenizza and Karfreit for the location of the dam. The turbine house is to be erected at Fernova, and in it will be installed six alternator units of 3,000 horsepower each.

What is known as the "Telephon Hirmondo," or telephone journal, is now in very successful operation at Budapest. The central office is connected at present with 15,000 subscribers who can thus receive the news by telephone at different hours of the day between 9 a. m. and 9:30 p. m. There are no less than 1,000 miles of telephone wire now employed for the lines. According to the present system, the manuscript copy containing the news received by telegraph or otherwise is turned over to a special corps of speakers with good voices, who deliver the news into the transmitters. The news, unless of unusual importance, is sent out at different hours of the day, according to the nature of the items. Thus the financial news is sent at 10 o'clock, 11:30 and also at 3 o'clock p. m. For political news the hours are 11:45, 2:30 and 3:15. The theatrical sections are at 11:15, 3:15 and 8:30. At this last hour the subscribers are connected with the Opera in order to hear the performance. A special electric bell is rung whenever there is any news of special importance. As regards the cost of the system, it is quite low, and is said to be only two cents a day, but no doubt there are some preliminary expenses for installing the apparatus for the subscribers. Advertisements are not neglected, and these are inserted adroitly between the news items. For this the rate is 50 cents for a "ten seconds" ad. Among other places, the system is in great favor in cafés and restaurants.

At the last meeting of the Societe Internationale des Electriciens held at Paris there were several interesting communications brought before the assembly. One of these was the report of the International Photometric Commission, and a paper read by Mr. Vedovelli on the subject of high-tension apparatus up to 60,000 volts.

Upon some portions of the Paris Subway tunnel which is now in construction there has been a strike, which, however, is at present only partial. The workmen claim an increase of 20 cents a day according to the contract, whenever the work is carried out under unfavorable conditions, such as wet or unhealthy ground, working among stones or cement, etc. At present the work has been stopped on the tunnel, especially at the Invalides section, but the strike has not as yet extended to all the sections of the line, and it is hoped to come to a satisfactory conclusion before long. A. DE C.

Great Britain.

London, December 21.—The death of Lord Kelvin at the advanced age of 83 years will no doubt have been dealt with before these notes arrive. Up to within three weeks of his death Lord Kelvin may be said to have been on the active list, despite his advanced age. As one of the consulting engineers to the Victoria Falls power scheme he was deeply interested in the transmission of electrical energy at high pressure over long distances, an interest of which he gave a practical demonstration in the early summer. He attended two consecutive meetings of the Institution of Electrical Engineers and took part in the discussion upon Mr. Highfeld's paper, which dealt with the Thury direct-current high-tension series system; and Mr. Highfeld in his reply felt constrained to remark upon the wonderful tenacity of purpose shown by Lord Kelvin at his great age in attending the meetings. It was evidence of his great vitality, a characteristic of his life to which his grand achievements bear sufficient testimony.

The effort which is being made to create a class of engineers to be known as "illuminating engineers" does not appear to be meeting with unqualified approval here, to judge from recent expressions of opinion. Mr. Gaster, who is starting a society of illuminating engineers, has attempted too much in endeavoring to enlist the sympathies of both electrical and gas people. It is another instance of how local conditions operate against the adoption in toto of American ideas. Mr. Gaster admittedly desires to follow the American plan, but appears to have failed to observe a great fundamental difference, viz., that the feeling between the gas and electrical industries is acute, to put it no [illegible] leader, whe[illegible] condition of alt[illegible] [illegible] the illuminating expert [illegible]

The committee of the [illegible] which has [illegible] been considering the [illegible] cars, has now completed its investigations and inspections and a final report may be looked for within a very short time. [illegible] during the past [illegible] months have been [illegible] that the report will be awaited with much interest, especially as it is known that [illegible] of new types of [illegible] have been inspected. The fact that the association has been working with the Board of Trade in the matter is another reason why valuable results may be anticipated.

The Board of Trade has just commenced an inquiry into the cause of an explosion which took place early in the year at the works of the South Metropolitan Electric Light and Power Company, London. A thermal storage drum, working in conjunction with Babcock & Wilcox boilers, exploded and killed, in addition to two employes, an inspector of the boiler insurance company. The case is of some interest, but no theory has yet been advanced for the cracking of the end of the drum. G.

Dominion of Canada.

Ottawa, December 28.—The management of the Montreal Light, Heat and Power Company has in view a proposition, which it contemplates placing before the civic authorities of the city of Montreal, offering to light the city streets, free of charge, in return for an extension of the company's franchise and exemption from taxation.

The town of Listowel, Ont., has not been able to renew its street-lighting contract with the Listowel Electric Light Company. The town desires to buy out the company.

The City Council of St. Catherines, Ont., has decided to accept the tender of the Falls Power Company to light the streets of the city, until the year 1927, for $39.50 per lamp.

A meeting in the interests of cheap electric power was held in the city of Hamilton, Ont., a few days ago. The meeting was called to consider the Hydro-electric Power Commission by-law, to be voted on in January, when Hamilton will decide whether it will empower the City Council to make a contract with the commission for electric power at $17.50, or less, per horsepower, and also spend the sum of $227,000 for a municipal distribution plant. Hon. Adam Beck, the chairman of the commission, stated that the highest voltage transmitted in Canada now was 60,000 over a distance of about 90 miles.

An important consolidation is now on foot in the city of Quebec. A merger of six companies has been formed—two gas, three electric-light and power and one traction. The names of the companies are: Quebec Railway, Light and Power Company, Jacques Cartier Electric Light and Power Company, Quebec Gas Company, Frontenac Gas Company, Canadian Electric Light Company and Quebec and Charlevoix Electric Railway Company. The present capital of the companies is $5,000,000 in stock and $5,000,000 in bonds, or $10,000,000 altogether. The increased capital will probably be double the amount of the combined capital of the companies concerned, making altogether a capital of $20,000,000. An expert engineer, representing the English capitalists, is now on the way to Quebec to report upon the situation. W.

New York.

New York city, December 28.—A passenger in one of the subway steel cars was badly burned a few days ago, it is reported, from a part of the seat on which he was riding. The incident has created much comment as to the possibility of shocks from accidental contact of the wires beneath the seats with the steel cars and seats. The wires are in conduits and Manager Hedley will investigate the accident to see if there is any possibility of a short-circuit heating up the seats of the cars. It is believed that the burns were caused by the man sitting on a box of matches in his hip pocket.

The Public Service Commission will recommend changes in the existing law which will embody its belief that private ownership of new subways and the construction of them by private capital is the only means by which this city can obtain new transit lines within the next few years. The clauses in the Elsberg law limiting franchises to 20 years and providing that no further subways shall be built except with the city's money are the ones which the commission, after long consultation with Governor Hughes, has decided should be changed. Twenty-five year terms with the right of the city to purchase at the expiration is thought to be a reasonable condition which would induce private capital to bid on much-needed subway extensions.

In the list of free lectures for next week is one on "The Application of Electricity in Mining," by W. Wallace Ker, at Public School 2 on Friday night at 8 o'clock, and one on Saturday night at [illegible]

Mr. Bryan points out that practically everything [illegible] takes up Mr. Arnold's suggestion under five different heads. [illegible] the loading of trains at the Brooklyn Bridge and Fourteenth Street station in the subway. Mr. Bryan says that this is already being done, as far as practicable, by the new special policemen.

A system of wireless telegraphy is to be established between New York and Philadelphia, it is said. A permit has been issued by the Building Department of Philadelphia for the erection of a wireless-telegraph tower on Chestnut Hill by the United States Wind, Engine and Pump Company of Batavia, Ill. A similar tower is to be erected on some high point in or near this city. It is the intention of the company to send wireless telegrams between the two points and distribute them by telephone. W.

Ohio.

Toledo, December 28.—The Council at Defiance has granted a 25-year franchise to the Haymaker electric-railway project, which includes the proposed Detroit, Defiance and Fort Wayne and the proposed Defiance, Paulding and Fort Wayne railways.

The Columbus Citizens' Telephone Company recently declared a quarterly dividend of 1½ per cent. on the preferred stock, payable January 1st.

The Central Union Telephone Company will erect a new $25,000 brick and concrete exchange building at Lima, Ohio. Contracts were recently let for the work.

The Columbus Railway and Lighting Company repeated a holiday custom begun last year. Each of the 1,100 employes was given a deposit book on a bank, the married men receiving $2 and the single men $1. About 75 per cent. of the accounts started last year were kept up by employes and additions made from time to time. S.

Indiana.

Indianapolis, December 28.—C. A. Harrington of the American Engineering Company of Indianapolis, with a corps of engineers, is surveying a route for an electric road between Paducah and Maysfield, Ky., a distance of 25 miles. This line when constructed will reach many inland towns and open up new avenues of trade between the two cities.

February 1st is the date set for opening through service by the Terre Haute, Indianapolis and Eastern Traction Company between Terre Haute and Indianapolis. The entire road has been completed except a short gap near Eagles, but the work of completion is near at hand.

The new limited cars recently received by the Indianapolis, Columbus and Southern Traction Company have been given a tryout between Indianapolis and Louisville and the officials report that the preliminary tests were entirely satisfactory. These new cars will soon be put in regular commission between Indianapolis and Louisville. The new cars are equipped with "trolley wire-finders," which obviates the trouble motormen or conductors experience with the trolleywheel slipping the wire.

There will be no sale of the Richmond municipal lighting and power plant to the syndicate that owns the private plant, known as the Light, Heat and Power Company. A committee appointed to investigate the advisability of the sale reported an excess of $2,729.95 in receipts for the month of November and the council decided unanimously not to sell the plant.

A large planing mill is being erected in Fort Wayne by George Krudop, to be installed with modern machinery to be driven by four large electric motors by power which the owner expects to secure from the local traction company. When in operation it will be the first plant to depend upon the Fort Wayne Traction Company for electric power.

It is reported that the City Council of Columbus is asking for bids for the furnishing and installation of two horizontal 150-horsepower boilers at the waterworks plant.

The City Council of Monticello has granted a 25-year franchise to the Tippecanoe Electric Power Company, recently incorporated, with a capital stock of $75,000. The company has purchased the waterpower and dam in the Tippecanoe River near Monticello and will erect a modern plant for the manufacture and distribution of electricity. The dam will be improved and built four feet higher

and other improvements made so as to constitute a modern hydraulic power plant. In addition to furnishing the city of Monticello with light and power the company proposes to distribute the same to adjacent towns and cities in the territory. The directors of the new company are Abraham S. Strauss, Henry Meyers and J. G. Smith, all of Chicago. Mr. Strauss is at the head of a company proposing to build a traction line between Frankfort and Chicago by way of Monticello, and it is proposed to make the Monticello hydraulic-electric plant furnish a portion of the power. S. S.

Illinois.

Peoria, December 28.—The village of East Springfield has filed suit against the Illinois Traction Company for the sum of $730,000 for damages said to have been done to the village. The village authorities some time ago passed an ordinance fixing a penalty of $200 for each car run through the streets, and it is on this ordinance they expect to recover damages.

Work on the line of the Sangamon Valley Interurban Railway Company was commenced this week. The line will form a direct connection between Springfield and Hillsboro.

The Interstate Telephone Company has completed the new line between this city and Canton, and this week the company is giving free use to encourage the use of it. The line is a full metallic one and gives the company here access to several other near-by cities.

The Mattoon, Shelbyville, Pana and Hillsboro Traction Company will ask for the granting of a franchise by the City Council of the city of Shelbyville.

The Wabash Railroad at Decatur is installing an electrically operated turntable at the roundhouse. The roundhouse is being wired and the current will be furnished from the new car shops.

Since the passing of the ordinance by the City Council here requiring the Western Union Telegraph Company to place its wires underground the Postal Telegraph-cable Company has had a conference with the officials, and its local representatives have requested an extension of time to allow them to take the matter up with the officials in New York city with the understanding that the company will reply by the first of the year.

Work on the new Lincoln-Mackinaw line of the Illinois Traction Company is being pushed as fast as possible to get the line in operation by the first of the year. Limited cars will be put on between this city and Springfield in the spring, and it is expected that the run of 75 miles will be made in 2 hours and 30 minutes.

There has been an ordinance introduced into the Peoria City Council requiring the street-railway company to use iron poles in the fire limits and to place its feed wires underground. Manager Nelson of the railway company says that the company has set aside a certain sum of money to be spent in improvements of the system. Of this a part has been used to equip the Adams Street line with the new cars, and if the council requires the company to place the iron poles and build the underground work the company will be unable to buy more new and larger cars for the other lines as was the intention. V. N.

Northwestern States.

Minneapolis, December 28.—An ordinance has been introduced in the Minneapolis City Council granting a franchise to the Minnesota Power and Trolley Company, which contains a number of important changes from the former ordinance. The company was granted a franchise three years ago, but it is thought that a new one is necessary, owing to the lapse of time having outlawed the old one.

The Hastings Electric Light and Power Company has applied for a 15-year franchise at Hastings, Minn.

A municipal electric-light plant is to be established at Kewaunee, Wis.

The business men of Red Oak, Iowa, are pushing a project for building a trolley line to Des Moines.

Additional machinery will have to be purchased for the municipal light plant at Barron, Wis.

F. P. Hopper and others are talking of building a new lighting system at Lead, S. D. R.

PERSONAL.

Mr. Fred R. Reamy, manager of the Central Union Telephone Company at Canton, Ill., died at the Presbyterian Hospital in Chicago last week [illegible] Mr. R[illegible] had been [illegible] and [illegible] well liked.

Mr. W. H. Owens, who has been assistant super[illegible] has resigned. Mr. Owens will go to his home in Baltimore for a short time, after which he will return to Illinois, having accepted a position in Chicago.

General Manager Fischer of the Illinois Traction [illegible]

Dr. Coleman Sellers, the distinguished engineer who was instrumental in the adoption of the form of hydraulic equipment used by the earlier power plants at Niagara Falls, was reported to be seriously ill at his home in Philadelphia on December 26th. He is in his 81st year, and is suffering from a general breakdown.

Mr. C. M. Hobbs, general manager and one of the owners of the Nevada-California Power Company, operating at Tonopah and Goldfield, Nev., has resigned his position and will be succeeded by Delos A. Chappell of Denver, Colo., who was recently elected president of the company.

Prof. Albert A. Michelson returned to Chicago from London and Stockholm on December 29th. He will resume his regular work at the University of Chicago at the beginning of next term. Professor Michelson is the recipient of the Royal Society's Copley medal and the Nobel prize for physics.

Mr. B. F. Vreeland, president of the Western Lumber and Pole Company of Denver, Colo., has been in Texas looking after the delivery of poles for the Texas Traction Company, which is building an interurban road between Dallas and Sherman, a distance of about 60 miles, requiring some 3,300 poles, all Idaho red cedar.

Mr. Edward B. Pillsbury, for eight years New England superintendent of the Postal Telegraph Cable Company, left Boston on January 1st to assume new duties at the executive offices of the company in New York. He will be succeeded as superintendent by A. L. Edgecomb of Portland, Me., who has been superintendent of Maine for a number of years.

Cards are out announcing the marriage of Mr. Harold Almert and Miss Anita Tiedeman in Chicago on December 28th. The bride is a daughter of Mr. and Mrs. Jacob Henry Tiedeman, while Mr. Almert is a widely known and well-liked electrical engineer, long a resident of Chicago, but now engaged in central-station management in Wichita, Kan., where the newly wedded pair will be "at home" after February 15th. Mr. Almert is a former president of the Northwestern Electrical Association. He will receive cordial congratulations.

ELECTRIC LIGHTING.

Kewaunee, Wis., will install an electric-light plant.

John Burke is seeking a franchise for installing an electric-light system in Columbus, Neb.

The Fort Smith Light and Traction Company has been granted a franchise in Van Buren, Ark.

On January 14th the city of Maysville, Mo., will vote on a bond issue of $10,000 for an electric-light plant.

The Mamou Power Company of New Orleans, La., has been incorporated with a capital stock of $10,000.

The Boonville (Ark.) Ice, Light and Storage Company has been incorporated with a capital stock of $50,000.

The Gorman Light and Power Company of Gorman, Tex., has been incorporated with a capital stock of $15,000.

The Johnsonburg Electric Company has filed at the state capitol in Harrisburg, Pa., a statement of increase of capital stock to the extent of $20,000.

The village of Newburgh Heights, near Cleveland, Ohio, will receive bids until January 7th for furnishing the labor and material for a street lighting system. Plans and blank forms can be secured from P. S. Ruggles, village clerk, 611 Garfield Building, Cleveland.

There is considerable interest in the electric situation in Harrisburg, Pa., owing to the possibility that the Harrisburg Light, Heat and Power may reach an agreement or consolidate with the Paxtang. An ordinance is contemplated, but has not yet been presented to Councils.

The Pennsylvania Lines West of Pittsburg will install new electric power and lighting equipment at Mahoningtown, Pa., including three 110-kilowatt Allis-Chalmers 60-cycle, three-phase, 240-volt alternators and a large number of induction motors of the same company's build, ranging from 5 to 15 horsepower.

Three electric companies have been chartered to furnish light, heat and power to towns in Lackawanna County, Pa., W. G. Robertson being the treasurer of each. One company is the Olyphant Light, Heat and Power Company for the borough of that name; another, the Archbald for Archbald borough, and the third, the Jessup of Winton. It is understood that they are shortly to be amalgamated with one of the large companies at Scranton. The Lackawanna Electric Light, Heat and Power Company of Scranton, on almost the same day the charters were issued, filed an increase of indebtedness of $2,500,000, making its authorized bond issue $3,000,000.

ELECTRIC RAILWAYS.

P. O. Dowd of Kansas City, Mo., is seeking a franchise for a street-railway system in Minot, N. D.

The Pueblo and Arkansas Valley Electric Railway Company of Pueblo, Colo., has been incorporated with a capital stock of $300,000.

The Aurora, Elgin and Chicago electric railway reports gross earning of $108,653 for the month of November, compared with $96,722 for November, 1906.

A franchise has been granted the Danville and Southeastern Railway Company by the City Council of Danville, Ill. The franchise is to run for 30 years. The company agrees to give a 20-minute service. The line will connect with the proposed Terre Haute and Clinton interurban road.

The Illinois Traction Company remembered all the various employes of the system the day before Christmas by presenting them with a turkey or a box of cigars. The company sent one of the express cars from Springfield to St. Louis, and the distribution was made from that. On the other branches the same system was followed.

The Detroit United Railway will close the year 1907 with an increase of about $700,000 in its gross earnings over the year 1906. The gross earnings up to December 1st were $6,166,479. Operating expenses and taxes were $3,836,748, an increase of $440,755 over the 11 months of 1906. This leaves net earnings of $2,329,731 for 11 months of 1907, an increase of $175,637 over 1906.

Prospects are bright for the early construction of an electric railway from Veblen, S. D., to Lidgerwood, N. D. A company with a capital of $500,000 has been organized for the purpose of building a main line to Lidgerwood and branch lines. The proposed line will do a passenger and freight business. It is proposed to locate the power house at Lidgerwood and in addition furnish power for an electric-lighting system for Lidgerwood.

Following the purchase of a 3,250-kilowatt Allis-Chalmers steam turbo-alternator a few months ago, the Virginia Passenger and Power Company of Richmond, Va., has recently made a further addition to its power-plant equipment in the shape of a 750-kilowatt waterwheel-type alternator of the same make, wound for 2,300 volts, 60 cycles, three-phase, and designed to operate at 128 revolutions per minute. This unit will be ready for operation by April 1, 1908.

Consul-general A. G. Snyder of Buenos Aires, Argentine Republic, reports that the city of Buenos Aires has called for tenders for the construction of two lines of the underground electric railways which form part of the system proposed and approved by the Municipal Commission, and for the leasing of the operation of the lines upon their completion. The requirements of the bids can be obtained from the office of the secretary of public works of the municipality, at Buenos Aires. Bids will be received until May 1, 1908.

Resenting the ruling of the judge in the Circuit Court at Mattoon, Ill., by which he distributed an additional $1,000 to the $40,000 raised by Federal Judge Grosscup and his associates in the Illinois Central Traction Company, which was to be paid equally among the claimants for damages growing out of the disastrous Charleston wreck, one of the persons who was severely injured has given notice that he will contest the settlement. President Potter of the company said that the company would be able to maintain its solvency should the settlement be made according to the present plan. The distribution of the $41,000 will be made at once according to the scale arranged by the various attorneys representing the claimants.

To aid conductors in the avoidance of accidents the Pittsburg Railways Company, controlling all the street-car lines of Pittsburg, Pa., on December 24th started to enforce the new rule of collecting fares from each passenger as he enters the car. It is believed to be the first time that such a thing has been attempted in any city, except where special cars are provided. The company will try the experiment on the ordinary cars. The object of enforcing this new rule is to enable the conductor to remain on the rear platform at all times. Because of the many hills, accidents happen frequently, and usually the conductor is in the car collecting fares at the time. The company says that if he were on the platform, many of the accidents could be averted.

PUBLICATIONS.

The name of Technical Literature, a New York magazine, has been changed to Engineering Digest. The character of the publication is well indicated by the new title.

With the January number the Engineers' Review of Cleveland will be merged with Power of New York. Power will be issued both weekly and monthly. The monthly issue will be known as Power and Engineers' Review.

The Wagner Electric Manufacturing Company of St. Louis is distributing its Bulletin No. [illegible] on transformers, which fills in between the regular lighting and power transformer bulletins. It contains much interesting information, including some data about the contract for 30 transformers for the irrigation project in the Salt River district, Arizona.

SOCIETIES AND SCHOOLS.

The next meeting of the New York Section of the Illuminating Engineering Society will be held in the Engineers' Building on the evening of January 9th. A paper by Dr. H. H. Seabrook on "Light and the Eye" will be presented and discussed. A general invitation is extended to all interested in this subject to be present. This will also be the annual meeting.

Before the electrical section of the Canadian Society of Civil Engineers on December 19th Mr. Walter T. Goddard read an interesting illustrated paper on the subject of high-voltage insulator manufacture. Concerning the highest practicable voltage, without reference to anything but insulators, he believed it safe to say that insulators for the heaviest mechanical strains and for the highest at the present time be looked for in other directions than in insulator design, particularly porcelain electrical stresses can be manufactured at moderate cost, so that limitations of transmitting voltages must insulator design.

MISCELLANEOUS.

At Charles City, Iowa, the City Council has voted to install an electric fire-alarm system.

A portion of the coffer-dam built by the Economy Light and Power Company of Joliet at Dresden Heights on the Desplaines River at the junction with the Kankakee River was carried away by flood water a few days ago.

According to the Copenhagen correspondent of the London Daily Mail, the German war ministry has purchased the rights of Poulsen's wireless telephone, with which, it is said, communication was successfully established between Copenhagen and Berlin.

A Paris dispatch says that on December 29th "Pascal Berjonneau, an inventor, exhibited before the postmaster-general and a number of persons interested in scientific investigation, a new telephotography apparatus which can be adapted to the wireless system or to the ordinary telegraph-wire system. He transmitted the picture of the postmaster-general, without the aid of wires, from one end of the hall to the other. The inventor claims that distance does not interfere with the effectiveness of his method. Photographs, he says, can be sent by it between New York and Paris."

The shipyard of the Fore River Ship Building Company of Quincy, near Boston, Mass., although opened only a few years ago, has already become one of the most important plants on the Atlantic Coast for the construction of large ships. A recent Allis-Chalmers bulletin, besides containing illustrations of motor applications used by the Fore River company, gives a description of the various features of electrical equipment, one of the most interesting of which is the system for speed variations. The generator is operated on the two-wire plan, supplying the highest voltage, 240 volts, and on this voltage are operated all the constant-speed motors, the crane motors and the lighting system of the yard. For variations of speed, this voltage is divided into three, by means of a balancing transformer, and [illegible] requirements of speed regulation; or, in other words, [illegible]

TRADE NEWS.

The India Rubber and Guttapercha Insulating Company of 253 Broadway, New York, has changed its name to Habirshaw Wire Company. For over twenty years this well-known company has manufactured Habirshaw wires, cables and cores under the supervision of Dr. W. M. Habirshaw, and now the name of that gentleman has been made a part of the legal title of the company. The company announces, what will be believed readily enough, that the highest grade of insulation will characterize the output of the concern under the new name as well as under the old one.

A new departure has been made by the Weston Electrical Instrument Company in the production of accurate and yet low-priced ammeters and voltmeters for switchboard work. The direct-current instruments are called the Eclipse type. They work on the "soft-iron" principle, but have been designed after years of investigation to eliminate the disadvantages ordinarily possessed by such instruments. The alternating-current instruments work on similar lines. This is the first alternating-current ammeter produced by this company, it having been found impossible heretofore to construct such an instrument possessing sufficient accuracy. The new instruments are dead-beat, very sensitive and are practically free from hysteresis error. They are made in two sizes, one for large and the other for small switchboards. The ammeters are made in 16 ranges from one ampere to 500 amperes capacity. The voltmeters are made in seven ranges from 75 to 750 volts full scale deflection.

By the decision of the United States District Court of the Eastern District of Missouri on December 24th, the award of $132,433.35 returned last August by the special master in favor of the Westinghouse Electric and Manufacturing Company in its patent-infringement suit against the Wagner Electric Manufacturing Company, has been set aside and the amount of damage placed at the nominal sum of $1. The suit has been in court since 1900 and involved Westinghouse patent No. 366,362, covering detail methods of cooling the working parts of transformers, and Thomson patent No. 430,328, pertaining to the employment of a water cooling coil in the oil of transformers. The Wagner company won on the latter patent, but was held to infringe on claim 4 of the Westinghouse patent. The Wagner company admitted a slight infringement on a small part of the entire apparatus and substituted a modified construction, which construction was later attacked by the Westinghouse company as still infringing claim 4 of the patent named. In this proceeding the new construction was held not to infringe, but the injunction was continued as against the earlier construction, and the court ordered an accounting as to damages growing out of the earlier litigation. In this accounting the master, Judge Dennison, last August awarded the Westinghouse company damages amounting to $132,433.35. To this report the Wagner company took exception, which exception was sustained on December 24th by Judge Dyer, who held that the damage sustained was nominal only, and assessed $1 against the Wagner company. The judge held [illegible]

BUSINESS.

[illegible]

The Chicago Glove Company, [illegible] North Halsted Street, Chicago, has just issued an illustrated catalogue showing a complete line of its [illegible] ironworkers, heaters, linemen and for railroad work [illegible] skin gloves, which have become very popular. Catalogue will be sent on request.

The Shultz Belting Company of St. Louis, one of the oldest and best-known makers of leather belting, has just received a foreign order for 5,000 feet of belting running from 14 to 18 inches, double. This belting will be used in an electric-mining plant. The company has also just shipped 17,000 feet of belting to Russia, half of it being double belting. The Shultz company did a good domestic business last year and anticipates that the year 1908 will be equally as prosperous.

The Aluminum Solder Company of Syracuse, N. Y., is furnishing for the trade an alloy which, it says, is in fact as well as in name a solder, by means of which aluminum can be easily, rapidly and firmly soldered to aluminum, brass, copper, iron, tin, etc., or any of these substances to each other. No flux is required. The various substances of which this solder is composed give a compound which not only has a low melting point, but which, it is said, readily alloys with the various metals to be soldered, forming without the use of a flux a union of great strength and durability.

Dossert & Co., New York, have received large orders from the Westinghouse Electric and Manufacturing Company for Dossert solderless terminal lugs for use on the panels and switchboards and fuse boxes (enclosed type) in the Hudson terminal buildings. Orders have been received also from the M. B. Foster Company for a large number of Dossert solderless two-way connectors, terminal lugs and cable taps for the wiring of the Singer Building and from the L. K. Comstock Company for Dossert solderless cable taps and terminal lugs for the City Investing Building, Cortlandt and Church streets, New York.

George J. Weber, president of the Weber Gas Engine Company of Kansas City, Mo., has been informed that the contract has been awarded to his company for the large gas engines that are to be installed by the government at the Roosevelt dam (Yuma, Ariz.) project by the Reclamation Service. Careful investigation was made by the government consulting engineer, Mr. O. H. Ensign, of numerous gas engines and suction gas-producer plants that have been installed by this company and he recommended the Weber as satisfactorily complying with strict government requirements. A careful service and economy test of a 250-horsepower Weber gas engine and suction gas producer installed in the large manufacturing plant of the McClary Manufacturing Company, London, Ontario, demonstrated that it surpassed the guarantee called for in the contract. In regular operation less than 0.95 pound of coal per horsepower-hour is used, it is said.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 24, 1907.

874,411. System of Electrical Transmission and Propulsion. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 31, 1904.

A high-frequency alternating-current transmission line has condensers connected at intervals across the line to increase the ratio of its capacity to its self-induction.

874,430. Ceiling Fan Motor. Thomas H. Pither, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed August 22, 1907.

The frame has a motor adjustably mounted in it. The motor is connected by a driving gear to a casing mounted so as to rotate about the frame.

874,445. Insulator. Albert L. Shears, Seattle, Wash. Application filed March 5, 1907.

This insulator has a lateral projection with wire-receiving slots diverging therefrom. The sides of the projection and of the slots are inclined upward and inward.

874,477. Railway Signal. Harry M. Abernethy, Cleveland, Ohio, assignor to the American Railway Signal Company, Cleveland, Ohio. Application filed April 3, 1906.

Two signals are arranged on a mast so as to be independently operated by an electric motor. Track circuits control the action of solenoids that connect each signal to the motor.

874,483. Electric Fire and Burglar Alarm. Melancthon J. Briggs, Philadelphia, Pa. Application filed April 25, 1906.

This system comprises a number of independent circuits connected to a common battery and including audible and lamp signals and an annunciator. The fire-alarm circuits are controlled by thermostats. (See cut on next page.)

874,508. Brake for Electric Cars. Moses G. Hubbard, Jr., Austin, Ill. Application filed November 18, 1896.

A generator driven by the motion of the car supplies current to a motor operating the brakes. A brake controller automatically controls the connections.

874,511. Interrupter. William Kaisling, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed January 3, 1907.

This interrupter comprises a movable contact member, an actuating member having a primary movement in the same general direction and a secondary movement transverse thereto, and means including co-operating engaging parts on these members whereby the contact member is moved when the actuating member reaches a definite point in its primary movement.

874,531. Automatic Motor Starter. William C. O'Brien, Baltimore, Md., assignor to the Monitor Manufacturing Company, Baltimore, Md. Application filed October 23, 1905.

An electromagnet is arranged to close one of two switches in a shunt circuit around the starting resistance when the line switch is closed. Another magnet opens the other switch whenever the armature current at starting is excessive.

874,550. Controlling Device for Automatic Weft-replenishing Looms. Albert E. Walker, Arthur Walker and George Walker, Norwood Green, near Halifax, England. Application filed October 16, 1905.

A number of movable feeling points form terminals of an electric circuit, of which the bobbin is the other terminal. When the circuit is completed by contact of the terminals, the weft-replenishing mechanism is operated.

874,552. Wire Fastener. Sylvester Wilburn and Thomas E. Smith, Tunis, Texas. Application filed September 9, 1907.

A fastening device for telegraph wires and the like comprises a head secured to the arm of a telegraph pole, a clamping member secured to and insulated from the head and means whereby the wire may be automatically fastened by the clamp.

874,558. Alternating Direct-current System of Control, and 874,559. System of Control. Howard L. Beach, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Applications filed March 3, 1906.

A pneumatically operated change-over switch moves a trolley into engagement with the [illegible]

[illegible] a contact shoe into engagement with a direct-current third rail. In the second patent the change-over switch arranges the system for operation by the current source to which the trolley or contact shoe has been previously connected.

874,564. Electrolytic Apparatus for the Manufacture of Nitrocellulose. Gaston C. de Briailles, Paris, France. Application filed March 10, 1906.

Two chambers are provided. The upper one contains the cellulose, which is compressed by a piston. The lower chamber is separated from the upper by means of a perforated diaphragm and is provided with gilded platinum wire electrodes.

874,567. Electric Controller. Roy W. Brown, Amsterdam, N. Y. Application filed February 19, 1907.

A spring-controlled contact arm has connected with it a rack engaging an electromagnet that holds the arm on any contact as long as the magnet is energized.

874,601. Switch for High-potential Circuits. Joseph N. Kelman, Los Angeles, Cal. Application filed April 8, 1907.

The contacts and switch blades are mounted on insulators in an oil tank. The switch blades are connected to wooden rods and operate in opposite horizontal directions. (See cut.)

874,602. Telegraph Key. John P. Kinney, Pocatello, Ida. Application filed April 23, 1907.

The key lever has an operating member arched to span the instrument so that it can be operated from the side opposite that from which the key lever projects.

ing the molten material to a high temperature, so as to change its electro-depositing characteristics, and finally so depositing the treated mass in a suitable electrolyte.

874,745. Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed June 13, 1903.

A coherer for wireless telegraphy controls a local circuit. An unbiased armature is attracted from normal position to signaling position by the local circuit on the reception of a signal wave, and a second local circuit, normally open, is closed on the completion of a signal and acts to retract the armature to its normal position.

874,780. Thermo-electric Element. Albert L. Marsh, Lake Bluff, Ill., assignor to William A. Spinks & Co., Chicago, Ill. Application filed January 17, 1907.

This is a thermo-electric couple, one element of which consists of an alloy of vanadium and nickel and the other element of an alloy of nickel and copper.

874,781. Temperature-controlling Device for Furnaces. Allan G. Mather and Ernest C. Shaw, Milwaukee, Wis. Application filed April 7, 1905. Renewed November 14, 1907.

A thermostatic switch closes the circuit of an electromagnet which releases the brake on a gravity motor that operates the dampers.

874,792. Electric Horn. Leon Chalas, Edouard Réquillart and Camille Contal, Levallois-Perret, France. Application filed September 20, 1905.

In this alarm device a horn has a diaphragm arranged in operative relation thereto, an electromagnet, an arma-

The crude nickel is treated in solution with a soluble sulphide. The liquid with the resulting solids is further treated with a solution that dissolves the foreign bodies and the remaining solids are separated and electrolyzed in the presence of a chloride.

874,868. Telautophote. Sidney Rothschild, New York, N. Y. Application filed September 6, 1906.

This is a system for transmitting visible images over a circuit. All that is sensitive to light controls the transmitting currents. A vacuum tube receives them at the other end of line.

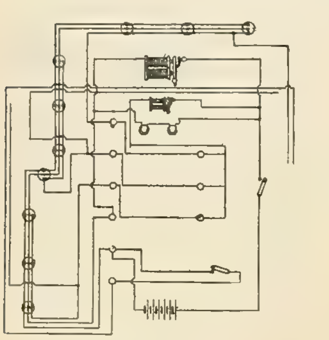
874,869. Control System for Electric Vehicles. Olof A. Sandborgh, Swissvale, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 3, 1906.

This is a modification of No. 874,559.

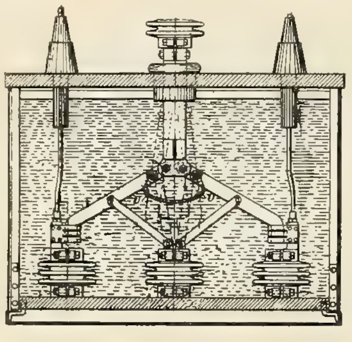
874,895. Motor-controlling Treadle. Albert B. Mann, Cincinnati, Ohio, assignor to the American Laundry Machinery Company, Norwood, Ohio. Application filed December 4, 1906.

The treadle is aranged to reverse the polarity of the armature terminals when it is rocked from one position to the other.

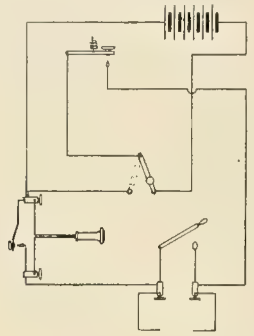
874,898. Automatic Starting-box. Thomas M. Morris, New Haven, Conn., assignor of one-fourth



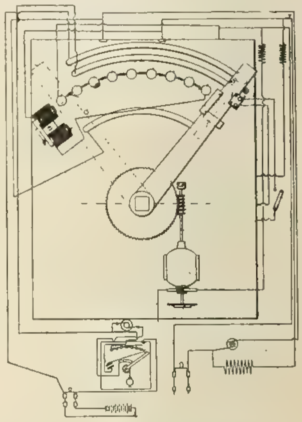
NO. 874,483.—FIRE AND BURGLAR ALARM.



NO. 874,601.—HIGH-POTENTIAL SWITCH.



NO. 874,690.—LINE TESTER.



NO. 874,898.—AUTOMATIC STARTING BOX.

874,608. Danger Signal. Clevia J. Luther, Desloge, Mo., assignor of two-fifths to James T. Mayberry, Desloge, Mo. Application filed August 13, 1907.

A float carries a target which is exposed when the float rises. This also closes a switch and lights an electric lamp.

874,628. Process of Producing Steel. George O. Seward, East Orange, N. J., and Franz von Kugelgen, Holcombs Rock, Va., assignors to the Virginia Laboratory Company, New York, N. Y. Application filed July 6, 1907.

This process of producing steel consists in fusing iron as an electrode in presence of a refining slag, while blowing air into the furnace in order to oxidize a part of the impurities.

874,630. Third-rail Attachment for Electric Cars. George H. Sohn, Lincoln, Cal. Application filed June 10, 1907.

A hollow rail with a longitudinal slot supports within it the current conductor. A dummy car connected with the electric car runs on this rail and carries a trolley contacting with the conductor.

874,635. Registering Device. Ralph Storm, Joseph F. Underwood and Robert Jackson, Waterloo, Iowa. Application filed May 10, 1907.

A circuit containing an electromagnet connects two railway stations. A semaphore signal at one of the stations is connected through a registering device to the electromagnet.

874,638. Controller. Emmett W. Stull, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed May 3, 1906.

The controller has a drum, a reversing switch, a locking device for the reversing switch and a blow-out magnet which also operates the locking device.

874,641. Apparatus for Use in the Hardening of Steel. William Taylor, Leicester, England. Application filed March 11, 1907.

[illegible] hardening, tempering or annealing [illegible] having soft iron polar extensions [illegible] forked and rotatably connected with the magnet.

[illegible] Brush-holder for Electric Machines. Giorgio Finzi and Emilio Tallero, Milan, Italy. Application filed April 2, 1906.

[illegible]

[illegible] Brookline, [illegible] 11, 1907.

[illegible]

[illegible]

ture influenced by the electromagnet, a circuit interrupter operated by the armature and a connection between the armature and diaphragm whereby vibrations of the armature are mechanically transmitted to the diaphragm.

874,795 and 874,796. Safety Fuse. Joseph Sachs and Frank D. Reynolds, Hartford, Conn., assignors to the Sachs Company, Hartford, Conn. Applications filed March 19 and April 5, 1906, respectively. Renewed May 16, 1907.

The construction of enclosed fuses is described. The first has flat-blade contact terminals. The second has an indicating attachment.

874,797. Safety Fuse. Joseph Sachs and Frank D. Reynolds, Hartford, Conn., assignors to the Sachs Company, Hartford, Conn. Application filed April 18, 1906. Renewed June 15, 1907.

This is a modification of the previously described fuses.

874,798. Safety Fuse. Joseph Sachs, Hartford, Conn., assignor to the Sachs Company, Hartford, Conn. Application filed April 18, 1906. Renewed September 11, 1907.

Still another modification is described.

874,826. Nullifying Disturbances in Telegraphic or Other Signaling Circuits. Edward Blakeney, Ossining, N. Y., and Robert E. Chetwood, Jr., Elizabeth, N. J., assignors to the American Telephone and Telegraph Company. Application filed May 29, 1906.

A telegraph system consists of a main circuit, a Wheatstone balance system having its branches connected in the main circuit, a receiving instrument in the bridge of the balance, and a condenser connected in a portion of each branch at each side of the bridge, and rendering the portions impassable to steady currents.

874,834. Insulator and Protector for Electric Conductors. Thomas C. Copping, Houston, Texas. Application filed January 24, 1906.

This insulator consists of longitudinal sections each having its respective edges provided with a longitudinal groove and rib, and a series of notched transverse supports for a conductor, the supports being arranged staggered.

874,841. Storage-battery Plate. William Gardiner, Chicago, Ill., assignor to the Commercial Storage Battery Company, Chicago, Ill. Application filed April 26, 1906.

The plate has a frame, a number of receptacles having spaced transverse bars constituting bottom supports of the same, a number of dividing members having spaced transverse ribs, and sheets of absorbent material interposed between the receptacles and rigid plates.

874,860. Incubator. Oliver P. Phillips, Amo, Ind. Application filed October 24, 1906.

A thermostat regulates the heat. [illegible] a bell circuit under abnormal conditions.

874,864. Electrolytic Process for Refining Nickel. John N. Paine, New York, N. Y., assignor to [illegible] Sperry, Brooklyn, N. Y. Application filed November 8, 1906.

to Frederick P. Lewis and one-fourth to Edward H. Everit, New Haven, Conn. Application filed May 3, 1907.

Self-controlled means for automatically moving the arm from its dead to its running position are provided, also means operated by the arm for closing a circuit through an emergency motor, and a switch operated synchronously with the arm for turning to the running machine, whichever it may be, the secondary leads to the switchboard. (See cut.)

874,908. Apparatus or Means for the Production, Transmission and Distribution of Electric Currents. Charles E. Fritts, New York, N. Y.; Josephine H. Fritts, administratrix of said Charles E. Fritts, deceased, assignor of one-third to Spencer B. Prentiss, Washington, D. C. Application filed November 23, 1886.

An electric generator is connected with regulating apparatus for uniformly varying its potential so as to charge a number of condensers connected with the poles of the generators.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 30, 1907:

443,493 and 443,494. Telephone. S. Bergmann, New York, N. Y.
443,526. Telephone. E. H. Johnson, New York, N. Y.
443,527. Apparatus for Automatically Grounding or Cutting Out of Circuit-exposed Electrical Conductors. F. W. Jones, New York, N. Y.
443,540. Socket for Electric Lamps. C. A. Lieb, New York, N. Y.
443,556. Secondary Battery. H. H. Wardwell, Lake Village, N. H.
443,557. Arc Lamp. A. W. Whitcomb, Worcester, Mass.
443,632 and 443,633. Electric Arc Lamp. E. Heymann and F. W. Heymann, Boston, Mass.
443,636. Apparatus for Measuring and Registering Electric Currents. C. A. Faure, New York, N. Y.
443,642. Electric Meter. C. P. Elieson, London, England.
443,646. Magneto-electric Stop Mechanism. W. H. Kilbourn, Greenfield, Mass.
443,671. Electric Locomotive. R. Eickemeyer, Yonkers, N. Y.
443,674. Electric Stop Motion for Warping Machine. P. Goldschmidt, Paterson, N. J.
443,693. Electric Switch. J. J. Wood, Brooklyn, N. Y.
443,716. Electric Damper Regulator. J. O'Meara, New York, N. Y.
443,724. Electrical Fire-alarm and Extinguishing System. C. E. Ongley, New York, N. Y.
443,725. Non-interfering Signaling System. C. E. Ongley, New York, N. Y.
443,726. Electrical Signal System. C. E. Ongley, New York, N. Y.
443,727. Safety Device for Dynamo Stations. C. E. Ongley, New York, N. Y.
443,787 and 443,788. Watchman's Electric Time Recorder. C. E. Ongley, Yonkers, N. Y.
443,789. Electric Valve Controller. C. E. Ongley, New York, N. Y.
443,790. Electric Protective and Signaling System. C. E. Ongley, Yonkers, N. Y.
[illegible] Electric Attachment for Railway Switches. A. W. Berry, New Orleans, La.
[illegible] Galvanic Battery. G. A. Smith, Halifax, Canada.
[illegible] Electric Motor. C. J. Van Depoele, Lynn, Mass.

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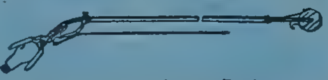
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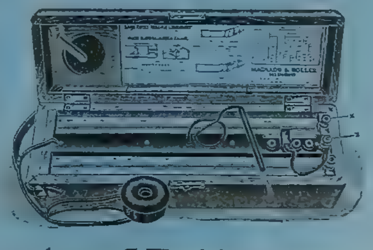
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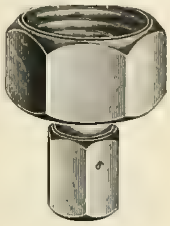

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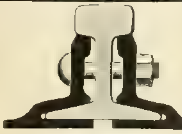
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It has a higher insulating resistance than either silk or cotton, and is not affected by moisture. You can put more turns of Black Enamel Wire in a given winding space, besides many other advantages.

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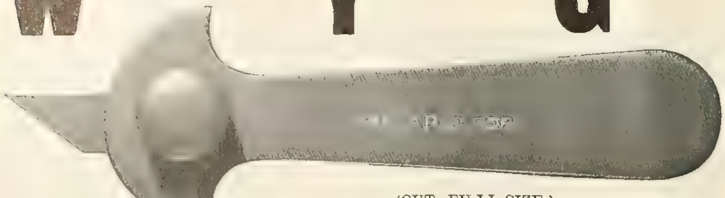

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RUBBER COVERED
WIRES
CABLES AND CORES.

Change of Name January 1st, 1908

THE INDIA RUBBER AND GUTTA PERCHA INSULATING CO.

For over twenty years
the manufacturer of

"Habirshaw Wires, Cables and Cores"

announces to its customers and the trade generally, that under the continued supervision of Dr. W. M. Habirshaw and the management of those officers and heads of departments who have been identified with the Company in the past, it will continue to manufacture the highest grade of "Red Core," "White Core," "Black Core," Telephone, Telegraph and all kinds of "Code" and Special Wires, as well as Signal, Submarine, Mine, Torpedo and Underground Cables, under the legally authorized name of

HABIRSHAW WIRE COMPANY

OFFICES
253 Broadway, New York City

WORKS
Yonkers, New York

JUST OUT!

New Benjamin Separable Wireless Cluster

FOR MULTIPLE INTERIOR SERVICE

SOME OF ITS SALIENT FEATURES:

Consists of two principal parts, separably connected. Supporting base may be installed while construction work is under way. Body portion can be installed later on; can instantly be attached or removed without disturbing wiring connections.

Does away with slack wire. Allows the use of any standard shade holder. Supporting base so small that glassware may be installed or removed without disturbing wiring connections. Light in weight, compact, and neat in appearance. All porcelain parts concealed. Made in any finish. Only two forms of insulating base are employed to cover the entire range of lights. Is especially adapted as centerpiece for spread-electric or combination fixtures.

Write today for Pamphlet giving complete description

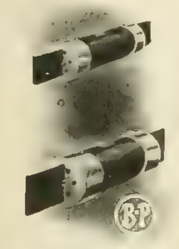
Benjamin Electric Mfg. Co.

New York CHICAGO San Francisco

WOOLLEY ELECTRIC CO.

B-P
Enclosed Fuses

Excel in



61-100 and 101-200 Amp., 250-Volt N. E. C. Standard

3-30 and 31-60 Amp. 600-Volt N. E. C. Standard

Rating

Are absolutely within the limits of the Underwriters' Ratings and Specifications.

Construction

Every separate part accurately blanked, formed, punched and set by special dies, templates, jigs, etc., to standard dimensions.

Quality

Fuse Strips made from the best of composition metals; tubes of hard vulcanized fiber tubing throughout the line—no paper tubes; and metal parts of heavy brass or copper—no copper plated or brass plated shells.

Appearance

The best looking fuse on the market.

Good Inside and Out

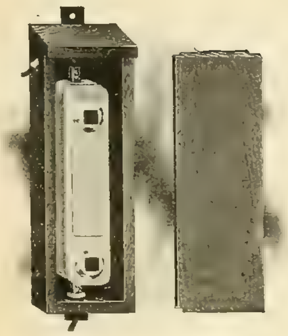
Immediate shipments made from stock in all Old Code and New Code Dimensions

Catalogue listing all fuses and cut-outs, with complete dimension sheets, list and refilling prices, will be gladly sent upon application

Reliable, Efficient and Permanent Lightning Protection

IS BEST SECURED WITH

C-C NON-GAP ARRESTERS



700 and 1,100 Volt Types

Reliable

Because they have no moving parts and can be depended upon at any time to take any number of discharges in any degree of rapidity of succession.

Efficient

Will take care of the lightest static as well as the heaviest lightning discharges. Closed circuit the most perfect path.

Permanent

Because they cannot fuse, shatter or burn up. Every C-C Non-Gap is absolutely Non-Arcing, and guaranteed for TWO years.

2,300-Volt Type

ASK FOR OUR DESCRIPTIVE BULLETIN

ST. LOUIS, MO.

137 S. CLINTON STREET - - CHICAGO - - S. H. FINNEY

WAGNER ELECTRIC MFG. CO., St. Louis, U. S. A.

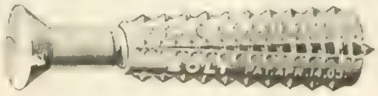
HILLSIDE PLANT

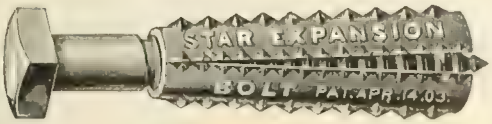
CORRESPONDENCE SOLICITED THE WONDERFUL GROWTH OF OUR PLANT INDICATES THE QUALITY OF OUR APPARATUS See our Exhibit at the Chicago Electrical Show

Lighting and Power Transformers. Single and Polyphase Motors. Switchboard and Portable Instruments. District Offices in all the Principal Cities.

STAR EXPANSION BOLTS

THE STANDARD OF GENUINE EFFICIENCY





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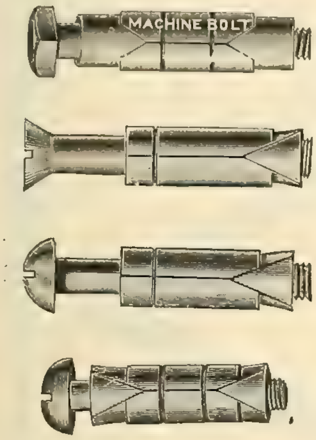

GENERAL ELECTRIC COMPANY

PRINCIPAL OFFICE
SCHENECTADY, N. Y.

Schenectady, N. Y., July 15.

STAR EXPANSION BOLT CO.,
147 Cedar Street, N. Y.

Dear Sirs:

Replying to your July 14th letter and referring to M. 154-HGL, regarding our experience with your expansion bolts and screw anchors, we beg to advise that we have been using principally expansion shields or lag screws in connection with our general construction work, and we found that for securing apparatus to brick or concrete walls they are very satisfactory.

Very truly yours,

H. E. Raymond

HER-WEN Construction Department.

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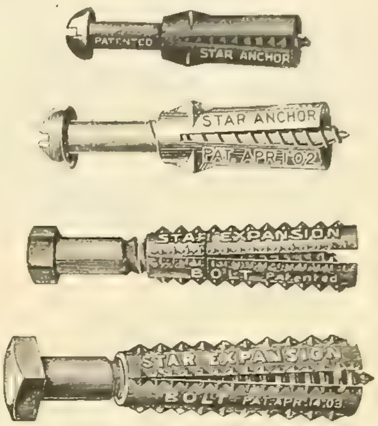

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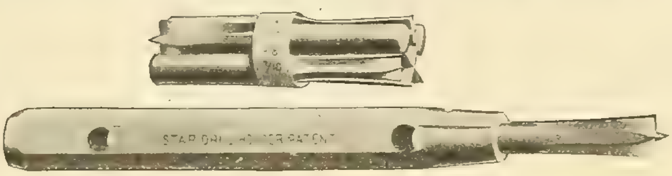

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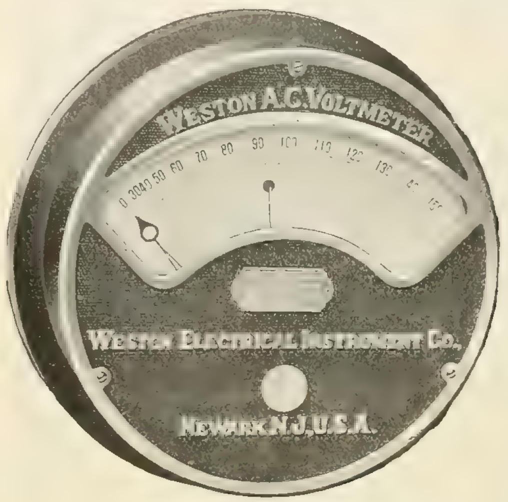

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These new instruments are the result of very prolonged study, painstaking mathematical analysis and the most thorough and exhaustive scientific research, and experimental investigation of each one of the many very complex problems involved in devising, designing and constructing instruments adapted to give really accurate indications of the value of the forces on alternating-current circuits under the very numerous variable and most trying conditions necessarily occurring in practical work.

The instruments are unique in their Electrical and Mechanical characteristics, and are exquisitely made in every detail. We have no hesitation in stating that they constitute a real and important advance in the art, and feel certain that when their merits become known, they will be accepted as the standards for switchboard service throughout the world.

Both Ammeters and Voltmeters are extremely sensitive, and will correctly show the most minute changes in current or voltage.

They may be used on circuits of any frequency within the limits of practical work (15 per second to 140 per second) without sensible error.

They are absolutely dead beat. They are perfectly shielded from the disturbing influences of external magnetic fields.

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40th ANNUAL STATEMENT
JANUARY 1, 1907

CAPITAL	$ 500,000.00
SURPLUS	1,485,457.73
RESERVES	1,992,787.98
ASSETS	3,978,245.71

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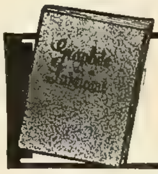

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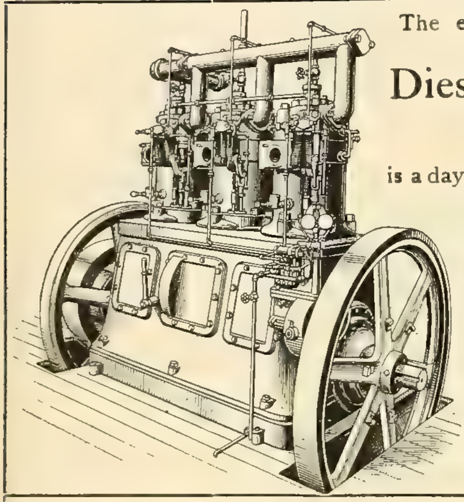

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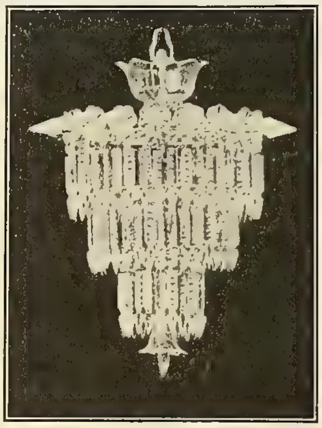

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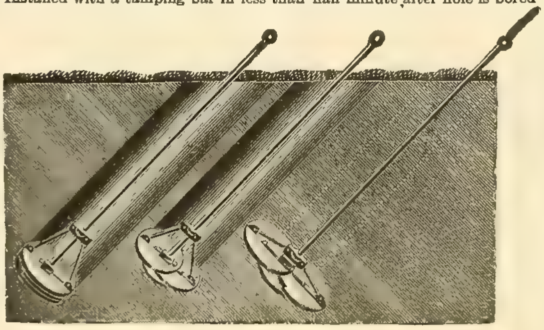

Fig. 1—Represents Anchor placed at bottom of hole.
Fig. 2—Partially expanded.
Fig. 3—Fully expanded.

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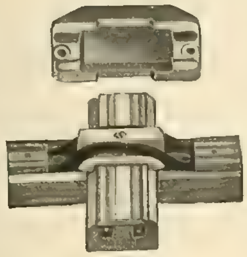

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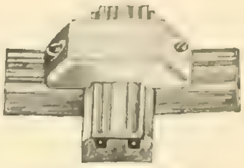

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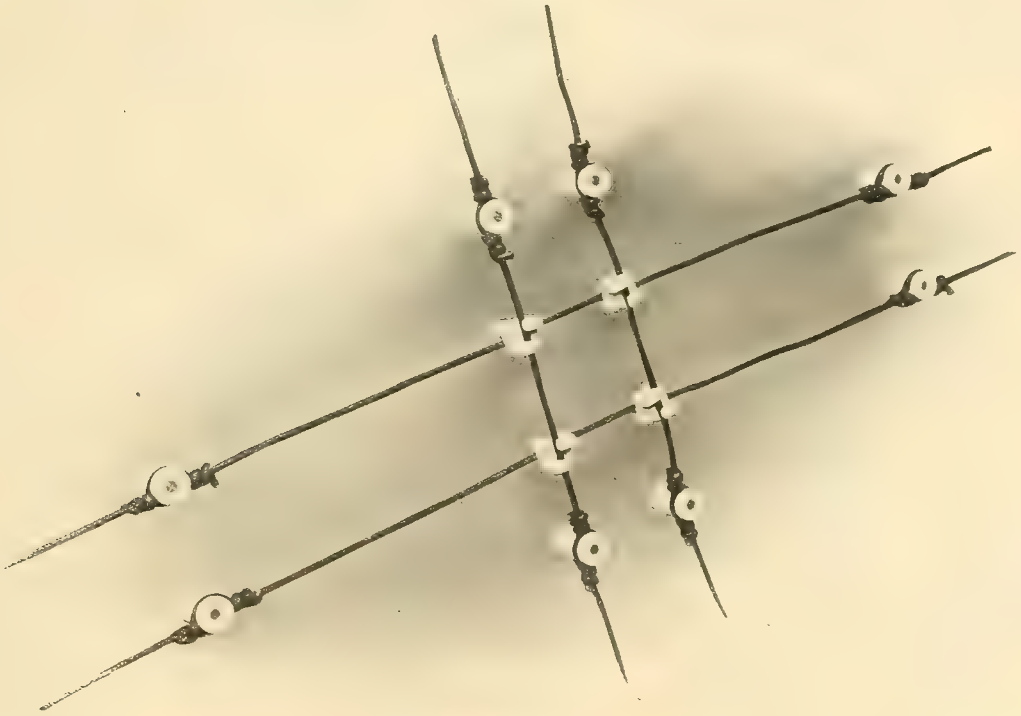

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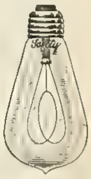

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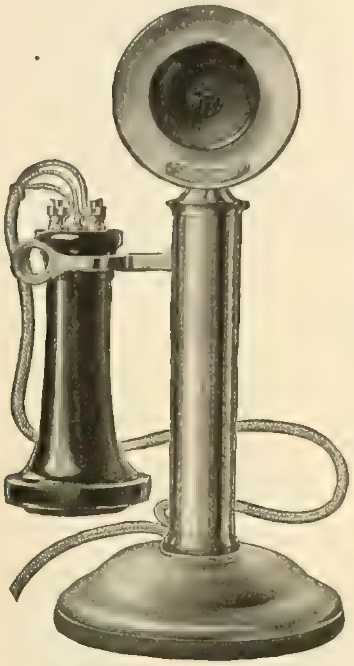

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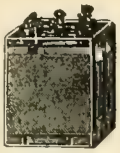

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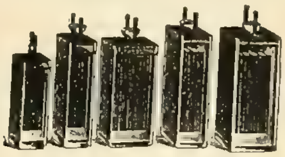

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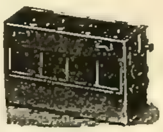


Larger size Lighting and Sparking Batteries.

Stationary Battery in Lead-lined Tank.

Begin your campaign for 1908 business by taking advantage of the WESTERN ELECTRICIAN'S ELECTRICAL SHOW NUMBERS (Issues of January 11th, 18th and 25th)

DO IT NOW

A good-sized advertisement in these numbers will effectively place your product before the possible users in the Central and Western States. The first Show Number goes to press January 9th. Forward copy TO DAY

WESTERN ELECTRICIAN, 507 Marquette Bldg., Chicago

The Electrical Show

is a Western Institution. The WESTERN ELECTRICIAN, therefore, by right of its location and magnificent facilities on the ground, will lead all electrical papers in the matter of covering the Electrical Show from a newspaper standpoint—that is to say, the WESTERN ELECTRICIAN will deliver all news of the Electrical Show to the electrical people of the United States before any other electrical publication.

Consequently it will pay you best to advertise in the WESTERN ELECTRICIAN, particularly in our

ELECTRICAL SHOW NUMBERS

January 11th, 18th and 25th. Copy needed immediately

The Telephone Hand Book,
New Dynamo Tenders' Hand Book,
Bell Hangers' Hand Book,
Incandescent Wiring Hand Book,
Electric Transmission Hand Book

Comprise the famous Western Electrician Hand Book Series.
Price, by mail, postage prepaid,

$1 A VOLUME.

Electrician Publishing Co.,

507 Marquette Building, Chicago.

THE ARNOLD COMPANY
ENGINEERS—CONSTRUCTORS
ELECTRICAL — CIVIL — MECHANICAL
181 LA SALLE STREET
CHICAGO

BYLLESBY, H. M. & CO
(Incorporated)
ENGINEERS
Design, Construct and Operate Railways, Light, Power, Hydraulic and Gas Plants
Examinations and Reports
American Trust Bldg CHICAGO, ILL.

D. C. & WM. B. JACKSON
[illegible]
ENGINEERS EXPERTS
CHICAGO BOSTON

L. HAM RANDOLPH
[illegible]

BADT, F. B. & CO.
Experts, Consulting Engineers
1504 Monadnock, Chicago
Telephone, Harrison 745

HALE, WILLIAM B.
CONSULTING ELECTRICAL ENGINEER
Examinations, Reports, Estimates, Appraisals, Tests and Supervision of Electrical Installations in any part of the Republic of Mexico.
1a Independencia No. 6, City of Mexico.

A WEEKLY REPRESENTATION
in the "Directory" enables one to keep before all possible customers.

RUEBEL & WELL
CONSULTING MECHANICAL AND ELECTRICAL ENGINEERS
[illegible]
ST. LOUIS [illegible]

W. F. BRENNAN, Pres. F. W. BLOCKI, Treas J. P. EARLY, Secy.
BRENNAN ELECTRIC CONSTRUCTION COMPANY
330 Dearborn St., Chicago
High Tension Transmission Lines
Heavy Electric Cable Work—Electric Railway Construction—Isolated Electric Light Plants—All Kinds of Electric Wiring.

ROBERT W. HUNT & CO.
ENGINEERS
1121 The Rookery, Chicago 66 Broadway New York
Monongahela Bank Bldg., Pittsburg
Norfolk House, Cannon St., London

KOHLER BROS.
Contracting Electrical Engineers, Lighting, Power, Railways.
1804-1806-1808-1810-1812 Fisher Bldg. CHICAGO.

SARGENT & LUNDY,
ENGINEERS,
RAILWAY EXCHANGE.
Cor. Jackson and Michigan Boulevard
CHICAGO.
FREDERICK SARGENT. A. D. LUNDY.

IF ONLY ONE
person or firm or corporation should look in this Directory for your address and fail to find it, you might fail to make a lump of money.

TRY IT
Keep your name and address in this Directory where it will be seen by possible clients.

RADFORD, JOHN A.
ENGINEER
Plans, Specifications, Reports, Tests, Estimates and Supervision for Complete Steam and Electrical Installations.
1325-1326 Marquette Bldg., CHICAGO, ILL.

Long Distance Phone Central 498
SCHOTT, W. H.
ENGINEER AND CONTRACTOR
SPECIALTIES—Central Station Heating Plants, Water Works, Steam Plants, Electric Light, Gas and Street Railway Plants.
1100-1128 American Trust Bldg., Chicago

Grimshaw Raven White Core Raven Black Core

ALL OUR WIRES pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Grimshaw** and **Competition Tapes** and **Splicing Compounds.**

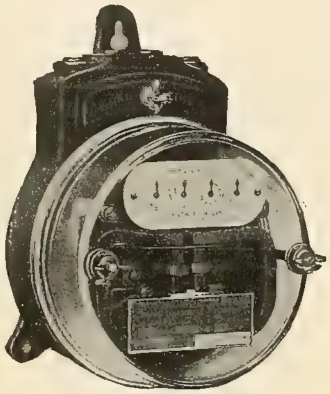
NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 746 Folsom St.

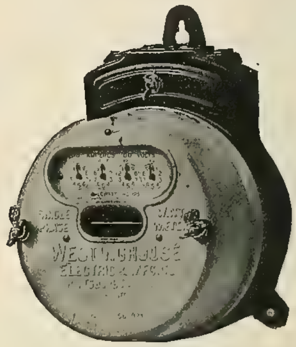
NOW READY!
WESTERN ELECTRICIAN'S
MOONLIGHT SCHEDULE
FOR 1908.
TEN CENTS A COPY.
Electrician Publishing Co.,
507 MARQUETTE BUILDING,
CHICAGO.

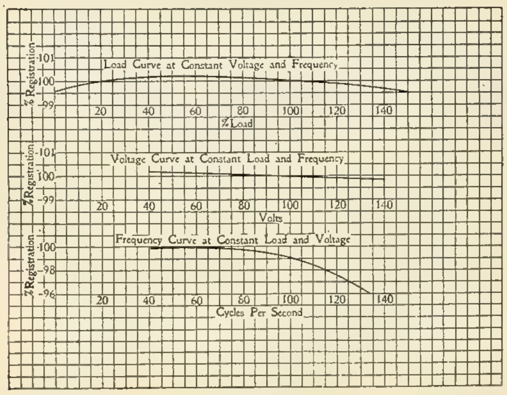
Westinghouse

Type "C" Integrating Wattmeters



The Only Wattmeters with Rolling-Ball Bearings





Characteristics of 100-Volt, 60 Cycle, Single-Phase Type "C" Meter.

The curve sheet illustrates the accuracy obtainable with Type "C" Meters under varying conditions

Westinghouse Meters register accurately and freely at ½ per cent. of full load, within 2 per cent. plus or minus from 2 per cent. of load to 150 per cent. overload, and maintain this accuracy under all normal variations of voltage, wave form, power factor and temperature.

We have an Integrating Wattmeter Folder No. 4065 just off the press; ask for it.

Westinghouse Electric & Mfg. Co.

ADDRESS NEAREST SALES OFFICE

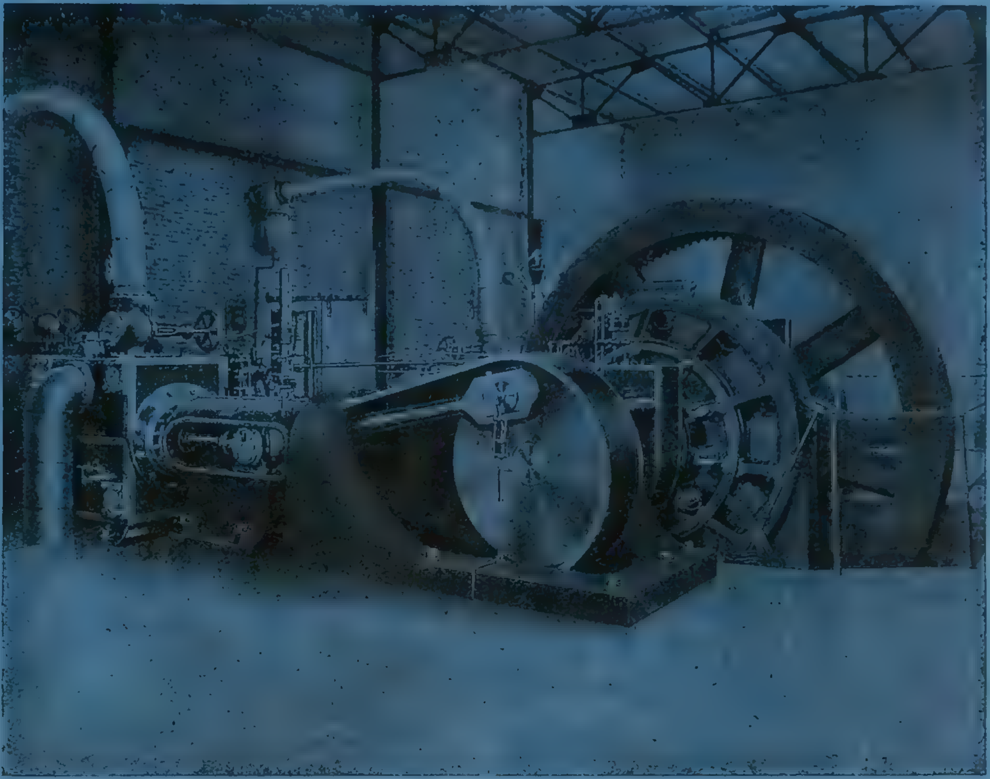
Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Minneapolis, New Orleans, New York, Philadelphia, Pittsburg, St. Louis, Salt Lake City, San Francisco, Seattle, Syracuse

For Canada: Canadian Westinghouse Co., Limited, Hamilton, Ontario.

FORT WAYNE ELECTRIC WORKS

"WOOD" SYSTEMS

Direct Current Generators For Railway or Commercial Service



Type MPL, 10-Pole, 300-K. W., 120-R. P. M., 250-Volt Generator, Direct Connected.

Fort Wayne Type MPL Generators have laminated pole-pieces cast—welded into the field frame, making the magnetic circuit continuous and aiding commutation. Variations in load are accommodated without sparking or shifting of brushes.

Type MPL Generators give continuous satisfactory service.

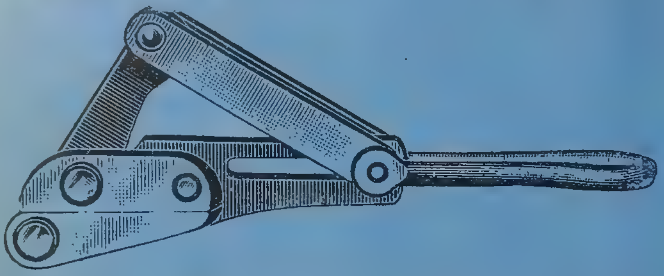
Bulletin 1079 gives details of design. Ask for it.

Main Office and Factory, Fort Wayne, Ind.

Branch Offices:

Atlanta, Ga., 1316 Empire Bldg.
Boston, Mass., 110 State St.
Cincinnati, Ohio, 1125 Union Trust Bldg.
Chicago, Ill., 623 Marquette Bldg.
Detroit, Mich., 1025 Chamber of Commerce Bldg.
Grand Rapids, Mich., 310 Murray Bldg.
New Orleans, La., 1007 Hennen Bldg.
New York, N. Y., 40 New St.
Pittsburg, Pa., 812 Empire Bldg.
Philadelphia, Pa., 415 North American Bldg.
St. Louis, Mo., 325 Lincoln Trust Bldg.
St. Paul, Minn., 615 Germania Life Bldg.
San Francisco, Cal., 403 Atlas Bldg.
Syracuse, N. Y., 717 Dillaye Bldg.
Yokohama, Japan, Bagnall & Hilles.

KLEIN'S TOOLS



Klein's New "Chicago" Grip

A well-proportioned, thoroughly reliable tool. Made of steel throughout, and nickel-plated. Just the right shape to handle quickly, is light and when placed on the wire will hold itself in place.

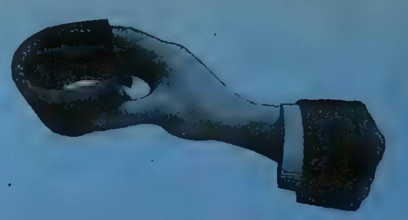
Can be pushed out on the wire so as to take up as much slack as necessary. Covers all the essential points required of a grip to do good work on either iron or copper wire.

See Our Exhibit at the Electrical Show, Chicago, January 13-25, 1908

All Prominent Supply Houses Carry This and Other Klein Products

MATHIAS KLEIN & SONS

81 W. Van Buren Street, CHICAGO, ILL.



THE BELT FOR SMALL PULLEYS

Send for Free Sample

Did you ever try to run an ordinary belt on short drives and small pulleys?

The reason oak-tanned belting slips and burns under such conditions is that it is stiff and inelastic. It won't pull and load unless it is tightened frequently and soaked with "dope," and even then it soon wears out. It is too brash and short-fibered to stand so much bending.

Shultz Sable Belting

is tough and elastic like catgut. The long, soft fibers are so interlaced that they bend around the smallest pulley without breaking or tearing apart. The pliability of rawhide permits Sable Belting to lay against the pulleys instead of standing away from them. It need not be drawn so tight, as its kidlike surface clings without "dope" and pulls when other belts slip, burn and waste power.

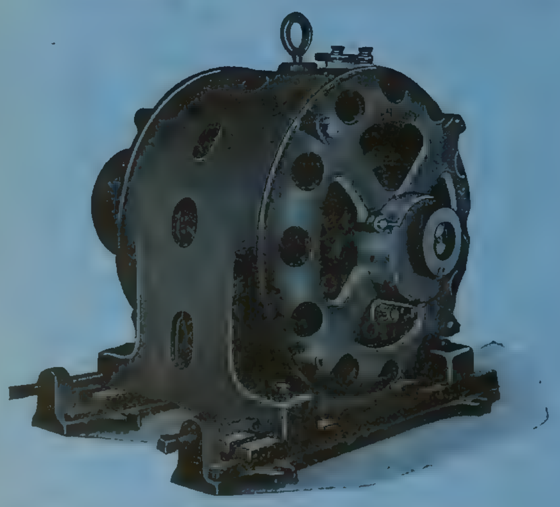
Get a free sample of double-ply Sable Belting, and bend it as shown. Then try the same trick with oak-tanned belting. Or better, let us send you a Sable Belt for 60 days' trial, to be returned if it isn't better than any other belt you have ever used.

SHULTZ BELTING CO.

ST. LOUIS, MO.

NEW YORK BOSTON PHILADELPHIA

IF PRICE ALONE COUNTS, ANY SINGLE-PHASE MOTOR WILL DO



If QUALITY is a governing factor, get a

CENTURY

They are self-starting under full load and will render service that in some respects is not duplicated by any others. Write for Bulletin No. 9. It will explain them in detail.

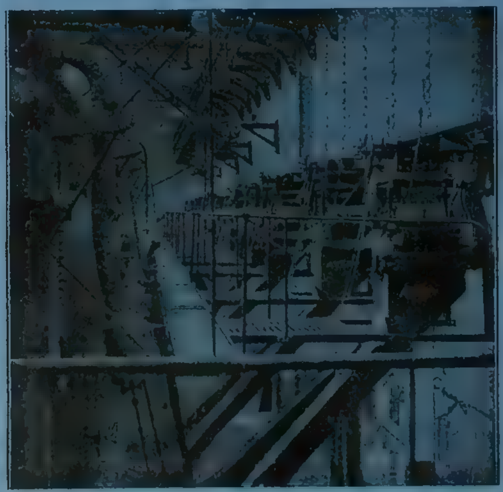
MANUFACTURED BY

CENTURY ELECTRIC CO.

ST. LOUIS, U. S. A.

WEIGH YOUR COAL AUTOMATICALLY BY AVERY SCALE

Know what you're doing. Every fortnight or so we'll show you what we're doing in the electrical field



This photograph shows 21 Avery Automatic Coal Scales at a Power House of the Glasgow Electric Street Railways. This corporation has since installed 10 further scales.

THE AVERY SCALE COMPANY

Head Office and Works: North Milwaukee, Wis.

Branch Offices: 1500 Fisher Bldg., Chicago. 307 South 3d Street, Minneapolis, Minn. Wilson Bldg., Dallas, Texas 225 Board of Trade, Kansas City, Mo. Davenport, Ia.

WESTERN·ELECTRICIAN
·NEW·YEAR'S·NUMBER·
1908
J·ALLEN·ST·JOHN

THIRD ANNUAL

ELECTRICAL SHOW

Coliseum, CHICAGO, January 13-25, 1908

LARGER AND BETTER THAN EVER

All the Leading American Electrical Manufacturers
have Contracted for Space

SOME SPACE LEFT—NOT MUCH—APPLY NOW

ELECTRICAL TRADES EXPOSITION COMPANY

1006-1007 Monadnock Block, - CHICAGO

HOMER E. NIESZ, Manager

New Weston *Eclipse* Direct Current Switchboard Ammeters and Voltmeters

(Large Size) MODEL 160

The instruments herein referred to consist of two sizes of a new line of Switchboard Ammeters and Voltmeters for use on Direct-current Circuits. They are of the "soft iron" or "electromagnetic" type; but in their electrical and mechanical characteristics they are so far superior to, and in advance of all preceding forms of "soft iron" instruments, as to mark a new epoch in that branch of the art of instrument manufacture. Indeed, these new Weston **Eclipse** "soft iron" instruments are so good as to be better, for many purposes, than most, if not all, of the many imitations of the well-known Weston permanent magnet moving coil instruments, and they possess the further advantage that they are much lower in price than the imitations.

Indeed the prices of these Eclipse Ammeters and Voltmeters are nearly on par with the crudest and most unreliable forms of soft iron instruments now on the market.

To avoid confusion with the Weston permanent magnet switchboard instruments we deemed it necessary to give these soft iron instruments a distinguishing name. As they possess a degree of accuracy and general electrical excellence hitherto wholly unknown, and heretofore deemed impossible of accomplishment in the soft iron type of instrument, and a degree of excellence in mechanical design and construction heretofore unapproached, we have designated them as "ECLIPSE VOLTMETERS and ECLIPSE AMMMETERS."

In sensitiveness or power to promptly respond to minute changes in potential difference, or to minute changes in current strength, they closely approach the Weston permanent magnet instruments.

In their dead-beat qualities they also closely approach the Weston permanent magnet type of instrument.

The voltmeters are really wonderfully accurate instruments, because:

FIRST: They have no discernible working error; that is, they indicate precisely the same whether left in circuit for a few seconds or permanently.

SECOND: They have practically no chamber error; that is, they indicate practically the same at all ordinary (or bearable) temperatures of the room or atmosphere in which they are used.

THIRD: More remarkable still, for soft iron type of instruments, they have practically no magnetic lag, or hysteresis error, at the normal working voltage point of the different ranges, and relatively to all preceding forms, very little lag error at any other point of the scale.

The ammeters have, of course, the same excellent qualities; but we have referred to the voltmeter more particularly, because it is in the soft iron voltmeter that the difficulties encountered are the greatest and have heretofore been insurmountable.

They are handsome in appearance, well finished and exquisitely made.

Every part is made strictly to gauge and each instrument is perfect in every detail and carefully standardized.

The scales are remarkably good for "soft iron" instruments.

We recommend them to engineers, contractors and users for service on switchboards for small capacity plants, or for use in all cases where a really good instrument is needed but low cost is essential.

(Small Size) MODEL 159

These instruments are made in two sizes, one adapted for large and the other for small switchboards. 16 Ranges of Ammeters are made in each size, varying in range from 1 ampere to 500 amperes. Voltmeters are provided in 7 ranges for each size, varying from 75 volts up to 750 volts. The voltmeters for ranges above 300 volts in the model 160, and above 150 volts in the model 159 are provided with external resistances.

The prices range between the following high and low limits:

Model 160 Ammeters,	Minimum,	$15.00	Maximum,	$19.50
" 159 Ammeters,	"	11.50	"	16.00
" 160 Voltmeters,	"	16.00	"	22.50
" 159 Voltmeters,	"	12.00	"	18.00

Write for Circulars to:

WESTON ELECTRICAL INSTRUMENT CO., Newark, N. J.

NEW YORK—74 Cortlandt St.
CHICAGO—1504 Monadnock Block
PHILADELPHIA—346 Mint Arcade
BOSTON—176 Federal St.
ST. LOUIS—539 Frisco Bldg.
DENVER—1725 California St.
SAN FRANCISCO—418 Eugenia Ave.
CLEVELAND—1018 Citizens' Bldg.
LONDON—Audrey House, Ely Place, Holborn
BERLIN—88 Ritterstrasse
PARIS—12 Rue St. Georges

Shelby Lamps

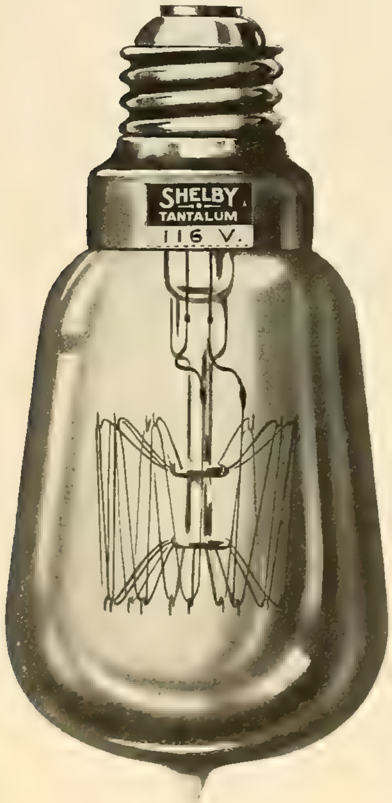
TRADE Shelby Lamps MARK

TRADE Shelby Lamps MARK

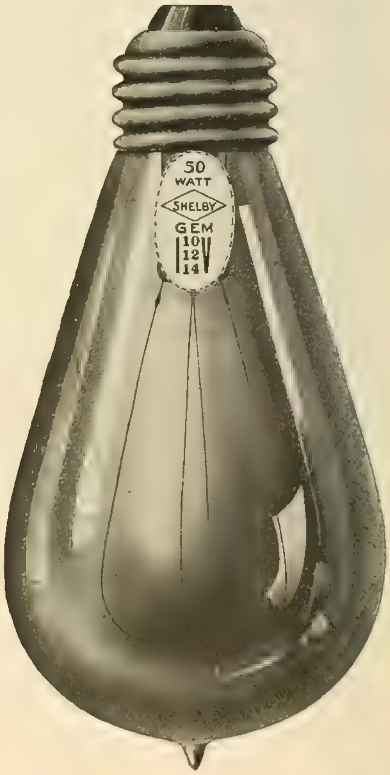
Shelby Useful Light Lamps are made to deliver the light on the objective plane. More light where you need it. What's the use of paying for light that's wasted?

Useful Light Type

We manufacture incandescent lamps, nothing else. We devote our entire attention to making the best lamps on earth. We have thousands of satisfied customers. Why can't we have your order?



We make over 600 different kinds. Shelby Type, Oval Anchored Type, Tantalum, Tungsten, Gem Metallized, Miniature, Street Series, etc.



SEND US AN ORDER TODAY
EVERY SHIPMENT GUARANTEED

The Shelby Electric Co.

SHELBY, OHIO
U. S. A.

BRANCHES

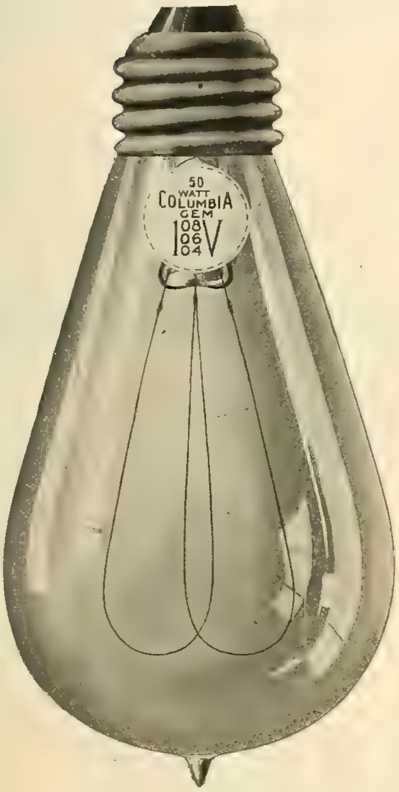
Atlanta, Ga.	1426 Empire Bldg.
Atlantic City, N. J.	27 North Stenton Street
Baltimore, Md.	1026 North Eden Street
Boston, Mass.	620 Atlantic Avenue
Buffalo, N. Y.	15-21 Terrace
Chicago, Ill.	Hibbard, Spencer, Bartlett Bldg.
Cincinnati, Ohio	615 Commercial-Tribune Bldg.
Cleveland, Ohio	24 South Water Street
Detroit, Mich.	46 East Congress Street
Indianapolis, Ind.	Van Camp Bldg.
Louisville, Ky.	Belknap Bldg.

LOOK FOR

BRANCHES

New York, N. Y.	32-34 Frankfort Street
Omaha, Neb.	414 McCague Bldg.
Philadelphia, Pa.	1112 Chestnut Street
Pittsburgh, Pa.	429 Seventh Avenue
Portland, Ore.	20 Concord Bldg.
San Francisco, Cal.	204 California Street
Scranton, Pa.	931 North Irving Avenue
St. Louis, Mo.	227-228 Frisco Bldg.
Traverse City, Mich.	525 Fifth Street
Washington, D. C.	2126 Flagler Pl., N. W.

1889 1908



GEM METALLIZED

50-Watt Lamp
100 to 130 Volts
20 C. P. at 2.5 W. P. C.

COLUMBIA STANDARD

COLUMBIA TANTALUM

100 to 130 Volts
20 C. P. - - - - 40 Watts
40 C. P. - - - - 80 Watts

YOU MAKE NO MISTAKE IN BUYING COLUMBIA LAMPS

We can furnish every type of Incandescent Lamp that has been made a commercial success. All of the highest quality. Let us figure with you on your needs for 1908. Write us direct or to any of our branch offices—each one carries a large stock ready for immediate shipment.

THE COLUMBIA INCANDESCENT LAMP CO.

Main Office and Factory, 2115-17-19 Locust Street, St. Louis, Mo.

BRANCH OFFICES:

NEW YORK: Taylor Bldg., 39-41 Cortlandt Street
PHILADELPHIA: 1221 Real Estate Trust Building
CHICAGO: 264-270 Fifth Avenue
MEMPHIS: 26 Randolph Building
DALLAS: 409 Main Street
MEXICO: Monterey—Sanford & Cia.

What's the Use of Worrying

when you can buy **PEERLESS** Lamps at any of the following places:

CAPITOL ELECTRIC ENGINEERING CO.,
Lansing, Mich.

THE CAPITAL ELECTRIC CO.,
Salt Lake City, Utah.

THOMAS DAY COMPANY,
San Francisco, Cal.

DOUBLEDAY-HILL ELECTRIC CO.,
Pittsburg, Pa.

THE ERNER ELECTRIC CO.,
Cleveland, O.

ELECTRIC EQUIPMENT CO.,
Erie, Pa.

ELECTRIC SUPPLY & CONSTRUCTION CO.,
Columbus, O.

FOBES SUPPLY CO.,
Portland, Ore.

HATFIELD ELECTRIC CO.,
Indianapolis, Ind.

THE ILLINOIS ELECTRIC CO.,
Chicago, Ill.

THE MONTANA ELECTRIC CO.,
Butte, Mont.

THE NEW ENGLAND ELECTRIC CO.,
Denver, Colo.

PETTINGELL-ANDREWS CO.,
Boston, Mass.

SOUTHERN ELECTRICAL CO.,
Nashville, Tenn.

THE STANDARD ELECTRIC CO.,
Cincinnati, O.

FRANK H. STEWART ELECTRIC CO.,
Philadelphia, Pa.

H. S. SANDS ELECTRIC & MANUFACTURING CO.,
Wheeling, W. Va.

SEIDLER-MINER ELECTRIC CO.,
Detroit, Mich.

HARRY I. WOOD CO.,
Louisville, Ky.

THE WESCO SUPPLY CO.,
St. Louis, Mo.

GEO. W. WALTHER & CO.,
Baltimore, Md.

HAPPY NEW YEAR

COME AND SEE G. I. HIGH EFFICIENCY LAMPS
BURNING AT THE
CHICAGO ELECTRICAL SHOW.

We are lighting the M. B. Austin Co.'s booth with

TUNGSTEN LAMPS
1 WATT PER CANDLE

Bring around your wife or sweetheart, we will give her a pretty souvenir.

P. S. (There will also be something for the men.)

GENERAL INCANDESCENT LAMP CO.
1811 East 45th Street CLEVELAND, OHIO
San Francisco Office, 403-406 Atlas Building

BETTER BUY BUCKEYE

AND THE BUCKEYE "TANTALUM"

is an especially good thing to buy now if you feel that your current bill is too high.

Remember, too, all the different types we have of "Tantalum."

And don't forget the old line regular BUCKEYE CARBON LAMP. For steady, reliable "saving service" it's strictly O. K.

HAPPY NEW YEAR

BUCKEYE ELECTRIC CO.

Main Office and Works, CLEVELAND, O.

PITTSBURG
611 Empire Building
DALLAS, TEXAS
426 Linz Building

CHICAGO
23 E. Lake Street
NEW YORK
114 Liberty Street

"COLONIAL" LAMPS

COLONIAL

CAREFULNESS

CONVINCES

CRITICS

ARE TRUE TO NAME

Made with the precision and carefulness of Colonial Times, but by up-to-the-minute methods and appliances.

No 20th Century, hurry-up, so-called inspection, but minute examination at every stage of their manufacture result.

"Colonial Lamps are Made to Wear"

Colonial carefulness is equally characteristic of Colonial Gem, Colonial Tantalum.

Colonial

and Lamp Satisfaction are Synonymous

WHEN ALL OTHERS FAIL TRY COLONIAL

COLONIAL

CONSISTENCY

CHALLENGES

COMPARISON

The Colonial Electric Company

WARREN, OHIO

New York: 136 Liberty Street

BANNER BETTERNESS

16 C.P. BANNER

BANNER LAMP FILAMENTS

A lamp filament is a small, simple looking affair, but it's a mighty important factor in the making of lamps. On the excellence of the filament depends the number of candle hours---on the number of candle hours, for the amount of current consumed, depends the success or failure of a lamp.

BANNER LAMPS

are a success---they always have been---always will be, and the principal reason for their excellence is that we have put much thought and care into the making of our filaments and can guarantee the greatest possible number of candle hours for the amount of current consumed.

LOOK FOR THE LICENSE LABEL IN THE STEM

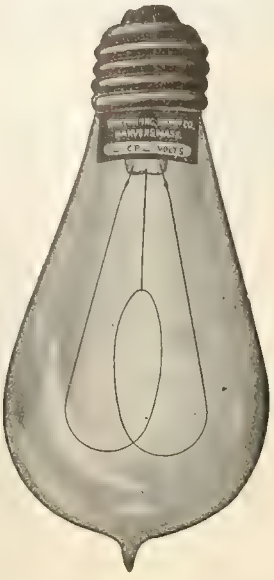
You've heard people say---"Buy Banner Betterness"---Well, they say it because they have proven to their own satisfaction that what we claim for our lamps is true,---and you can prove it too.

Ask about the metallized filament of our GEM lamp.

THE BANNER ELECTRIC CO.

YOUNGSTOWN, OHIO, U. S. A.

We guarantee prompt deliveries on TANTALUM and GEM Filament Lamps.



$15 on Standard Package
$60 on One Thousand

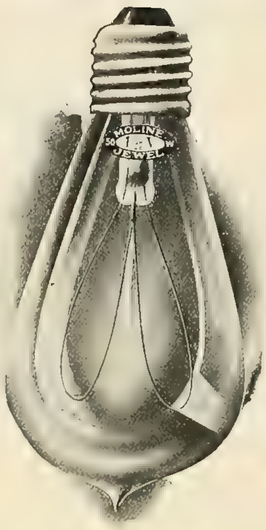
INCANDESCENT LAMPS WILL BE SAVED IF YOU BUY "BOSTON" RENEWED

BOSTON LAMPS
Once used must
Surely prove
The truth of the
Oft-repeated phrase
"None made that are better."

Order at once from

BOSTON INCANDESCENT LAMP CO.
DANVERS, MASS.

MOLINE JEWEL
Metallic Filament Lamp



2½ watts per candlepower
20, 40, 50, 75 and 100 candlepower

Also

New Moline Jewel Meridian Type
METALLIC FILAMENT
20 and 40 candlepower

WRITE FOR PRICES

MOLINE INCANDESCENT LAMP CO.
Main Sales Office and Factory:
MOLINE, ILL.
BRANCH OFFICES:
136 LIBERTY ST., NEW YORK. 99 RANDOLPH ST., CHICAGO.
Agencies in All Large Cities.
SEE OUR EXHIBIT AT THE CHICAGO ELECTRICAL SHOW.

"JUST AS GOOD LIGHT, LESS MONEY" "WE HELP YOUR EXPENSE ACCOUNT"

LOOK FOR THE LICENSE LABEL IN THE STEM

"ECONOMY"

Writ large is what we offer you.
Economy Combined with
EFFICIENCY.

LAMPS BUILT FOR SERVICE.

LAMPS THAT ARE HONESTLY RATED.

LAMPS WITH LOW CURRENT CONSUMPTION.

LAMPS THAT WILL SAVE YOU 30%.

LAMPS THAT YOU CAN HAVE ON TRIAL.

IN FACT THE LAMP FOR YOU.

THE ECONOMY ELECTRIC CO.
WARREN, O.

JUST OUT!
THE
NEW INC. LAMP!

THE SOLAR GLASS CO.
TOLEDO, OHIO.

Agents Wanted—Exclusive Territory—
Write for Particulars.

DUNCAN METERS

STATION GOSSIP

Genial Tom Conway, Superintendent of the Electric Light and Waterworks Plant of a town in Illinois, had spent a very strenuous day in reading his meters and sending out part of his statements.

When scanning over the readings, he incidentally noticed that some of the meters had not registered anything during the month, while others he thought were high, yes, too high, but what could he do? Nothing, of course, because many of his patrons were in the habit of reading their own meters, so he couldn't send a doctored bill to them.

When 6 o'clock arrived, Tom went home; hurriedly partook of a couple of cheese sandwiches and a cup of coffee, then returned to his office; and sitting down in an easy-chair belonging to the night trouble-man, he happened to doze off into a sound slumber and had a dream, which he told to his friends a few days afterward, as follows:

"I dreamed that my meter troubles would soon be at an end; that the Board had voted $1,500 with which to purchase 100 DUNCAN METERS to replace a similar number of three other makes that kept all of us in the frying-pan all the time; and that my joy and consolation knew no bounds. Also, that in due time, the DUNCAN METERS arrived, were installed, and that everybody was jubilant and high in their praise of their accuracy. Yes, I further dreamed that everybody was so solicitous and satisfied that the consumers tendered me a banquet, which the Mayor and Aldermen graced with their presence; and, after I had responded to the toast—THE DUNCAN METER—and all had their glasses raised to drink to my health and success—the banquet hall was hit by a terrific cyclone, and I suddenly awoke to find Mike McCauley, the big blacksmith, stampeding my office like an enraged lion, his words sounding like peals of thunder; and threatening to make my office look like the chopping corner in a woodyard, if I didn't take out that d—d ——— meter and put in one of those DUNCANS that he had been promised for months." He got it.

MORAL: Never eat a cheese sandwich or rarebit for supper unless you have your system metered with the DUNCAN.

DUNCAN ELECTRIC MANUFACTURING CO.

LAFAYETTE, IND., U. S. A.

Start the New Year Right

By Using OKONITE

THE STANDARD FOR RUBBER INSULATION

OKONITE TRADE MARK REG. U.S. PATENT OFFICE

We Wish You a Prosperous and Happy New Year

Okonite Insulated Wires and Cables will stand more
Kinking and tortion than any
Other wires on the market, and are
Not only the best, but because of their high
Insulating qualities they soon prove a saving over
The original cost and are cheaper in the
End than any other wires on the market.

We Solicit Your Patronage

Central Electric Company.

GENERAL WESTERN AGENTS, 264-266-268-270 Fifth Avenue, CHICAGO

"Quotations on the Spot"

THE F. BISSELL COMPANY
226-228-230 Huron Street. TOLEDO, OHIO.
Bulletin No. 19 November, 1907
Direct Current Security Switchboards
Switchboards shown and listed herein cover the usual requirements of 125 and 250 volt direct current service for isolated and central station plants

Switchboards of The Better Kind

With our new Switchboard Bulletin you are at once able to arrive at intelligent and business getting prices. We illustrate each different type of Board. We are originators of these convenient features.

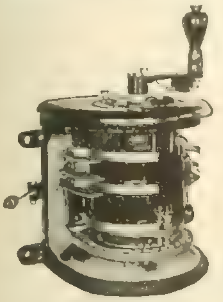
Bulletin will be mailed you on request.

Write today—tomorrow you'll forget.

THE F. BISSELL COMPANY, TOLEDO, O.

Ten minutes of your time and a two cent stamp

IT HAS BEEN said that the ability to use the services of other men to advantage is the secret of success. Few men acquire fortunes by their own unaided effort. The men who prosper beyond their fellows are those who have learned to husband their own time by making use of others. The purpose of this advertisement is to show you how you can profit by making use of us.


Machine Tool Controller

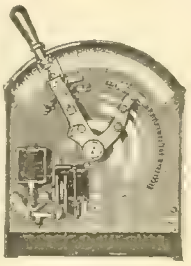
If you are engaged in any branch of the electrical industry you will have before you from time to time, problems that will require some effort to figure out. The hours you devote to this work (be they few or many) are just so many hours diverted from your other affairs—time which might be more profitably employed in securing new business. If at a total expense of 10 minutes of your time and a 2 cent stamp you can secure the solution of any problem involving electric control, would it not seem wise to put these problems up to us? We are glad to do this work free of charge because in nine cases out of ten these inquiries result in orders.

Our business has been built up in just this way by being helpful to others. For 16 years we have been designing and building electric controlling devices and working out problems of every conceivable kind having to do with electric control. The files of our Engineering Department probably contain more data on the control of electric motors than exists elsewhere in the world, for our business is the largest of its kind and we have specialized along this one line.

Two heads are said to be better than one. Granted that you are capable of working out your own problems (as most of our correspondents are) is it not conceivable that the advice of men who for years have been doing constantly what you are called upon to do only once in a while, might be helpful to you? Or consider the matter from this point of view:—You figure out a problem that is new to you. Can you guarantee in advance that the plan you have worked out on paper will give the desired result? We can, because if the problem is new to us we have at hand the apparatus and facilities for testing out our theories. It is not often, however, that we are obliged to do this. Most of the problems submitted to us, though new to our correspondents, are problems that have been put up to us time and again and we are frequently able to furnish blue prints showing how the same conditions were successfully met in former cases

Here are a few abstracts of some typical inquiries recently received by us from consulting engineers, electrical contractors, supply houses, central station managers, superintendents of industrial plants, printing offices, stage electricians, etc.:

How can we arrange to start a 15-H.P. 110-V. direct-current motor used in connection with a pumping outfit the object being to start the pump from the power house without going to the pumping plant?


Printing-Press Controller

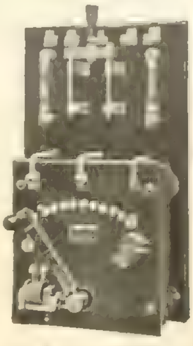
Please advise us best type of controlling apparatus to use for controlling a 1-H.P., 3-phase, 220-V. induction motor driving a pump which supplies a roof tank, the motor being too far away from the tank to use a float switch.

Can you send us suggestion for lighting signal lamps to indicate high and low water in tank, the object being to notify the operator when to start or stop a steam pump?

One of our customers who has a slow speed direct-connected motor on a refrigerating machine reports it is running rather high and we want to get a starting panel combined with armature resistance which will reduce the speed to 115 r.p.m. not only when running at load of 65 amperes, but to keep speed uniform at 115 r.p.m. when running at full load as well. Can you send us full description and price on panel that will accomplish this result?

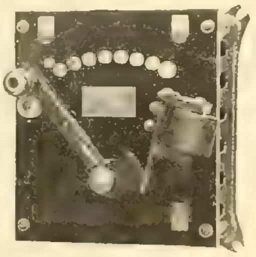
A customer of ours who is in the coal mining business has two of our 35-H.P., 220-V. shunt-wound motors operating electric fans installed about a half mile from their power house. They wish to operate and control them from the power house. Would it be practicable to do this by using a self-starter on the motor and a main line switch located in the power house? [illegible]

In our building [illegible] in connection with a motor operating organ bellows. Could this same mechanism be employed if a blower were used instead of the bellows? We want to control the motor operating blower automatically. Please give us full particulars of what you can supply suitable for our purpose.


D. C. Motor Starter

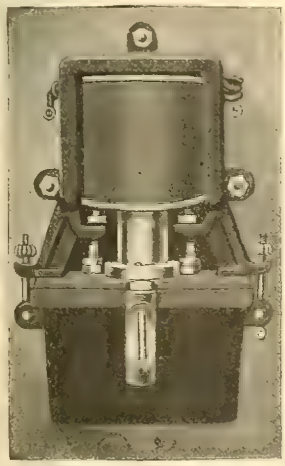
In our theater we have a shunt-wound motor driving a hot-air fan. This heats up the house pretty well on ordinary days when motor is running at full speed, but on very cold days the fan does not run fast enough to keep the house warm. Is there any way in which we can increase the speed of the motor above normal, so as to keep the temperature right in extremely cold weather?

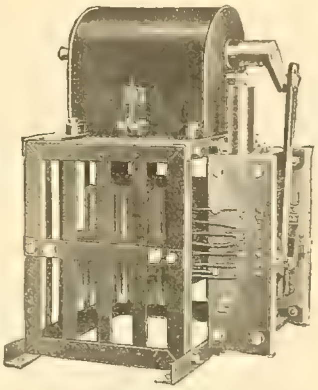
We wish to vary the speed of one of our printing presses from 1,000 to 2,000 impressions per hour. We are using a 1-H.P., 250-volt direct-current motor running at 1,275 r.p.m. The motor is driving from a 2½-inch pulley belted to a 22-inch pulley on press shaft which makes four revolutions per impression—equal to 2,175 impressions per hour. Can you furnish us with description and price on a controller designed to provide for about 55% speed reduction below normal, so that we can obtain the specified minimum speed of 1,000 impressions per hour?

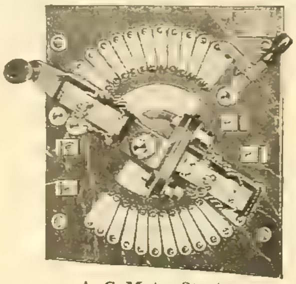

Speed Regulator

In each of the above cases there was mailed to the inquirer within 24 hours of the receipt of his letter a clear and complete explanation of how the exact result desired could be accomplished and accompanying each letter was a Bulletin illustrating and describing type of controller best suited for each particular case. If you have any problem before you *today* involving electric control, ten minutes spent in dictating a letter to us will put you in possession of the information you are seeking.

Please bear in mind that we do not make electric motors, nor generators, nor lamps, *but controlling devices only*—crane controllers, dimmers, elevator controllers, organ regulators, pressure regulators, field regulators, float switches, machine tool controllers, printing press controllers, pump controllers, resistances, self-starters, solenoid switches, starting rheostats and speed regulators for all classes of motor driven machinery for both alternating and direct current. Letters addressed to our district offices will receive the same prompt attention accorded those addressed to our main office at Milwaukee.


Oil-Immersed Self-Starter


Elevator Controller


A. C. Motor Starter

The Cutler-Hammer Mfg. Co.

Milwaukee, Wisconsin

NEW YORK OFFICE 136 Liberty St.

CHICAGO OFFICE Monadnock Block

PITTSBURG OFFICE Farmers' Bank Bldg.

BOSTON OFFICE 176 Federal St.

INTERIOR CONDUITS

AMERICAN CIRCULAR LOOM CO.
TRADE MARK

"CIRCULAR LOOM"

The perfect conduit for electric wires. Is thoroughly flexible. Allows for the many bendings and turnings necessary in installation. Is strong and tough, and does not collapse, thus insuring perfect protection from injury to the wires it contains. Fishes easily. Is moisture-proof and does not carry fire—thus insuring protection to the wire and the building. Wires will not stick in it. Is not affected by climatic conditions.

Not only specify "CIRCULAR LOOM" but see that you get it.

"ELECTRODUCT"

Is a steel, enamel finished conduit for electric wires. It was the first enameled conduit on the market. It is strong, smooth, free from the minutest obstructions on the inside and so protected by a proper coating as to prevent rust or corrosion. No other conduit possesses the durability, life, protection, or elasticity of "Electroduct."

If you specify "Electroduct" in ordering, you will know you have the best.

AMERICAN CIRCULAR LOOM CO.

CHELSEA, MASS.

New York, R. B. Corey Co., 39 Cortlandt St.
San Francisco, Jno. R. Cole Co., 766 Folsom St.
Chicago, Thos. G. Grier, 128 West Jackson Blvd.

START THE NEW YEAR RIGHT

BY USING

CLEAR— WHITE— ELECTRA ·TRADE MARK· **STEADY— BRILLIANT!**

HUGO REISINGER, 11 Broadway, NEW YORK

General Electric Company

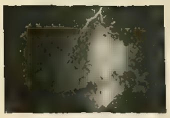
LIGHTNING ARRESTERS

Relieve electrical systems from excessive voltages incident to lightning discharges, line surges, and other line disturbances.

Its arresters are the result of the most thorough, scientific and practical investigation of high-voltage phenomena ever undertaken, and arresters have been standardized for all conditions ordinarily arising in the commercial operation of lighting and power systems.

If you will state your conditions the General Electric Company stands ready to offer you the assistance of its engineers who will advise you the best type of arrester to be used on your system.

Large stocks of standard arresters are carried to meet all ordinary conditions, and ample manufacturing facilities permit the prompt shipment of special arresters to meet unusual conditions.



General Electric Company

The modern house should be Wired for all electrical conveniences

The many conveniences now in use in the household necessitate extra outlets. Proper suggestions to the architect or owner lead to heating circuits or at least extra outlets. The electrical contractor of today recommends that every house be wired for Light, Heat and Power.

Cat. No. 58303.

In many houses already wired a heating outlet is now a necessity—moulding wiring with this receptacle is the neatest form of installation.

There are many demands for all of these in every room in the house.

Cat. No. 34153.

This metal cap attaching plug presents the best appearance with metal shell sockets and receptacles. A double bushing permits the use of either standard lamp cord or reinforced cord.

Cat. No. 45395.

A receptacle with a capacity of 25 amperes and specially made for the electric radiator and cooking and baking outfit—made also triple pole—Cat. No 45490.

Cat. No. 9185.

A keyless metal shell receptacle for concealed work which can be installed in every room at small expense—the shell is secured to the base by the standard bayonet catch connection—strong and secure.

Cat. No. 42456.

A separable-cover attaching plug which is strong and reliable is most necessary for heating devices. This plug can be strongly recommended.

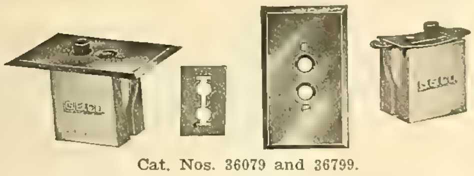
Cat. No. 39134.

An indicating switch prevents waste. This single-pole 5-amp. 250-volt switch is also made double pole, 10 amperes, 250 volts—Cat. No. 39135.

For moulding work use sub-base Cat. No. 37895 for single pole-switch and 37896 for double pole switch.

Receptacle Cat. No. 36817 and Double-pole Push Button Switch Cat. No. 36079 on the dining-room or sitting-room wall are most convenient appliances for use with all sorts of household devices.

Cat. Nos. 36817 and 36818.



Cat. Nos. 36079 and 36799.

Flush-plates Cat. Nos. 36818 and 36799 finished to match the room present a most attractive appearance.

Receptacle Cat. No. 33441 is specially useful where it is desired to limit the use of a heating device or other electrical convenience to certain parts of the house. The device equipped with Plug Cat. No. 33442 cannot be used except where the special receptacles are installed.

Receptacle Cat. No. 33441 and Plug Cat. No. 33442.

SEE OUR EXHIBIT AT THE ELECTRICAL SHOW, CHICAGO, JANUARY 13-25, 1908

1560

Chicago Office:
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PRINCIPAL OFFICE:
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Sales Offices:
In all large cities.

MOTOR DRIVEN SWING SAW

Can be Driven by Various Standard Types of A. C. and D. C. Motors.

Write for Bulletin W. E. No. 103

RELIANCE ELECTRIC MFG. CO.
CINCINNATI, - - OHIO

SPARKING *Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . .*

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

50 Cents per Stick. $5.00 per Dozen.
SEND FOR FREE SAMPLE STICK
For sale by all supply houses, or

K. McLENNAN & CO., Sole Mfrs., Room 411, Inter Ocean Bldg., 130 Dearborn St., Chicago

JEM SHADE HOLDERS
ONE PIECE, RIGID, SCREWLESS
1⅝", 2¼", 3¼"
WRITE FOR SAMPLES
JEM SHADE HOLDER CO., 13 E. 30th St., NEW YORK

LET US HAVE YOUR INQUIRIES, WHEN IN NEED OF MICA OF ANY DESCRIPTION—WE CAN GIVE YOU WHAT YOU NEED QUICK AND AT THE RIGHT PRICES.
CHICAGO MICA CO., VALPARAISO, IND.

THE COMMUTATOR COMPANY, Minneapolis, Minn.
Manufacturers of COLD DRAWN COMMUTATOR SEGMENTS.
We duplicate any segment made without cost of dies or special tools
Electric light companies and repair men given special attention.

GLOVES
Electrical Workers' Gloves a Specialty, in Buck, Horse, Pearl Calf, Etc. Strictly Union Made, Bearing Label. Write for Mail Order Catalogue.
CHICAGO GLOVE AND MITTEN CO.
172 North Halsted St., Chicago, Ill.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD.
U.S. METAL POLISH 3 OUNCE BOX 10 CENTS. SAMPLES SENT FREE. GEO. W. HOFFMAN
POLISHES ALL METALS. BRANCHES NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

Illustrated Lectures on Cooking BY Electricity

By the well-known Writer and Lecturer, Mrs. F. Violet Sanborn. The most successful specialist on the above subject in the electrical field today. For terms and dates, address 983 Jackson Boul., Chicago, or 5647 Chamberlain Ave., St. Louis, Mo.

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CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
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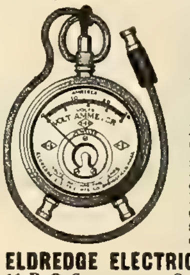
"ADVANCE" POCKET VOLT-AMMETER



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0-8 VOLTS
0-30 AMPERES
It indicates in either direction of current. ZERO adjustment. Moving parts enclosed in glass. Morocco leather case. High grade instrument at a moderate price.
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EUGENE MUNSELL AND CO.
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INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
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VOLTMETERS AMMETERS
for charging boards, etc., portable and switchboard types; compact, inexpensive.
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—FOR—
POWER and LIGHT
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National Battery Company
GENERAL OFFICES AND WORKS: BUFFALO, N. Y.

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Inspections and acceptance tests made for the purchaser at the shops of the manufacturer **INSURE** the shipment of **SELECTED GOODS** How otherwise can you *know* that the goods delivered are reasonably close to your specifications? . . . . Our facilities are at your service.

"ELECTRICAL AND PHOTOMETRICAL TESTS OF EVERY DESCRIPTION"

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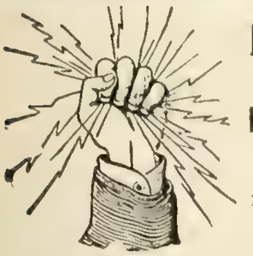
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof
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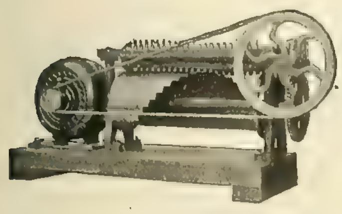
Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.



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to produce any flashing effect,

ELECTRIC SIGNS

THE BEST ONLY

Write for bulletins

THE ELECTRIC MOTOR & EQUIPMENT CO.

NEWARK, - - - - - - N. J.

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INSULATED WIRES AND CABLES

Address

John A. Roebling's Sons Co.

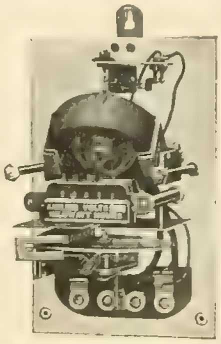
CHICAGO BRANCH: 171-173 Lake St.

Works: TRENTON, N. J.

See Our Exhibit at the Electrical Show, Chicago, January 13-25, 1908.

COLUMBIA METER

DIRECT AND ALTER-NATING



Columbia Meter Co.
INDIANAPOLIS

Insulated Staples

4 Sizes

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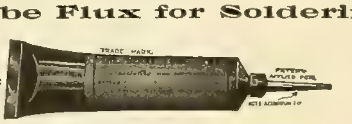
BLAKE

Tube Flux for Soldering

Full Size of Tube 1" x 5"



Compressed Cleats

FOR USE ON PLASTERING

EXACT SIZE PAT. JULY 1906

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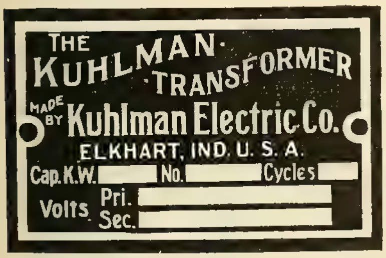
QUICK DELIVERY.



Standard Special 3-Phase.

Not Catalogued. Note its size.

No. 6015. Electrolier.

Height to Nozzle 13½ ins.

Extreme Height 19 ins.

SPECIAL OFFER

Greatest Value Yet Offered

Finished in Brushed Brass and Black or Naxos Green. Complete as shown with 2-light Vertical Cluster, supporting shade from the top (no shade ring required), 2 pull Sockets, 6 ft. Code Cord, Detachable Attachment Plug and No. 6016 Art Glass Shade 19 inches in Diameter, in Green, Amber, Pink or Sunset Glass, ready to light without bulbs. List each.......................... $20.00

Also made for GAS.

THE GOODWIN & KINTZ CO.
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CATALOG D-22

OF

Something Electrical for Everybody
FREE—SEND FOR IT.
Manhattan Electrical Supply Co.
NEW YORK: 17 Park Place, 14 Murray Street.
CHICAGO: 188 Fifth Avenue.
See Our Exhibit at the Electrical Show, Chicago, January 13-25, 1908.

"AMERICAN" STORAGE CELLS
ARE THE BEST. Send for descriptive Circular
AMERICAN BATTERY CO.,
[illegible] 171 S. Clinton St., Chicago.

IT WAS STRONG ENOUGH BEFORE

BUT NOW THE

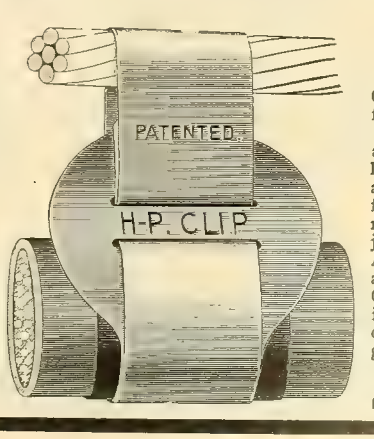
HUBBELL LAMP GUARD

IS DOUBLY SO

Every intersection of wire is welded—not simply tinned—but ELECTRO WELDED. This gives greater strength, greater resistance, more protection.

HARVEY HUBBELL, Inc.
BRIDGEPORT, CONN.

H-P Rustless Cable Hanger



For Suspending Telephone and Telegraph Cables

Made entirely of ZINC and of ONE PIECE. Packs closely (laid flat) in small boxes, each holding 500 hangers of a size. Quickly applied. Holds fast. There are no loose parts to set up electrolytic action, rust out and allow cable to fall, or to get lost. The cable chair rides over this hanger without injuring either cable or hanger. Adopted by the W. Un. Tel. Co. and a number of large Telephone Cos. A wrap of 1½ in. tape [illegible] insulation, protection against mechanical injury and insures a [illegible] grip of the cable.

JAMES S. BARRON & CO.
H-P Dept., 200-206 [illegible]

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion: additional words 2c each.*

WANTED

An engineer in an electric plant, must be able to handle Corliss engines and condensers, and be able to make his own repairs. Must be sober and give references. Also state salary expected. Address Box 774, care of Western Electrician, 507 Marquette Building, Chicago.

WANTED

A first-class electrical construction man—one who is capable of managing a business. Salary $200 a month, with percentage of profits. Give experience and age. Address Richardson Electric Co., Duluth, Minn.

WANTED

A licensed incandescent electric lamp company manufacturing only new lamps will give exclusive territory to result bringing salesmen. Address Box 763, care of Western Electrician, 507 Marquette Building, Chicago, Ill.

WANTED

Manager wanted for an electrical construction company with an investment of $20,000, doing an annual business of $75,000 (chiefly interior construction) in a town in the Northwest of about 100,000 population. Must be a practical man, a hard worker and be able to get business; must understand repairing electrical machinery and figuring construction work. Salary $2,500 to $3,000 a year to the right man. Apply, giving age, education, single or married, experience in detail, the last three positions held, how long employed in each, what your duties were and what salary you received. (All this information will be strictly confidential.) The right man may take an interest in the business if he so desires. Address Box 775, care Western Electrician, 507 Marquette Building, Chicago.

FOR SALE

150 K.W. Generator in fine condition. General Electric 3 ph., 60 cy., 2,300 v., "A T B" compensated revolving field type, belt driven, 600 R. P. M. The Hawks Electric Co., Goshen, Ind.

Department of the Interior, Office, Superintendent, U. S. Capitol Building and Grounds, Washington, D. C., November 23, 1907. In accordance with the terms of the advertisement issued by this office, and dated November 21, 1906, calling for equipment for the heating, lighting and power plant for the United States Capitol and Congressional buildings, proposals will be received and publicly opened at this office at 12 o'clock noon, Wednesday, January 15, 1908, for boiler feed pumps, barometric condensers, centrifugal pumps, motors, cranes and chimneys. Bids will be submitted for each item separately. Each proposal must be in duplicate and accompanied by a certified check or approved surety bond in the sum of five per cent (5%) of the total amount of the bid. The right is reserved to reject any or all bids, and to waive technicalities or informalities. Elliott Woods, Superintendent United States Capitol Building and Grounds.

PLACE YOUR

"Want" and "For Sale" advertisements in the

WESTERN ELECTRICIAN.

Immediate Returns.

TELEPHONE TROUBLES Price 25 Cts.

DO YOU NEED ONE IN YOUR BUSINESS?

Electrician Pub. Co., 507 Marquette Bldg., Chicago

LEGAL NOTICE

Sealed proposals will be received by the Board of Trustees for the Central Indiana Hospital for Insane, Indianapolis, Ind., until 10 o'clock a. m., February 4, 1908, for the installation of one direct-current generator, direct-connected to a steam unit (engine or turbine), foundations, steam connections, switchboard panel, with main switch and all necessary connections.

Specifications for above work on file at the office of the Board of Trustees at said hospital.

The Board of Trustees reserves the right to reject any and all proposals.

By order of the Board of Trustees.

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THE NATIONAL ORGANIZATION OF BRAIN BROKERS

With offices in 12 cities and a force of 350 people, is at your disposal and can be of inestimable value to both employer and employe.

Do you need a man?
We can get him for you.
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We can provide the opportunity for a better one.
Call or write today for a copy of either Hapgoods opportunities or Hapgoods men. Mention this paper.

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Offices in all Principal Cities

SECOND-HAND ENGINES FOR SALE.

H.P.		Speed
1	35-45 Ideal, self-oiling, 8"x10", automatic center-crank, practically new	350
1	56-70, Dick & Church, 10"x12", automatic center-crank wheels, 48"x10½"	300
1	75 Williams, comp., vertical, 8"x12"x16", automatic	500
1	72-86, Chuse, 12"x12", automatic center crank wheels, 60"x11"	300
1	97-121 Erie Ball, automatic 13"x12" center-crank wheels, 54"13"	300
1	100-150 Barnes, comp'nd, tandem, 9¼"x16"x12", automatic, with 2-59" wheels	275
1	115-150 Allfree, 14"x14", self-oiling automatic 56" gov. wheel	275
1	150-200 G. H. Corliss, 16"x42", girder frame with 14'x24" flywheel, fine order	80
1	180-200 H.P. Mackintosh & Seymour tandem, compound, 13"x19"x15" Railway type, wheels 74"x14½" and 76"x15"	230
2	200-330 Westinghouse, compound, 16"x27"x16", flywheel 84"x28"	250

Send for our monthly bargain sheet.

GREGORY ELECTRIC CO.
Chicago, Ill.

FOR SALE CHEAP

1 2 K. W. C. & C. 125-V. 4-Pole Generator.
1 6 K. W. Claus 125-V. 2-Pole Generator.
1 6 K. W. Sprague 125-Volt 4-Pole Generator.
1 10 K. W. Sprague 125-Volt 6-Pole Generator.
1 10 H. P. C. & W. 125-V. 4-Pole Motor.
2 25 K. W. Edison 125-Volt 2-Pole Generators.
1 25 K. W. Card 125-Volt 4-Pole Direct-connected Gen. Set.
1 14 in. by 8½ in. by 10 in. Worthington Duplex Pump.
1 5 in. by 5 in. Orr & Sembower Vertical Engine.
1 8½ ft. by 4 ft. 30 H. P. Vertical Boiler (High Pressure).
1 150 H. P. Spencer Pressure Damper Regulator.

JAMES A. GRAHAM,
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ELECTRICIAN PUBLISHING CO.
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Publishers and dealers of electrical books

OUR NEW "LUNA" SIGN

a money maker for the electrical contractor

Send for Circular 23

HALLER SIGN WORKS (Inc.)
321 S. Clinton St.
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Carbon Products
Battery Connectors
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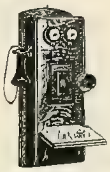
STACKPOLE BATTERY CO.
ST. MARYS, PA.



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Known and Used the World Over
Have you Tried Them?
If so, you are a Regular Customer.
If not, will you allow us to send a Sample?

International Telephone Mfg. Co.
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WE BUY OLD BELTS

OR SCRAPS, ANY SIZE OR CONDITION.

WE CLEAN, REPAIR AND RENEW OLD BELTS.

LEATHER PRESERVER MFG. CO.
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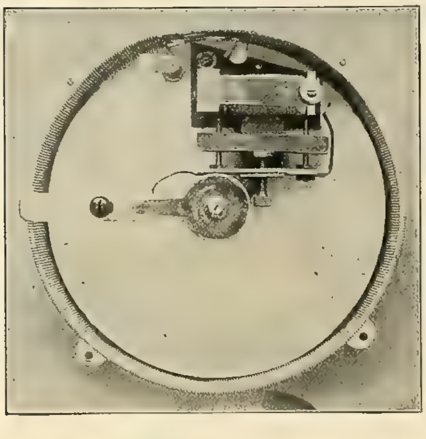
Complete and short courses. Thoroughly equipped engineering shops. **Shop work from the beginning.** Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested. **HIGHLAND PARK COLLEGE, DES MOINES, IOWA**



The National Rheostat

A new type of controller giving the closest possible control of the current. Each instrument has from three to four hundred steps instead of the usual ten to fifteen, and is designed especially for speed regulators or close control of either battery or lighting currents. Our motor controllers are equipped with both the line break and overload release.

The National Rheostat Co.
Office and Salesrooms
115 Franklin St., Chicago, Ill.

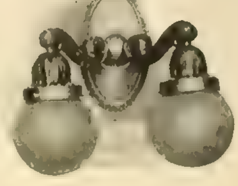
SPEER HIGH-GRADE CARBON BRUSHES

SPEER CARBON CO.
ST. MARYS, PA.

LIGHTING FIXTURES, UP-TO-DATE CATALOGS

By Up-to-Date People, Express Prepaid to Dealers

Catalog "S" will be ready Jan. 1, 1908, containing an assortment of **Electric, Combination** and **Gas Fixtures** carried by us in stock for **immediate shipment. Larger catalogs** of exclusive designs are our **No. 15** containing **Electric Fixtures** only, **Catalog No. 14** contains **Combination** and **Gas Fixtures, Catalog No. 13** contains **Gas Fixtures** only. All our latest issues and priced the **Beardslee way**; that is, having a column showing price of fixtures complete with sockets and glassware, **original** with **Beardslee** and known everywhere as the **BEARDSLEE SYSTEM.** Write for catalogs.



BEARDSLEE CHANDELIER MFG. CO.

Clinton and Quincy Sts., CHICAGO

COMMONWEALTH EDISON COMPANY REPAIR SHOPS

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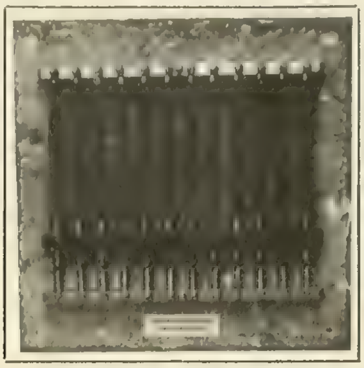
High-Grade Machine Work of All Kinds. Correspondence Solicited.

FIRST CLASS EQUIPMENT THROUGHOUT.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

A Bank of 12 Arresters in One



GIFFORD LIGHTNING ARRESTERS

operate within closer limits than any other arrester built, and their method of discharge is such that it is impossible for the line voltage to maintain an arc across them or damage their terminals.

They are Positively Non-Arcing

THE GIFFORD ELECTRIC MFG. CO.

TRAVERSE CITY, Michigan

UNION TRADE MARK

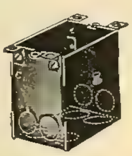
EVERY CUSTOMER CAN SAY

more in their favor than we can. Isn't that proof enough of their superiority?

UNION TRADE MARK

"UNION" SECTIONAL SWITCH BOXES

For OLD and NEW work



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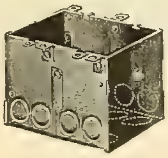

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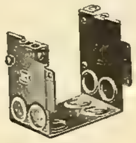

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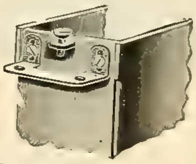


New Reversible Ear Type "C"

Takes all makes of Switches and Receptacles made in following depths:

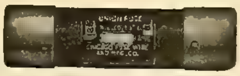
2-in. Known as "CCS"
2½-in. " " "CC"
2¾-in. " " "AB"
3-in. " " "AA"
3½-in. " " "BB"

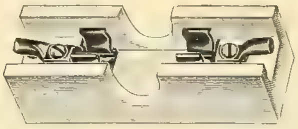
PATENTED APRIL 2d, 1907

WRITE FOR BOX CATALOGUE NO. 21

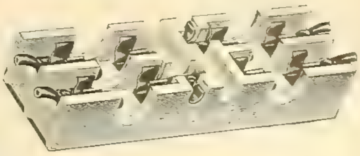
"UNION" ENCLOSED FUSES AND BLOCKS

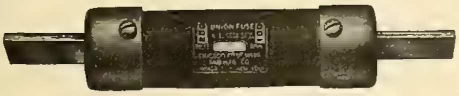
excel in their superior mechanical construction and finish; and in the constant accuracy of operation they afford absolute protection to the apparatus.



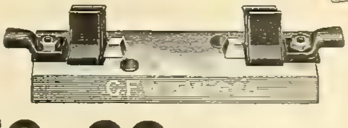


250 Volt and 600 Volt entire line approved





Approved by Underwriters' Laboratory



Write for Fuse Catalogue No. 19

CHICAGO FUSE WIRE & MFG. CO., Chicago and New York

THIS STANDS FOR QUALITY
NOBLAC INNER GLOBES
POINT 1.
H. R. NOBLAC Inner Globes are made of Heat-Resisting Glass of superb temper and purity—as a result they will stand the severest and most sudden variations of extreme cold and intense heat.
WRITE FOR PRICES AND PARTICULARS
THIS STANDS FOR QUALITY
THE FOSTORIA GLASS SPECIALTY CO. FOSTORIA, O.

PHOENIX INNER AND OUTER GLOBES

If you want to eliminate **ALL** element of chance, uncertainty and worry when you buy Inner Globes—then buy

"Phoenix Quality"

Purchasers of **"Phoenix Quality"** Inner Globes—for years—understand and realize from experience that they are a **standard of high merit.** Every essential embodied in approved and scientific construction, choicest material, and the most skilled and finished workmanship. **TRY THEM!**

☞ Every Central Station and Dealer should know what **"Phoenix Quality"** means. *Send for our Inner Globe proposition.*

Outer Globes for all Arc Systems

CATALOGUES UPON REQUEST

The Phoenix Glass Co.

NEW YORK PITTSBURG CHICAGO

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That is What the Man Does Who Buys Holophane Arcs

The man who buys HOLOPHANE ARCS is discounting future improvement. He is making his investment safe against new developments. He is not stocking up with lighting units which are in danger of becoming obsolete.

This is an important point.

HOLOPHANE ARCS, as now offered, accommodate everything from an 8-candlepower carbon filament to a 40-candlepower tungsten. This flexibility is fully shown in the following table:

Arcs Nos. 54, 55, 56 and 57.	Arcs Nos. 64, 65 and 66.	Arcs Nos. 74, 75 and 76
Lamps Available *20 cp. 50 watt Gem 16 cp. carbon filament 8 cp. " "	Lamps Available. *40 cp. 100 watt Gem 40 cp. 80 watt tantalum 40 cp. 50 watt tungsten †32 cp. carbon filament	Lamps Available. *20 cp. 40 watt tantalum 20 cp. 50 watt Gem 16 cp. carbon filament 8 cp. " "

*Lamps recommended. †Special holder required with this lamp.

This is purely a commercial consideration. It is a matter of cold dollars to the buyer, whether he be merchant, jobber, dealer or central station manager. An investment in HOLOPHANE ARCS is a safe investment.

Get the new Bulletin No. 5, which tells the story fully.

HOLOPHANE COMPANY

SALES DEPARTMENT

227-229 Fulton St., New York City

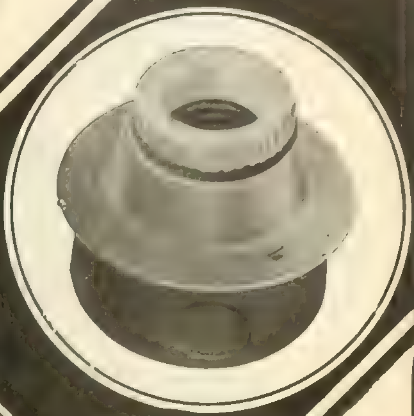
BOSTON PHILADELPHIA CHICAGO SAN FRANCISCO

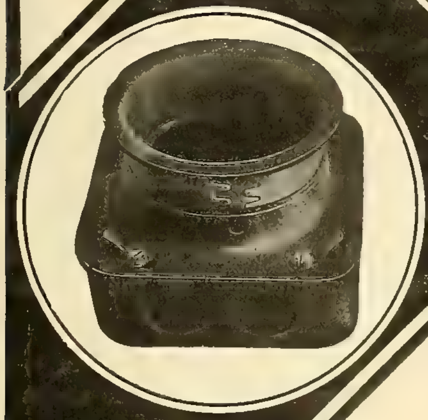
BOSSERT

STEEL DRAWN BOXES

Approved by the Underwriters and used by those who know.

Our new pamphlet gives details. May we mail it?





We also manufacture

Monitor Conduit Bushings,
Flexible Conduit Bushings,
Erickson Conduit Insulators,
Armored Conductor Bushings.

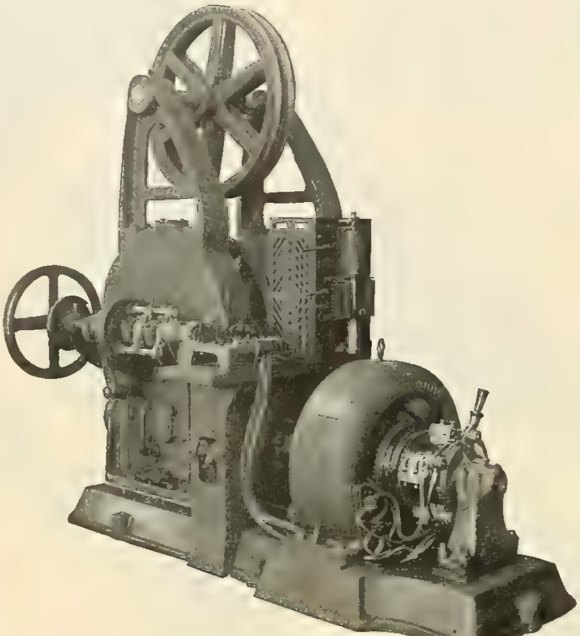
THE BOSSERT ELECTRIC CONSTRUCTION CO.

Chicago Office, 269 S. Canal St.

Utica, N. Y.

Electric Elevator Controllers

The controller used on this machine is the "Schureman" Freight Elevator Controller (Bulletin 38) with switch mounted separate, so that a gear or direct connection can be made from the operating shaft.



Haughton Elevator & Machine Co. Direct-Connected Freight Elevator.

The reversing switch is absolutely *quick-make-and-break.* The movement of the rheostat brush-holder is retarded by means of a *vacuum dash-pot,* which requires little or no attention.

The entire device is simple, reliable and durable, and has been satisfactorily used by elevator manufacturers and others for over ten years.

We make other types of controllers for lever, wheel, crank and car-switch control, and will send complete catalogue on request.

J. L. SCHUREMAN CO.

MANUFACTURERS OF

ELECTRIC MOTOR CONTROLLING DEVICES

70-86 West Jackson Boulevard, Chicago

Eastern Sales Office:
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LANG Stage Plugs and Receptacles

"NEW CODE"

These plugs are made with two, three or four Poles and spaced for 125 and 250 volts.

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Wall Box for Single Plug.

Send for Bulletin No. G606

Floor Box. Capacity, 4 Plugs.

The J. Lang Electric Company

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In a great measure the present magnificence of our standing is due to the Spartan reliability that has so long characterized our firm.

It will pay you to give us a chance to submit estimates on your work.

Just call Main 370, or drop a Post-card—*one of our special men will call on time.*

THE BLAKELY PRINTING CO.,

Tel. Main 370 **126-132 Market Street**

EVERYBODY

can now afford an

Electric Massage Vibrator

The above cut is four-fifths actual size of the Swedish Electric Massage Vibrator; weight but 18 ounces, and no parts to oil—overcoming the old objections to ALL other Vibrators, "It's too heavy and cumbersome." It is an artistic production, and would be an ornament to any dresser or toilet table. IT IS PRACTICALLY NOISELESS. There is no comparison between it and heavy, cumbersome, cast-iron vibrators. Operates equally well either on Direct or Alternating Current; gives a greater number of more penetrating and beneficial vibrations per second than ANY other at ANY price. The complete outfit comes in an elegant, substantial, portable case, including a full set of rubber applicators and directions for use. It is a thing of beauty, an electrical and mechanical marvel, perfect in its operation, construction and appearance.

The regular retail price is $20.00 for the complete outfit. Substantial discount to Electric Light and Power Companies and Electrical Supply Houses. Write for the agency in your town. First come, first served. Responsibility and ability considered.

SPECIAL 30-DAY INTRODUCTORY OFFER

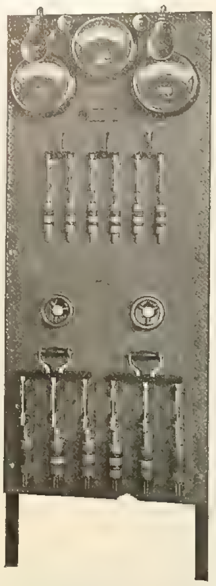
Which Positively Expires
February 1st, 1908

To introduce this Vibrator we will send ONE SAMPLE OUTFIT ONLY to any Electric Light Company, Supply House or person interested in electrical calling, upon receipt of $12.50.

Our References { Monroe National Bank / First National Bank } **Chicago, Ill.**

Swedish Electric Vibrator Co.

602-636 Farragut Avenue, - Chicago, Ill., U. S. A.



WORCESTER

Standard Electrical Specialties

Knife Switches
Tablet Boards
Cable Lugs
Switchboards
Fuse Blocks
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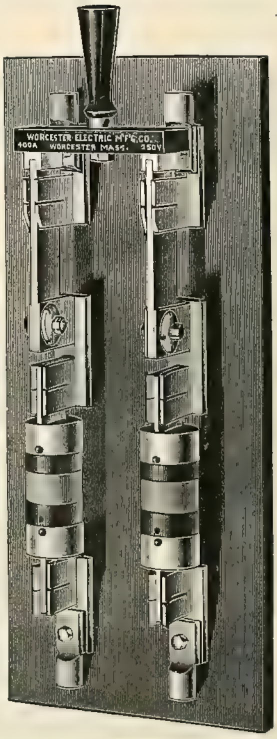
Combination Switches

N. E. Code Standard



OUR NEW CATALOGUE shows this complete line and is the handiest price list on this material ever published; with it you can obtain the net price of any combination of Isolated Plant Switchboard in THREE MINUTES; it is a time saver for those who have to give quick figures and feel assured that the prices they are quoting are absolutely correct.

This catalogue is now ready for distribution and will be mailed on receipt of your request. Everyone in the Electrical Trade should have a copy.

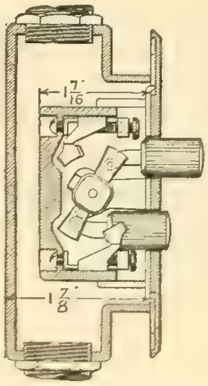
Worcester Electric Mfg. Co.

42 Lagrange Street, WORCESTER, MASS., U. S. A.

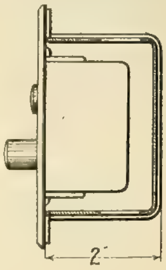
New York Office: 120 Liberty Street

THE NEW "M. & M." SHALLOWEST FLUSH PUSH-BUTTON SWITCHES

Approved and listed by the Underwriters' National Electric Association **embodies more features of advantage to the Electrical Contractors than all the other switches on the market put together.** They are pronounced by some of the leading Consulting Engineers and Contractors as **"Unquestionably the best switches on the market today."** The shallow bases allow ¾ of an inch more space for wiring in the standard wall box. The mechanism is simpler and stronger than that in any other switch, all wearing parts being accurately made of case-hardened steel.



They have been tested to make and break 10 amperes, 220 volts, over two hundred thousand times before the driving spring broke. The **"Quality"** of every detail of the **"M. & M."** switches is superior to anything yet offered in the switch line. Ask your Jobber for them the next time and see if we are not correct in our statements, or write to us for samples.



We also make "M & M." Shallow Wall Cases and Conduit Boxes and "M. & M." Receptacles and Plugs.

MACHEN & MAYER ELECTRICAL MFG. CO.

99 Randolph Street, CHICAGO, ILL. **12th and Buttonwood Sts., PHILADELPHIA, PA.**

THE J. L. MOTT IRON WORKS

118-120 FIFTH AVE.
NEW YORK

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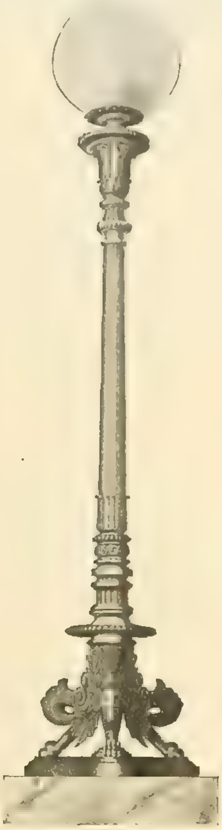

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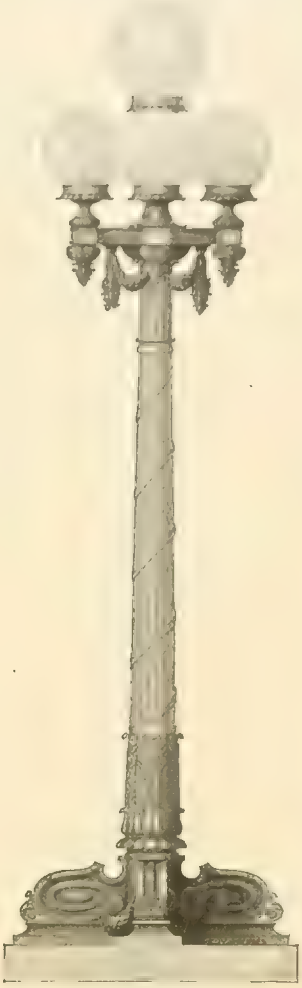
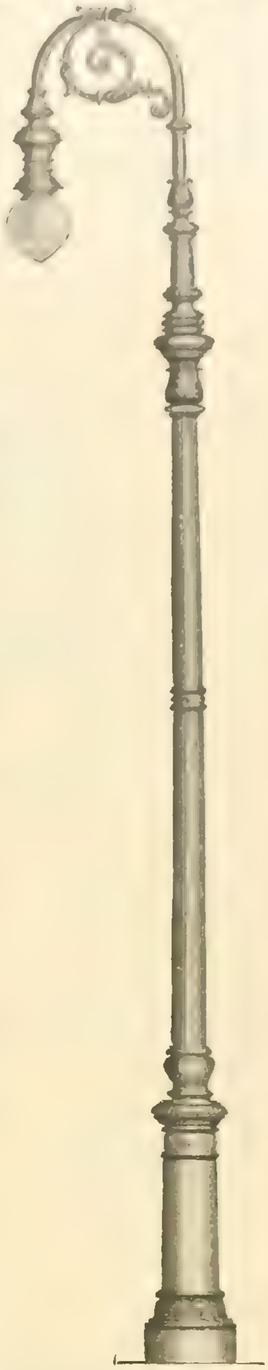


"ST. LOUIS"

F. A. POST

(DESIGNS COPYRIGHTED)



POLE NO. 3

ORNAMENTAL IRON ARC LIGHT POLES

We make a specialty of high-class Ornamental Arc Light Poles, Brackets, Electroliers and Lamp Posts, for Street Lighting, Public Buildings, Hotels, Apartment Houses, etc. Lighting companies who have used our Poles for years claim THEY COST LESS than so-called cheap poles where durability is concerned.

DESIGNS AND ESTIMATES ON APPLICATION. CORRESPONDENCE SOLICITED.

TRUMBULL PANEL BOARDS

Our Panel Boards have long since been recognized as one of the best types of standard boards.

Made of N. E. C. Plug and open link fuses.

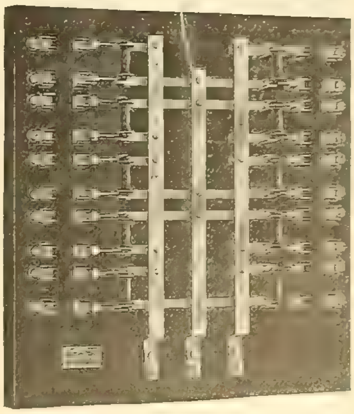
This Department has tripled in the last year, and occupies more than one-half of our new factory.

We can make all kinds of special boards promptly and at reasonable prices.

Let us quote you. Write for catalogue.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY

NEW YORK 136 LIBERTY ST. — PLAINVILLE, CONN. — BOSTON 65, 67 OLIVER ST.



Type "ES"

TOOL MAKING AND DIE SINKING

In connection with our Machinery Department we have one of the most complete Tool Shops, in which all the dies and tools for the manufacture of our high-grade instruments have been made. We are pleased to offer a portion of the service of this department to those wishing special dies and tools made under the supervision of the most experienced and careful workmen, capable of producing work of a high order of quality.

Send us your specifications and secure our prices

The Long Distance Telephone Mfg. Co.

South Bend, Indiana

W. R. OSTRANDER & CO.

Manufacturers and Dealers in all kinds of

Electrical Supplies, Bells, Annunciators, Speaking Tubes, Etc.

22 DEY ST. NEW YORK

FACTORY: 1431 TO 1439 DEKALB AVE., BROOKLYN, N. Y.

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Two steel blades, each with two cutting edges makes this the fastest and easiest working post hole digging tool manufactured.

Order from your supply company or hardware dealer.

Rapid and Efficient for Pole and Anchor Holes

Sizes 3 to 14 Inches

IWAN BROTHERS

Manufacturers

STREATOR ILLINOIS

EDISON PRIMARY BATTERIES

The cost of battery energy for any purpose is only distantly related to the original cost of the batteries.

Inferior batteries have a way of wasting current, growing weak with use and giving out before their time, which makes them as costly as they are unsatisfactory.

Edison Primary Batteries deliver a steady, constant current until the elements are entirely exhausted and when exhausted they can be renewed at a very small cost.

They never give out before their time, never dry up or explode. Use Edison cells and you will find them to be not only the cheapest, but also the most reliable batteries to be had.

If you contemplate buying batteries for any purpose, tell us what it is and we will tell you what you need and the cost.

Edison Manufacturing Company

7 Lakeside Avenue, Orange, N. J.

New York Office - 10 Fifth Ave.
Chicago Office - 304 Wabash Ave.
London Office - 25 Clerkenwell Road.

Where there is no necessity for the use of concrete as a protective medium

Orangeburg Fibre Conduit

of the sleeve-joint and screw types offers a style particularly adapted to use in private grounds, parks, parkways and millyards, or wherever there is no probability of future disturbance from excavation.

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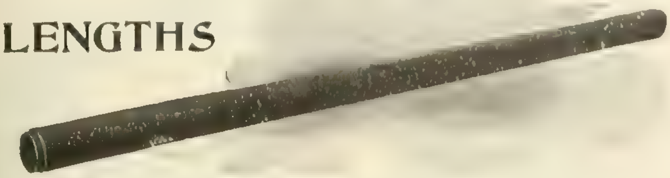

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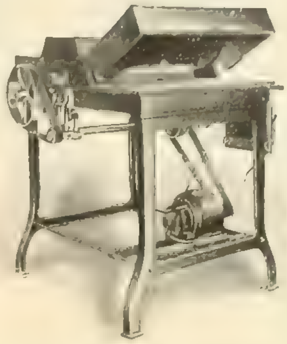

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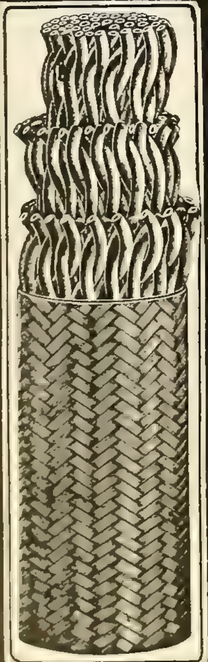

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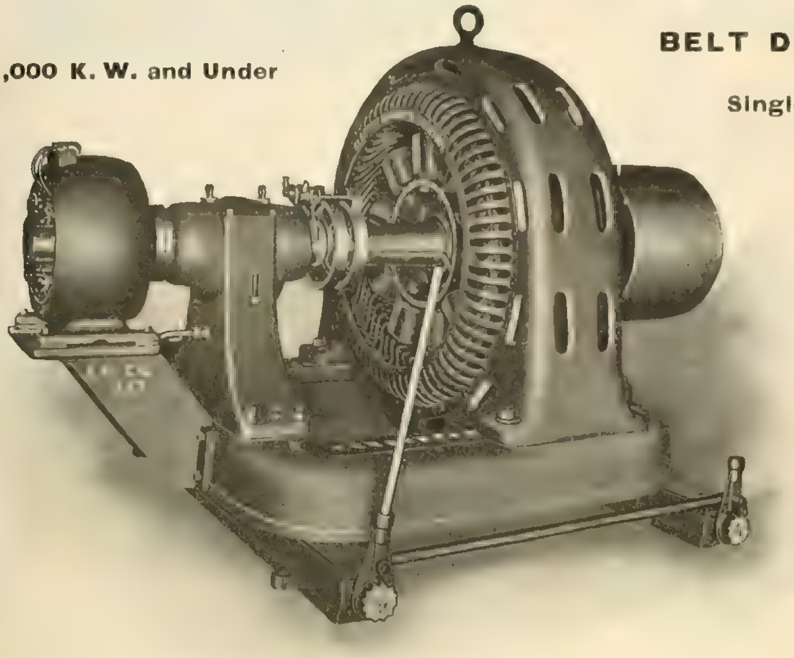

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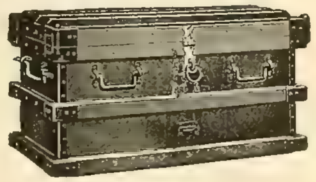

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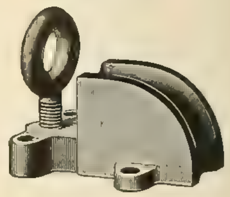

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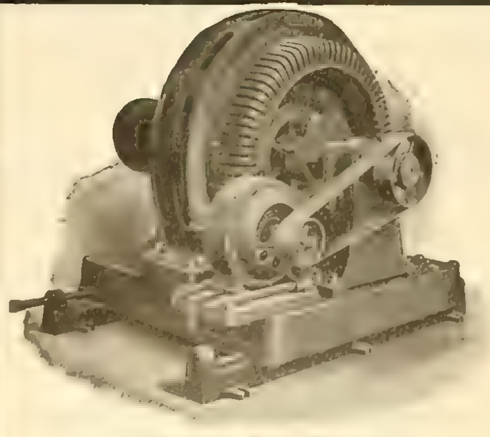

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EVERY SATURDAY

Vol. XLII. CHICAGO, JANUARY 11, 1908 No. [illegible]

Unusual Power Transmission on the Inland Canal of the Rhine Valley.

Endeavors to correct and to regulate the course of the Upper Rhine may be dated back to ancient times, but this problem was first taken up by the governments of the countries concerned about the middle of the last century.

The Inland Canal of the Rhine valley, which is 26.5 kilometers in length, is designed to prevent floods in the river and to allow the adjoining valley to be reclaimed. This canal is made up of three stages or steps, and the head of water thus afforded has now been utilized for the production of electricity. Three small power stations have been erected at Lienz, Blatten and Montlingen on the three stages respectively.

One of the three power stations, that at Montlingen, is the main central station, which is exclusively used for power distribution. This (Fig. 1) comprises three hydro-electric units of 250 horsepower each. The turbines are vertical Francis turbines operating, through bevel wheel gearings, the polyphase-current generators (Fig. 3) which are direct coupled to them. The current generated by the latter is of 10,000 volts tension at 50 cycles, and at 250 revolutions per minute. To the generator shaft are mounted the exciter machines supplying current at 60 volts and 136 amperes.

The switchboard (Fig. 5), arranged in three stories, is separated from the engine hall by a marble wall. The first three panels from the left to the right carry apparatus and instruments required in superintending and controlling the machine, viz., a lever for operating the switch, a main-current and exciter-current ammeter and the regulator. The last named can be controlled either separately for each generator through a handwheel or simultaneously for all machines. On the third panel is further installed a wattmeter.

The two remaining panels are set apart for the four transmission circuits, viz., the conductors connecting the Blatten and Montlingen power stations, the circuit between Montlingen and Oberried, that between Montlingen and Altstetten and the one between Montlingen and Heerbrugg alongside the Rhine Valley Inland Canal.

An ammeter is inserted in each transmission circuit. These two panels further comprise a wattmeter for determining the total yielded output, a polyphase voltmeter with switch for measuring the voltage of the machines and bus-bars, two pilot lamps for arranging the generators in parallel and a switch for each of the four conductors.

The lowest compartment of the switching plant behind the switchboard is divided into cells by walls of armored concrete. The cells intended for receiving the apparatus controlling the dynamos contain on one side of the armored concrete walls three oil switches, a measuring transformer and a current converter, and on the other an oil switch actuated from the switchboard through the intermediary of a lever located in one of the floor channels. The four circuit compartments contain each an oil switch operated as above stated.

These oil switches, in contradistinction to the generator switches, are fitted with automatic short-circuited disengagement so as to dispense with fuses. Two current converters are finally provided in each conductor cell.

Another cell contains the measuring transformer for the [illegible] lighting of the power station, and a 6-kilovolt-ampere polyphase-current transformer for 10,000-260 volts, supplying current to the workshop motor, in addition to the fuses of the primary ends of the transformers.

In the upper part of this compartment there are installed the induction coils for the outgoing and incoming conductors. In the compartment situated above there are located lightning conductors with water resistances fitted in conduits. Each of these conductors (which are situated in cells with iron armor walls) can be switched off separately by switches arranged at the ceiling. Between the three horn lightning arresters, located in the same cell, there are fitted cement asbestos plates for the sake of additional safety.

The outgoing conductors are carried away from the upper story through glass openings in the walls.

The power house contains a small workshop, the machines of which are operated by a 6-horsepower polyphase motor. The building has been erected on a concrete foundation like the two other stations and is designed in its upper part of brick masonry. The roof consists of iron and is covered with tiles. A hand-operated traveling crane is installed. Arc and incandescent lamps supply the illumination of the central power station.

The two other power stations, situated at Lienz and Blatten, respectively, are practically identical as to their design, each of them containing two hydro-electric units of 250 horsepower each. (See Figs. 2 and 4.) The turbines are coupled with the generators in the same manner as in the power station

Fig. 1. Power House at Montlingen. Fig. 2. Power House at Blatten.
Fig. 3. Interior of Montlingen Station. Fig. 4. Interior of Blatten Station.

UNUSUAL POWER TRANSMISSION ON THE INLAND CANAL OF THE RHINE VALLEY.

first described. However, the generators are of the asynchronous type. Such generators require neither regulation of the voltage nor of the turbines, nor is there any necessity of obtaining the synchronism of phase and tension in switching the generator onto the circuit. These generators are operated at 255 revolutions per minute and yield current at the same pressure, 10,000 volts, with 50 cycles.

The switching plant of these two stations is of a far simpler design than that of the Montlingen central station, each of the machine panels carrying a switch, a main-current ammeter and a bus-bar voltmeter with switch. A switch and an ammeter have been provided for each of the outgoing conductors in addition to a wattmeter serving for all in common. The apparatus compartment proper is designed in the same manner as at the Montlingen power station, but containing only two stories and being of simpler construction.

The Oerlikon Machine Works, which have been contractors for the whole of this plan, adopted this combination of a main central station containing synchronous generators with two secondary central stations containing asynchronous generators because the system can be simply controlled from a central point while facilitating the working in parallel of distant central stations. Whenever the load on the circuit falls below the output of the asynchronous-generator turbines the synchronous generators in the main central stations will be accelerated, and this acceleration can be compensated by simply switching the asynchronous generators out of circuit or closing their turbines. The voltage of the circuit as well as the excitation and turbine speed are controlled only from the main central station.

This scheme allows of a considerable saving, necessitating only the presence of an unskilled superintendent in the two secondary stations, whose functions are limited to switching the power station into circuit whenever there is some power required, and to switch it out again as soon as there is excess of energy. Orders for performing this work are given from the main central station. The starting of a secondary central station, like those above described, is effected by simply opening the turbine gate and inserting the corresponding generator.

A further advantage of this scheme is the saving in first cost, the exciter machines of the generators in the secondary stations being done away with, while the switching plant in the secondary station is greatly simplified.

The distribution of current is effected exclusively from the main central station, from which three lines leading to Oberried, Altstetten and Heerbrugg, respectively, are started, while a fourth line terminates at the upper secondary power stations. These circuits are carried nearly exclusively on poles fitted into a concrete foundation. The insulators are made up of two pieces glued together by two enameled portions which increases their insulating power. The high-tension conductors are half-hard-drawn copper wires six millimeters in diameter between the central stations and three millimeters on the remaining lines.

The whole transmission is interconnected, as the [illegible] station can be switched together at the Heerbrugg switching station by connecting the corresponding bus-bars, which in the case of a breakdown allows any one of the conductors to supply current from the other. In normal operation the loop connection is not used. The high-tension conductors are protected by lightning arresters installed at all transformer stations [illegible] A view showing the pole line is given in Fig. 6.

The 10,000-volt current is reduced to 2,000 volts at Altstetten by four 100-kilovolt-ampere transformers. This 2,000-volt current is then conveyed to seven transformer stations, most of which are designed as framework towers. In the brick transformer stations (Fig. 7) there is a first story containing the high-tension apparatus and a lower story containing the transformer.

The Heerbrugg sub-station receives the conductors coming from Altstetten and from the power station. This sub-station has been provided for two transformers of 100 kilovolt-amperes each with a ratio of 10,000 volts to 260 volts. For each of these conductors there is a bus-bar system connected to the transformers by means of a switch. In order to check the load on the two branches, measuring instruments are connected to both bus-bar systems through the intermediary of measuring transformers.

The plant above described is the first plant of such dimensions designed on this novel system.

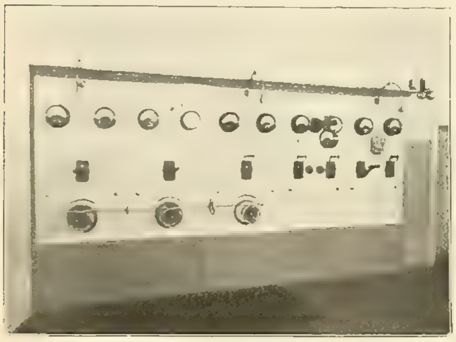


Fig. 5. Switchboard at Montlingen Power House.

Fig. 6. Pole Line, Showing Cutout.

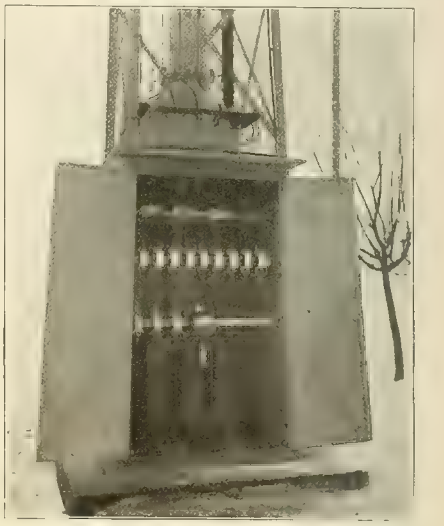


Fig. 7. Transformer Station.

UNUSUAL POWER TRANSMISSION FROM THE INLAND CANAL OF THE RHINE VALLEY

Northern Colorado Power Company's Extensions.

The Northern Colorado Power Company is preparing to extend its power lines from Greeley to Lafayette and from Lafayette to Denver. The tension of the company through this territory is towns now served are Louisville, Lafayette, Superior, Boulder, Longmont, Berthoud, Loveland, Fort Collins, Timnath and Greeley. The proposed extensions will serve the towns of Windsor, Evans, Lucerne, Eaton, Ault, Niwot, La Salle, Fort Lupton, Platteville, Brighton, Erie, Lyons, Johnstown, Mead, Canfield, Wellington and other places. Throughout the entire length of the transmission lines there will be a 2,400-volt service carried for local power and irrigation service. The average price for pumping an acre foot of water, available 8 to 30 feet below the surface of the ground, is between $4 and $5 per acre per year. This will make an increased production, it is estimated, of $25 per acre per year. It is estimated that 12,000 acres of land can be reclaimed by the aid of this electric power project.

In addition to the service to the above towns and power users, power will be furnished for the electric service of the Denver and Interurban Railroad Company, which will operate between Denver and Boulder. It is a subsidiary of the Colorado and Southern Railway. Power is now being furnished for the street-railway line at Boulder.

W. J. Barker of Denver, president of the company, has with the assistance of N. A. Carle, general manager, completed plans for the extensions. Mr. Barker is said to have been the first man to install a dynamo in Denver, which was also the first dynamo brought into Colorado. Nearly all of his long service has been with the Denver Gas and Electric Company, of which he is now the general superintendent.

Mr. Barker says that there are thousands of acres of land adjoining the Union Pacific Railway running north to Cheyenne, Wyo., which are too high to be reached by water with a gravity system. The Platte River runs through the fertile region and there is said to be enough water to supply most of the ground. As soon as the proposed extension of the company through this territory is completed the water will be lifted to a height which will make it possible to irrigate this ground.

The Northern Colorado Power Company is largely controlled by the Hallgarten company and the Electric Properties Company of New York, and their interests are represented by John F. Wallace. The company will sell power at wholesale in Denver to the Denver Gas and Electric Company and the Denver City Tramway Company.

Theory of Metallic Conductivity.

Prof. J. J. Thomson, in a recent paper before the British Institution of Electrical Engineers, summarizes the "corpuscular" or electron theory of metallic conduction and indicates a few modifications of it which have become necessary in the light of recent observations. The theory may be stated as follows: "By the action of one atom of the metal on another, corpuscles are split off from the atoms, and they remain diffused through the mass of metal; so that we may picture to ourselves a metal as somewhat like a porous body, the pores of which are occupied by a substance with the properties of a perfect gas. In the older theory it was supposed that these corpuscles remained free for a time sufficiently long to enable them to get in thermal equilibrium with the metal itself, so that, like all gases, the average kinetic energy of the corpuscle was a constant merely depending upon the temperature." The modification now required, says a writer in Science Abstracts in giving the points of Professor Thomson's paper, is to suppose that the electric force, instead of acting on the corpuscles after they have left their atoms, really acts upon the atoms before the corpuscles leave them. The atoms probably act on each other like a system of electric doublets, and the electron flows from the negative end of one doublet into the positive end of another.

This modification is based upon the experiments of Rubens and Hagen on the conductivity of metals under very rapidly alternating electric forces of the order of light waves, which is practically the same as that for steady currents. To give this conductivity, the number of corpuscles per cubic centimeter would have to be 1.8×10^{24} in the case of silver. The author states the difficulty thus arising as follows: "We require that number of corpuscles per cubic centimeter to give, in the time deduced from the experiments of Rubens and Hagen, the proper electrical conductivity of silver. Now, you have that number, each possessing at the absolute temperature θ an amount of kinetic energy $a\,\theta$, and therefore to raise the temperature 1° you would have to give to each one of these an amount of energy a, or to the whole lot an amount of energy represented by $a \times 1.8 \times 10^{24}$, being about 1.5×10^{-16}; so that this energy is $1.9 \times 1.5 \times 10^{8}$ ergs, that is, somewhere about 7 calories is required to raise 1 cubic centimeter of silver 1° C. if you leave the atoms of silver alone and merely attend to the corpuscles. The actual amount required to raise the temperature of the silver is only about 0.6 calorie, so that there is a serious discrepancy between the results of the theory in this form and the results of experiments on specific heat." The difficulty may be got rid of by supposing that the electron, instead of wandering about, jumps practically straight from one atom into another.

The outstanding difficulty of the Hall effect is dealt with by the author as follows: "Suppose that we have a doublet with negative and positive ends, then if it is pulled round by an electric force, the ends start moving, one in one direction and the other in the opposite, and if there is a magnetic force acting upon the thing at right angles to the plane of motion, then there will be forces acting

upon these two ends. If the end moves with equal and opposite velocities, the forces on the two ends are equal, but if the velocities are different from the forces on the ends are different, and there is a couple produced. In fact, the doublet when placed in a magnetic field behaves exactly like a gyroscope. Suppose we have a pendulum with a gyroscope bob instead of the ordinary bob; suppose it were held away from the vertical, corresponding to one of our doublets before an electric force acts upon it; now, it is let fall; gravity, instead of pulling it straight down to the vertical, will make it swing round like a gyroscopic pendulum one way or the other, according to the direction of the spin in the top in the bob. So that if this gyroscope property were attached to a doublet, then when there is an attempt to pull it along the lines of electric force it will come out a little at right angles, and there will be a current either that way or the other way, according to the sign corresponding to the spin of the top of the gyroscope. So that, in addition to the movement along the direction of the line of force, the doublets would tilt up a little bit at right angles to it; there would be a polarization in the direction of right angles to it, and that polarization would produce a current in that direction, so that, unless the negative and positive ends move with equal and opposite velocities—that is, unless the center of gravity of the doublet is exactly midway between the negative and positive charge—then these doublets when they are placed in a magnetic field will be acting like gyroscopes, and if it is attempted to pull them by a force in one direction they tend to squirm off in a direction at right angles to it; and that, I think, accounts for the Hall effect in metals."

In the course of the discussion Prof. S. P. Thompson asked why the author used the word "corpuscle" instead of "electron." The author replied that he preferred a word which could not be mistaken for the name of any "positive" electron. The corpuscle was always understood to be a negative electron.

Self-exciting Revolving-field Alternators.

An interesting form of alternator has been invented and patented by William Stanley of Great Barrington, Mass. The machine is of the revolving-field type in which the field windings are energized by alternating currents supplied from the machine itself. In former machines of the self-exciting rotary-field type it has been shown to be necessary that the phase of the electromotive force induced on the stator windings should not coincide with the phase of the electromotive force induced in the rotor windings.

Various means for accomplishing this result have been suggested. Such means consist in placing windings symmetrical in construction in dissymmetrical position or in placing windings dissymmetrical in construction in symmetrical positions. Mr. Stanley has now discovered means whereby the necessary displacement of the electromotive forces may be obtained by windings which are

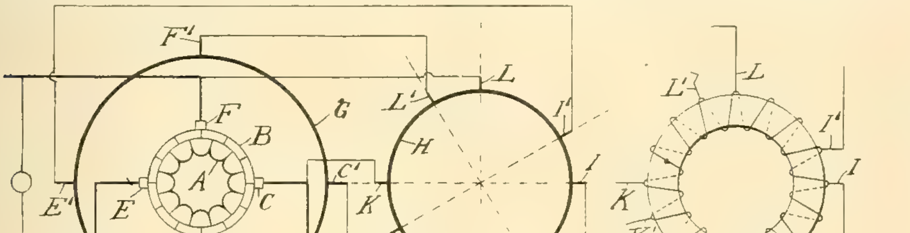
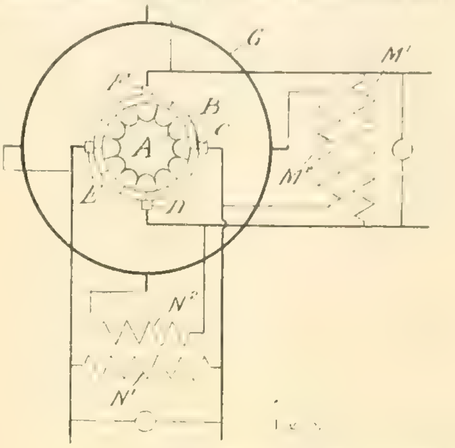


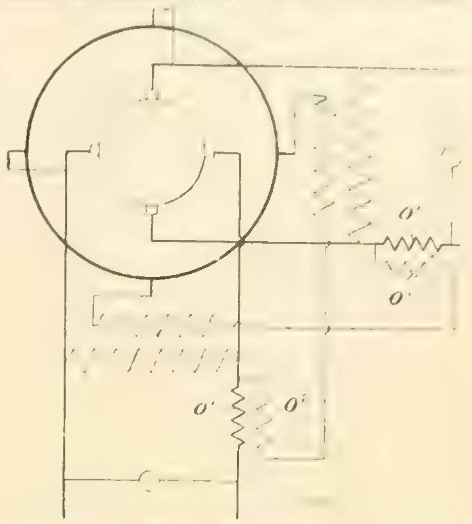
FIG. 1. DIAGRAM OF CONNECTIONS OF SELF-EXCITING ROTARY-FIELD ALTERNATOR.

symmetrical in construction and also symmetrical in position, the difference of phase of the rotor and stator electromotive forces being brought about by the introduction of phase-differing electromotive forces upon the magnetizing circuits of the machine. This arrangement is particularly useful in cases where it is desired to dispense with the commutator or to have the windings of a large number of turns of relatively high resistance. Thus in cases where dissymmetry of position is relied upon to produce the dissymmetrical field, a high-resistance winding would necessitate such a displacement of the rotor and stator windings as would lessen their mutual induction and interfere with the inherent regulation of the machine, which is dependent [illegible]

[illegible] diagrammatically shown. Modified transformer connections [illegible] stator winding (G) is indicated by a circle merely.

The exciting transformer (H) is represented in Fig. 1 as a rotary-field transformer and its winding [illegible]





MODIFIED TRANSFORMER CONNECTIONS FOR SELF-EXCITING ALTERNATOR.

From this transformer taps (I, J, K, L) are taken, these being connected, respectively, to the rotor brushes (C, D, E, F). Other taps (I', J', K', L') are also taken from this transformer winding and are connected at points (C', D', E', F') upon the stator winding directly opposite to the points (C, D, E, F) upon the rotor winding. The taps (I, J, K, L and I', J', K', L') are displaced by an angle substantially equal to 90 degrees less the lag of the magnetizing current of the stator. In this way two electromotive forces are obtained, one upon the rotor terminals and one upon the stator terminals, differing in phase from one another and capable of urging a magnetizing current through the rotor and stator windings, and thus to magnetize the machine. A similar result can be obtained with an exciting transformer, which has two windings constituting distinct primary and secondary, as distinguished from the single winding shown in Fig. 1. When the primary terminals of this transformer are connected to the rotor brushes and the secondary terminals to the stator taps, the angle of displacement of the transformer terminals in this case will also be substantially equal to 90 degrees less the lag of the magnetizing currents.

Instead of using a rotating-field transformer other types of exciting transformers may be used and may be arranged in various ways so long as the transformers induce electromotive forces upon the energizing circuits of the machine in quadrature to the electromotive forces induced by the rotation of its rotor, and therefore capable of sending a current over the resistance of the magnetizing circuit. Such an arrangement is shown in Fig. 2, in which (M') is the primary winding of an exciting transformer connected across the mains of one phase; whose secondary (M^2) is connected to the brush (C) of the other phase and to a stator tap in line therewith. (N') is the primary of a second exciting transformer connected across the mains of the other phase and having its secondary (N^2) connected at one end to the brush (D) of the first phase and at the other end connected to the stator tap in line therewith. These transformers are so wound that the induced electromotive forces of the

[illegible] pounding primaries for the magnetizing transformers or compounding transformers whose primaries [illegible]

tively, with the secondaries of the exciting transformers. This arrangement results in causing the the energizing currents to vary with the load upon the work circuits, so that the machine may be made to have any desired potential gradient. The particular work circuit with which a particular compounding transformer should be in series depends upon whether the machine is to be compounded for a lagging load or a unity power-factor load. The arrangement shown in Fig. 3 is the proper one when the load is of unity power factor. In this case, since the working currents lag zero degree behind their electromotive forces, the electromotive forces introduced into the energizing circuits by the compounding transformers will increase with increase of load, and will therefore cause an increase of magnetizing current. The compounding transformer, if connected so as to introduce an opposing electromotive force into the energizing circuit, will obviously produce a regulation resulting in a negative potential gradient, while if the two electromotive forces work together, the regulation will result in a positive potential gradient.

Characteristics of Lord Kelvin.

From an excellent memoir and a discriminating editorial in the London Times relating to the late Lord Kelvin the following extracts are made:

"Generally recognized at the time of his death as the foremost living physicist, he was not less remarkable for the profundity of his researches than for the range and variety of his attainments. Not confining himself to a single more or less specialized department of learning, he may be said to have taken all physical science to be his province; for there were few branches of physical inquiry that he did not touch, and all that he touched he adorned. Perhaps this manysidedness of his intellectual interests may be connected with the deep conviction he cherished of the unity of all science, and his impatience of conclusions, which, drawn from a limited field of study, were in opposition to the well-ascertained facts of wider generalizations. On one occasion, when accused of being 'hard on the geologists,' he repudiated the suggestion with the remark that he did not believe in one science for the mathematician, another for the chemist, another for the physicist, and another for the geologist. All science, he said, is one science, and any part of science that places itself outside the pale of the other sciences ceases for the time being to be a science."

"To the ordinary man it is interesting to note Lord Kelvin's own appreciation of his long researches into the ultimate nature of things. Speaking at his jubilee at Glasgow in 1896, he said: 'One word characterizes the most strenuous of the efforts for the advancement of science that I have made perseveringly for 55 years; that word is failure. I know no more of electric and magnetic force, or of the relation between ether, electricity and ponderable matter, or of chemical affinity, than I knew and tried to teach my class-students in my first session as professor.'"

"Great as were Lord Kelvin's achievements in the domains of scientific speculation, his services to applied science were even greater. His mathematical powers were undoubtedly high, but as a pure mathematical thinker he was surpassed by

several of his contemporaries, for his strength lay rather in the faculty which he possessed in an extraordinarily developed degree of applying mathematics to the solution of practical problems."

"Say a thing is not delicate enough; most inventors proceed to make it a little more delicate, and are rather proud of doing so much. Lord Kelvin would ascertain by a masterly analysis of the whole case what was the maximum of possible delicacy, and would then bring to bear wide and various knowledge and singular fertility of mechanical resource in order to reach that maximum."

Synchronizing Apparatus for a Telescope-driving Motor.

In all astronomical work in which it is intended to make continuous observations of any of the heavenly bodies, it is important that the telescope be kept accurately pointed to the object of investigation during the latter's movement from east

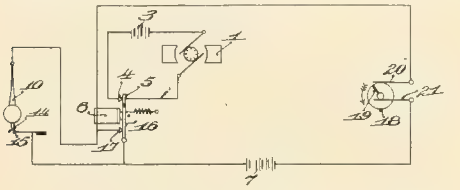


FIG. 1. CIRCUITS FOR SYNCHRONIZING APPARATUS.

to west across the sky. To relieve the astronomer of the necessity of making continual adjustments by hand, automatic mechanism for moving the telescope is now almost exclusively used in the larger observatories. For small-sized telescopes clockwork mechanism answers very well, but for large telescopes more power is required, and for this purpose the electric motor under proper control is admirably adapted.

A number of methods for accurately timing or synchronizing the operation of such motors have been invented by Willard P. Gerrish of Cambridge, Mass. On one of these improved methods an American patent was recently granted. A diagram of the electric circuits is shown in Fig. 1 and the application of the device to the driving mechanism of a telescope is illustrated in Fig. 2.

The battery (3) is shown as supplying current to the motor (1). Another battery (7) supplies current to a circuit including a relay (6) and a contact maker (18). This relay circuit also includes contacts (14, 15), one of which is carried

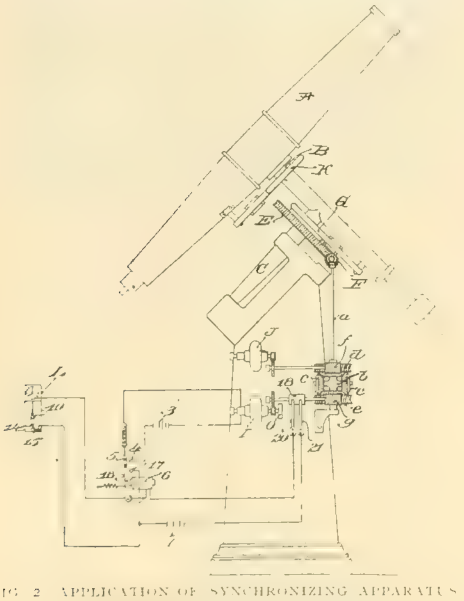


FIG. 2. APPLICATION OF SYNCHRONIZING APPARATUS TO TELESCOPE-TURNING MOTOR.

by a pendulum (10). These contacts are arranged to momentarily engage during the swing of the pendulum in each direction. The engagement of these contacts energizes the relay (6) and causes its armature (16) to be attracted, and closes the power circuit of the motor at the contacts (4, 5). When the armature of the relay is attracted, a shunt across the contacts (14, 15) is closed by the engagement of the armature with the contact (17), so that the relay remains energized after the separation of contacts (14, 15).

[illegible] closing device is [illegible] the [illegible] commutator, consisting of a cylinder of conducting material [illegible] the relay circuit bear respectively upon the periphery and the shaft of the commutator. During each [illegible]

this point, so that it can be closed as soon as the contact (14) engages the contact (15). The momentary break in the relay circuit at the commutator (18) de-energizes the relay, so that the relay armature is retracted by its retracting spring and the motor circuit is broken. The retraction of the relay armature also breaks the shunt across the contacts (14, 15), so that the armature remains in its retracted position, and the motor circuit remains open until it is again closed by the engagement of contacts (14, 15).

Under normal conditions the commutator (18) makes one complete revolution during the interval between successive closures of the motor circuit and the current impulses transmitted to the motor are of uniform duration. If the speed of the motor increases, the duration of the current impulses decreases, and if the speed of the motor decreases, the duration of the current impulses increases, so that the speed of the motor is accelerated or retarded until the commutator (18) rotates at its normal speed. This mode of operation is obvious without further description. It will be noted that the duration of the current impulses may be decreased to zero as a minimum, and that the duration of the current impulses can be increased to substantially the entire interval between successive closures of the motor circuit as a maximum. Under normal conditions the motor is deprived of current during much shorter intervals than with the apparatus heretofore used, so that the fluctuations in the speed of the motor are decreased to a marked degree, and in actual practice are inappreciable. In actual practice the wide variation which can be made in the duration of the electrical impulses enables the apparatus to restore synchronism until the commutator falls behind from a half to three-quarters of a revolution. The possibility of using a momentarily acting circuit closing and breaking device to control the closing of the motor circuit at regular intervals permits this circuit to be controlled by a momentary signal, such as is ordinarily given by an astronomical clock or chronometer.

Referring to the application of this synchronizing system, shown in Fig. 2, (A) indicates a telescope mounted on a declination axis (B), which in turn is mounted on a polar axis (C). The axis (C) is rotated by a worm gear (E) which meshes with a worm (F) driven through bevel gears from a vertical shaft (a). The worm gear (E) is loose on the polar axis (C) and is secured to the sleeve carrying the declination axis (B) by means of a suitable clamp (G), the object of this construction being to allow the telescope to be turned about the polar axis independently of its driving mechanism. A similar clamp (K) connects the telescope with the axis (B). The shaft (a) is driven through a differential gearing, comprising a spider (b), to which the shaft (a) is secured, and which carries bevel gears (c). These bevel gears mesh with bevel gears formed upon the adjacent faces of worm gears (d and e), loosely mounted upon the shaft (a). Worms (f and g) mesh with the worm gears (d and e) and are driven from electric motors (I and J). The motor (I) is used to drive the telescope synchronously with a clock mechanism, which is indicated at (L), the motor (J) being normally idle, so that the worm (F) holds the worm gear (d) of the differential gearing stationary. The provision of the differential gearing and the motor (J) is for the purpose of enabling the telescope to be adjusted while it is being driven by the motor (I).

The synchronizing apparatus is indicated diagrammatically in substantially the same manner as in Fig. 1, and will be readily understood without further description. The brushes (20, 21) which are included in the relay circuit both bear upon the periphery of the commutator (18), so that the relay of the circuit is broken whenever the insulating strip in the periphery of the commutator passes beneath the brushes. The commutator is mounted upon the shaft of the worm (g), and this shaft is geared to the armature of the motor. A flywheel (O) is provided, which is driven by the motor, and by its momentum aids in preventing fluctuations in the speed of the motor.

Chicago Wants Testing Plant.

At a meeting of civic and industrial organizations in Chicago on January 4th plans were considered and a large committee, headed by David R. Forgan, appointed to secure the location of the proposed United States government's testing plant in or near Chicago. The conference was under the auspices of the executive committee of the Chicago Association of Commerce.

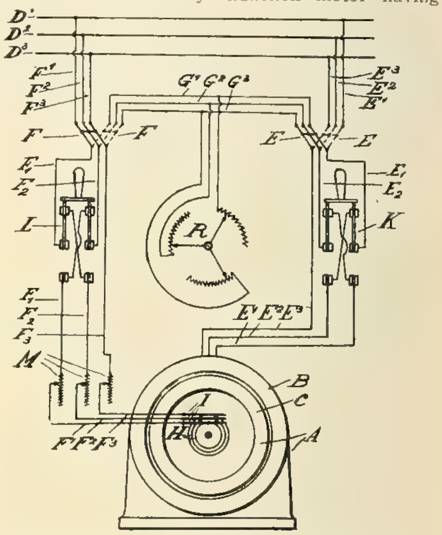
Dr. J. A. Holmes of the Department of the Interior at Washington spoke of the benefits to public safety and public saving of a central plant, and contended that it would bring to the city where located benefit that would prove general. President David R. Forgan of the association said that geographically and logically Chicago is the place for this plant, as it has the facilities. Robert W. Hunt of the Chicago Engineers' Club said that such a plant will test materials, so that no engineer or architect can find subterfuge for inferior workmanship and leave no excuse for accidents.

[illegible] of the industrial department of the association, told of securing a promise from the government commission to visit Chicago and inspect the several sites that have been offered for the proposed plant. He spoke of the educational and commercial advantage of the industry, contending the results would more than repay energies expended in securing its establishment in Chicago.

Lohr's Variable-speed Polyphase Motor.

A disadvantage that nearly all alternating-current motors possess is inability to run at variable speed. This is of course not true of the single-phase series motor, which has been developed in the last few years especially for railway work, but it is true of synchronous motors and to a less extent of induction motors. The speed of the latter has been varied by two means: (1) Arrangement of the stator windings so that the number of poles may be changed, say from eight-pole to four-pole, and (2) extension of the rotor windings through collector rings to externally adjustable resistances. The first method has the objection that the stator windings with their auxiliary switches become quite complicated if more than two speeds are arranged for. The second method has the disadvantage of poor efficiency at low speeds and that the speeds then varies considerably with the load.

To overcome these objections a novel form of polyphase motor has been invented by Carl Alfred Lohr of Schenectady, N. Y. This motor, which has been patented in the United States, is in construction not unlike any induction motor having



LOHR'S VARIABLE-SPEED POLYPHASE MOTOR.

its rotor connected through collector rings to an adjustable resistance. In operation, however, it is radically different from this type in many respects. In fact, the machine can run like a synchronous motor and also like an asynchronous, or induction, motor and, moreover, at a number of speeds.

The connections of the Lohr motor are shown by the accompanying diagram, in which (B) is the stator and (C) the rotor. The three-phase mains (D^1, D^2, D^3) are connected with the supply leads (E^1, E^2, E^3) and (F^1, F^2, F^3). The first of these when connected to the double-throw triple-pole switch (E) serve to energize the stator; the others when connected to the similar switch (F) serve to energize the rotor. The other terminals of these two switches are connected to the auxiliary conductors (G^1, G^2, G^3), to which is joined a regulating rheostat (R).

Interposed in the supply conductors (E^1, E^2) is a reversing switch (K), which serves to change the direction of rotation of the rotary field generated in the stator when the switch (E) is properly thrown. Interposed in the supply conductors (F^1, F^2) is a reversing switch (L), which serves to change the direction of the rotary field generated in the rotor when the switch (F) is properly thrown. To illustrate the application of this motor in a broader manner, there have been shown two reversing switches (K, L), which serve to produce the different motor speeds in both directions, but one of these may be left out without affecting the merits of the machine. These switches may also both be left out when certain methods of operation are not desired.

The arrangement of this motor differs from the usual construction of the motors hitherto in use in that both parts of the motor generate rotary fields when supplied from an alternating-current source. The speed of these rotary fields may be either the same or different. The speed may be different by the use of a different number of poles in stator and rotor, as here assumed, or by connecting the stator and rotor each with a source of electricity having a different periodicity. Also the direction of rotation of the rotary fields in

stator and rotor may be the same or different. Two other cases are possible also, either to generate a rotary field in the stator and connect the rotor with the variable resistances (R), as it is usually done, or connect the stator with the variable resistances (R) and connect the rotor with the current supply. The motor will have a tendency in this case to run with a speed of the rotary field generated in the rotor, and will in the first case run with the speed of the rotary field generated in the stator.

Having, for instance, a stator of 36 poles and a rotor of 12 poles, then, by connecting both members of the motor with a source of three-phase alternating current of a frequency of 60 cycles per second, the speed of the stator field will be 200 rotations per minute and that of the rotor field 600 revolutions per minute.

When only the stator is connected with the line by means of having switch (E) make connection with the conductors (E^1, E^2, E^3), and the switch (F) is thrown so as to make connection with the conductors (G^1, G^2, G^3), and thus with the variable resistances (R), the motor will run asynchronously with the speed of the stator field, that is, with 200 rotations per minute. When, however, only the rotor is connected with the line, that is, the switch (F) making connection with the conductors (F^1, F^2, F^3) and switch (E) thrown so as to make connection with the conductors (G^1, G^2, G^3), and thus with the resistances (R), as shown in the drawing by the full-drawn position of the switches (E, F), then the motor will run asynchronously with the speed of the rotor field, that is, with 600 rotations per minute. These two speeds of the motor are absolutely asynchronous, that is, by inserting resistance in the member not connected with the line, the speed may be varied or regulated to any desired speed below that of the rotary field.

When both stator and rotor are simultaneously connected with the line, that is, the switch (E) making connection with the conductors (E^1, E^2, E^3), and switch (F) making connection with the conductors (F^1, F^2, F^3), and when the rotary fields are generated in opposite directions, having properly thrown the reversing switches (K, L), then the motor will run synchronously with a speed equal to the sum of the rotary-field speeds, or 800 rotations per minute. When the rotary fields in stator and rotor are generated so as to rotate in the same direction, having properly thrown the reversing switches (K, L), then the motor will run synchronously with a speed equal to the difference of the rotary-field speeds, or 400 rotations per minute.

Hence, two principles are apparent: First, the generation of a magnetic rotary field in each of both members of a motor by simultaneously connecting both the stator and the rotor with a source of alternating current, the motor acting then as a synchronous motor; second, the alternating connection of but one member of the motor with a source of alternating current, and the generation of a rotary field in the first-named member, and the use of the other member of the motor as a part in which the currents necessary for producing a torque are induced. The motor acts then as an asynchronous motor.

In the example of a motor having a stator with 36 poles and a rotor with 12 poles and an alternating-current line of a periodicity of 60 cycles per second, the two speeds of 400 and 800 rotations per minute are synchronous, and can frequently not be attained in a satisfactory way by making the proper connections when the motor is at rest. In order to derive these synchronous speeds by electrical means the following operations have to be made: The synchronous speed of 400 rotations per minute can be readily produced by forming first a similar case where the motor runs asynchronously with 600 rotations per minute, namely, by connecting only the rotor with the alternating-current source. The synchronous speed of 800 rotations per minute, as well as the one of 400 rotations per minute, can be attained by connecting both members of the motor with the alternating-current line, having resistances inserted in the supply conductors of one of the members. These resistances can be short-circuited or switched out of circuit when the motor has attained the desired synchronous speed.

Furthermore, the two synchronous speeds of 800 and of 400 rotations per minute can be electrically derived by producing first one of the asynchronous speeds, viz., 600 or 200 rotations per minute, having only one member of the motor connected with the alternating-current source, and then connecting also the other member of the motor first over resistances with the alternating-current source and switching these resistances out of circuit when the motor has attained the desired synchronous speed. Such resistances (M) have been shown as being inserted in the supply connections (F^1, F^2, F^3) which connect the rotor with the line when the switch (F) is properly thrown, but these resistances can also be inserted in the supply connections (E^1, E^2, E^3) which supply the stator with alternating currents when switch (E) is properly thrown. The purpose of these resistances (M) is to facilitate the change from an asynchronous to a synchronous speed and to secure a starting of [illegible]

[illegible]

When the [illegible] the number of poles in the two members are different [illegible] one synchronous and one asynchronous speed in the ratio of two to one. In this case the synchronous speed may be obtained in the same way as explained for the higher synchronous speed of 800 rotations per minute in the cited example. Or this synchronous speed may be obtained by connecting simultaneously both members with the alternating-current line, having resistances inserted in the supply connections to one member of the motor.

In relation to the ratio of numbers of poles in the two members of the motor (when different numbers have to be used) it can be easily demonstrated that a ratio of one to three is feasible for both principles, viz., the generation of rotary fields in both members of the motor as well as the alternate connection of but one motor member with an alternating-current source.

The possibilities of this type of machine may therefore be summarized as follows: The motor can be run with at least four different speeds, two being asynchronous when running as an induction motor with either stator or rotor connected to the source and the other member short-circuited, the other two being synchronous speeds when both members are connected to the source so as to have the fields of the stator and rotor revolving in either the same or opposite directions.

Plans for Relieving the Union Loop.

The latest solution for relieving the steadily growing congestion of traffic on the Union Loop for the four elevated railroads of Chicago is meeting with favor on the part of city officials as well as those connected with the roads. An extended investigation of the problem recently carried on jointly by these officials showed conclusively that the chief causes of delay were the crossings at the three corners of the loop—Van Buren Street and Wabash Avenue, Van Buren Street and Fifth Avenue, and Lake Street and Fifth Avenue. At the first two of these the congestion is greatest, since the trains of the two roads using the inner track on entering and leaving the loop here interfere with the trains of the roads using the outer track.

The scheme now proposed is a modification of the one suggested by B. J. Arnold some time ago for elevating one track to cross over the present structure at two of these crossings. According to the new project this would be done at only one crossing, that at Lake Street and Fifth Avenue, the outer track and curve being raised at this point. The four roads would run their trains in the same direction as at present, but change to the other loop track so as to run right hand instead of left hand, as at present. Thus the South Side and Metropolitan trains would run on the outer track, take the upward incline at a point east of Clark Street in Lake Street, cross over the Northwestern and Oak Park trains at the Fifth Avenue corner and run down an incline in Fifth Avenue to the present level near Madison Street. The Northwestern and Oak Park trains, by using the inner track, would no longer interfere with the other roads at the Van Buren Street corners of the loop, though they would still interfere with each other at Lake Street and Fifth Avenue, as at present. This latter crossing is not so troublesome, however, since the traffic [illegible]

[illegible] increase the capacity still more. The sanction of [illegible]

Grade Raising in Galveston.

One feature of the gigantic task of raising the grade of the city of Galveston [illegible] little attention. It is [illegible] by the Galveston Electric Company, which operates the local street railway, in raising its tracks during the progress of the grade-raising work without suspending the regular operation of its cars. When the fact is considered that in some places the street level is raised to a height of more than 10 feet, it is noteworthy that the street-railway tracks have not been put out of commission. More than 15 miles of track is involved in the raising of the grade of the various streets.

The filling material is pumped into the city by great steam dredges direct from the sea. The sand is held in suspension and floods the particular area, embracing two or three blocks, where operations

GRADE-RAISING SCENE IN GALVESTON, TEXAS.

are being conducted at that particular time. This liquid filling material frequently floods the tracks of the street railway, but the water soon drains off, and the sand settles, bringing up the grade a few inches. Two or three laborers attend to the work of jacking up the track and permitting the liquid sand to flow under the ties, making a substantial roadbed until the dredge empties its next load through the discharge pipe, necessitating a repetition of the process of again raising the track while the filling flows in around it.

Where the filling is made the trolley poles have to be raised and other work done in order to make the overhead system conform to the new grade. At times the cars are run through a sea of water and sand, but the schedules are maintained with almost perfect regularity.

Practically the whole city is being treated to this grade-raising process. The work has been in progress for more than a year, and it will take another year or more to complete the big undertaking.

Electric and Steam Interstate Roads Alike Under the Law.

A dispatch from Washington, D. C., dated December 27th, says: "The Interstate Commerce Commission today decided that steam and electric interstate lines rank alike under the law, in dismissing the petition of the Chicago and Milwaukee Electric Railroad Company against the Illinois Central Railroad Company and others, involving the question of the establishment of through rates and joint rates on classes and commodities for movement in both directions. The commission further declared that the proviso in the amended law limiting the power of the commission to establish through rates and joint rates to cases where 'no reasonable or satisfactory route exists' was not intended to afford a means by which new lines, with the aid of the commission, may profitably force their way into shipping districts built up and already well served by other lines and thus seize and divide with the latter such traffic as may be offered for movement."

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[illegible]

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[illegible]

Electrical Salesmen's Association (annual meeting), Coli- [illegible]

International Independent Telephone Association (annual [illegible]

ELECTRIC FLATIRONS have been used in largely increased numbers during the last two or three years, and the fact has aroused the underwriters to point out the possible fire hazard in these extremely useful and convenient devices where the installation is not properly made.

In the National Electrical Code it is provided that an incandescent lamp of low candlepower be connected in multiple with irons or heaters so as to show at a glance whether current is on or off. Furthermore, each device must be protected by an approved cut-out and controlled by an approved indicating switch. Only approved separable or two-piece attachment plugs should be used, and all devices must be provided with an approved stand and be treated as sources of heat. Another point is that approved heating-apparatus flexible cord, made in accordance with Rule 45, Section G, of the Code, should be used.

Central-station men, electrical contractors and others having to do with the installation of electric-heating devices will do well to bear these rules in mind.

STREET-RAILWAY and electric interurban-railway companies are considering the recommendation of the Interstate Commerce Commission that electric roads establish depreciation funds similar to those which the steam railroads of the country were ordered to establish under the rules promulgated July 1, 1907, and into which a certain percentage of the earnings shall be placed each year to provide for the reconstruction and renewal of equipment of the lines. Managers of some newly constructed lines say that the physical properties of their companies are not depreciating to any appreciable extent at present and that it is an injustice to require them to set aside a considerable part of their earnings for a depreciation fund. Nevertheless the justice of allowing for depreciation is a widely accepted principle among managers of electrical plants, although opinions differ as to just how this should be done and as to the exact amount on different classes of apparatus. However, the Interstate Commission's recommendation must be merely a recommendation in the case of most electric-railway companies, for its jurisdiction can extend only to interstate business under the Federal Constitution, and few electric roads come under the interstate qualification. More important, perhaps, is the fact that the state commissions may follow the example of the national body.

THE UNITED STATES government is doing work of great importance and usefulness in testing fuels, timber, gas engines, steam boilers, structural materials and the like in the general effort to conserve the natural resources of the country. A recent example of the high character of this work was presented in the Western Electrician of December 14th last, page 465, when some valuable data on increasing the efficiency of steam boilers were given from the Bulletin entitled "A Study of Four Hundred Steaming Tests Made at the Fuel-testing Plant, St. Louis, Mo., in 1904, 1905 and 1906." This bulletin was issued by the United States Geological Survey. Dr. J. A. Holmes, of that department, addressing an audience of electrical men recently, said that the conservation movement meant the checking of waste and the use of the fuel and other natural resources of the country in the most efficient way. "We have," he said, "allowed our natural gas to burn continuously in the open air; we have been wasteful in the development of our petroleum supplies; we have been wasting nearly 50 per cent. in the mining of our coal; and of the coal which reaches our furnaces, as a rule, not more than five per cent of the heat is converted into the actual work of manufacturing. Of the 100,000,000 tons of coal used in the railroad locomotives each year not more than five per cent. of the heat developed is converted into the actual work of pulling trains. But these railroads must each year haul 3,000,000 cars of coal to keep these locomotives moving."

Already the technical branch of the Geological Survey has shown that the lignite coals occurring in 30,000,000 acres of land still belonging to the government can be [illegible] in the modern gas pro- [illegible] power equal to that [illegible] by good eastern steaming coals when used under the ordinary boilers. In many other ways the usefulness of this service has been demonstrated. An effort is now making to induce the government to locate its fuel and other testing plants of like character in Chicago, which, owing to its geographical location and ample facilities of all kinds, has exceptional advantages as such a location.

CHICAGO'S electrical show, to be begun next week, gives promise of being in every way a worthy successor of its two highly successful predecessors. A demonstration of wireless telephony is promised, and there will be a nine-room "electric house" completely furnished with all the modern household conveniences made possible by the utilization of electric light, heat and power. A scientific novelty announced is an electrical method of counteracting the injurious effects on vegetation from sulphurous and other detrimental gases from smelters. There is to be a model of the Brennan gyroscopic railroad car, and the ozone process of purifying water will be shown. A promised novelty is a typewriting machine on which a letter can be written to be reproduced electrically on a receiving machine at a distant point, the reproduction being a duplicate of the typewritten letter. This device, called the typograph, is said to be to machine writing what the telautograph is to handwriting. One of the educational features will be illustrated lectures and demonstrations of the work of the United States Reclamation Service.

Unusual attention has been paid to the artistic side of the exhibition as a spectacle, and the decorative lighting and other decorations have been planned with great care by architects and engineers of prominence. During the two weeks of the show there will be several meetings of technical or semi-technical societies, including the convention of the International Independent Telephone Association. The exhibits will be numerous and varied and of real value as an epitome of the art in many of its branches. The Independent telephone exhibits will be grouped together and will be an attraction to visitors at the telephone convention. The show will be of value and interest both to the technical man and the layman, and no doubt it will attract the large attendance which it deserves.

LOW FREEBOARDS and high freeboards for warships both have advocates among naval designers. But these divergent views relate mainly to the practicability and reliability of gun-fire during stress of weather and to the relative size of the ships as targets. The installation of electrical machinery in turret gear seems to introduce a new element in the discussion. In a recent widely quoted magazine article on alleged structural defects in American battleships and armored cruisers Mr. Reuterdahl dwells on the alleged difficulty of firing with accuracy many of the guns of a ship with a low freeboard in a heavy sea. He says: "The Virginia, with all her ports closed by steel bucklers, shipped 120 tons of water into her forward turret during a trip from Cuba to Hampton Roads a few months ago. With these ports open for action during bad weather, each wave would send through them tons of water. The electrical installations of the machinery which turns the turret, hoists the ammunition and elevates the guns would be short-circuited and burned out, and the turret and its guns would be rendered motionless. The water would pass down inside the turret to the handling room and from there directly to the magazines." There are probably several answers to this. One is that naval actions are seldom fought during bad weather. Another is that the electrical equipment is probably better protected against moisture and water than the critic seems to infer. Nevertheless the subject is deserving of careful attention. So much has been said about the alleged defective placing of armor belt, poor location of guns, possibility of short-circuiting of electrical apparatus, and the like, that Congress should order a careful and exhaustive investigation of the whole subject of warship design. We are confident that, whatever the outcome of such an inquiry, the standing of electric power on shipboard will not be injuriously affected, even if there should be some rearrangement in machinery and apparatus.

American Association for the Advancement of Science.

The report of the first day's session of the annual convention of the American Association for the Advancement of Science, which was held at the University of Chicago, December 30th to January 4th, was given in the Western Electrician of last week. On Tuesday the symposium on the teaching of mathematics to engineering students was continued in the joint meeting of Sections A, Mathematics, and D, Mechanical Science and Engineering.

Mr. Ralph Modjeski, consulting civil engineer, Chicago, gave a discourse on the methods of teaching mathematics in the technical schools of Europe as compared with those of America. The method which he favored was to drop all useless mathematics and take up the useful branches more thoroughly and to take up only those which time will permit to be thoroughly mastered.

Prof. Charles S. Slichter, professor of applied mathematics, University of Wisconsin, suggested that conclusions be drawn as to the amount of mathematics which an engineering student needs, not from what the engineers do but from what they do not do. He stated that the object of mathemathics is to make the student know more, to permit him to acquire more knowledge, and to enable him to extend his investigations. He held that "science is the best technology" and stated that in his experience with graduates from schools in both the East and West he found that the students remember the manual things and forget the intellectual parts, but that it is remarkable how quickly they can recover what they have lost. In concluding, he stated that statistics showed that the money expended per man per hour for instruction in mathematics is one-fourth to one-sixth that for instruction in technical studies.

Prof. G. S. Williams, professor of civil, hydraulic and sanitary engineering, University of Michigan, spoke from the standpoint of the professor of engineering. He contrasted the technical and the trade schools, stating that the former produce men who make engineers, while the trade schools produce men useful tomorrow. He said that engineers had not had mathematics enough to teach or to say how much should be taught. It was his opinion that mathematics should develop mathematical thinking power and that the engineering student should go as far as he is able to assimilate in mathematics.

Prof. F. S. Woods, professor of mathematics, Massachusetts Institute of Technology, spoke of the new method of treating mathematics at that institution. This method consists in the association of different branches of mathematics relative to their use in the solution of problems. He laid stress on a man's being able to interpret a problem, able to work it, and to understand the relation of the result with reference to the problem.

Prof. A. N. Talbot, professor of municipal and sanitary engineering, University of Illinois, divided the study of mathematics into theory, practice and philosophy, with stress on the theory and practice. He thought that attention should be given the average student and that the objects for which mathematics is taught should be kept constantly in mind.

Prof. G. F. Swain, professor of civil engineering, Massachusetts Institute of Technology, said that mathematics is valuable for the power which it gives a man to do things. He thought that it was wrong to teach mathematics as mental gymnastics, but to distinguish detail and develop the power of perception. He claimed that students should be taught to use and understand the use of mathematics and favored the method of questioning and probing as pertaining to the best results.

Prof. F. W. McNair, president, Michigan School of Mines, stated that the demand in his class of work is for men who can use simple mathematics and use that rightly.

Mr. J. A. L. Waddell, consulting bridge engineer, Kansas City, Mo., sent a paper in which he condemned the method of teaching mathematics by means of lectures, and emphasized the value of geometrical and graphical methods.

On Wednesday, before Section D, Prof. C. M. Woodward, professor of mathematics and applied mechanics, Washington University, read two papers: "Shearing Stresses in Beams," in which he showed that the maximum stress in beams of certain shapes does not lie in the neutral axis, and "The Problem of Power for Airships," in which he derived formulæ for the speed and horsepower of airships and discussed a paper by Mr. Wellman on the same subject and compared results therein with those of his own deduction.

Prof. H. T. Eddy, professor of mathematics and mechanics, University of Minnesota, delivered a paper on the "Pressure-temperature Diagram of the Properties of Superheated Steam." Professor Eddy explained the diagrams which he displayed showing the properties of steam superheated to different degrees and different pressures.

Mr. Frank C. Wagner, Rose Polytechnic Institute, showed a diagram and explained the workings of an instrument for investigating the direction of water in the tubes of a boiler. This piece of ap[illegible]

The meetings of Section B, Physics, were held jointly with the American Physical Society. Some 30 papers were presented, a large number of them dealing with electrical phenomena. Among these may be mentioned: "Discharge of Electricity from Pointed Conductors," by Prof. John Zeleny, University of Minnesota; "Notes on Spark Potentials," by Prof. R. F. Earhart, Ohio State University; "Stability of Cadmium Cells," by Prof. H. S. Carhart, University of Michigan; "Capacity of Paper Condensers and Telephone Cables," by Profs. Anthony Zeleny and A. P. Andrews, University of Minnesota; "The Use of Complex Quantities in Alternating Currents," by Prof. G. W. Patterson, University of Michigan. These papers and most of the others excited considerable interest. The topics considered were treated almost entirely from the point of view of pure science, and their immediate application to engineering problems was not strongly emphasized. Considering their bearing on such problems, however, a number of the papers were of much value.

A large number of topics were considered by Section C, Chemistry, and the American Chemical Society. Among the most interesting were addresses on "The Chemical Education of the Engineer," by Mr. W. H. Ellis, chairman of the section on industrial chemistry, and on "The Interrelations of the Elements," by Prof. Herbert N. McCoy, chairman of the section on physical chemistry. A paper by Dr. J. E. Siebel of Chicago, on "A New and Inexpensive Oxidizing Medium," created considerable comment.

Professor McCoy showed that ancient and medieval dreams of the transmutation of metals are now being realized on a modified and enlarged scale. Chemists are now compelled to admit that a number of supposedly fixed elements are so no longer. "Now we have abundant and varied evidence that between the elements there exist the most intimate relationships. The researches of the last few years of this new century have shown the fundamental significance of these relationships and lead us to the conclusion that the elements no longer may be considered immutable; that matter is probably of only a single sort, of which our commonest elements represent the more stable forms which have resulted from a process of natural evolution." In all over twenty distinct radio-active substances are now known. These have brought about a revolution in chemical theory and forced a new conception of the atom.

Dr. Siebel announced that he had made further discoveries proving that in the human body are numberless miniature electrical batteries comprising the muscular structure and supplying it with energy. He has verified his previous statements that nutritive elements such as alcohol, sugar, fats, etc., furnish the active power for these cells. Alkaline bicarbonates that exist in solution in the blood are said to be the transferrers of the oxygen from the oxyhemoglobin of the blood to the miniature cells. The electromotive force set up by these cells becomes the muscular force of the system. Dr. Siebel reproduced the make-up of the human batteries in regular wet-cell batteries and found that of all the different nutrient substances he used as positive elements, diluted alcohol gave the highest electromotive force. Next in line were the solutions of grape sugar, cane sugar, oleate of potash and peptones in the order mentioned. For negative elements he got the best results from aerated solutions of sodium and other alkaline bicarbonates. Cells of this type, he thought, might be used as commercial electrical batteries, as the denatured alcohol and sodium bicarbonate elements are cheap and yield a valuable by-product—ascetic acid.

Among other sections whose proceedings attracted most attention was Section I, Social and Economic Science, which conducted a symposium on the financial crisis of 1907. A number of speakers discussed the subject and found as many varying causes as speakers in general have found. A hopeful outlook was expressed, however. In connection with a number of affiliated bodies, this section discussed the subject of public health and again advocated the establishment of a national bureau for this purpose. A letter from President Roosevelt was read urging the appointment of representatives from the association to the national conference to discuss the conservation of national resources to be held in Washington on May 13th, 14th and 15th next. This movement was given hearty approval and the president and president-elect of the association were appointed to represent the body.

At the final session of the association the election of officers to act at the next annual meeting took place. Those so honored were: President, Dr. Thomas C. Chamberlin, professor of geology, University of Chicago; vice-presidents, Profs. K. E. Guthe, University of Iowa; L. Kahlenberg, Uni[illegible]

A very appropriate feature of the meeting just held [illegible] 300 visiting scientists and distinguished citizens of [illegible] read. Professor Michelson responded in a pleasant speech in which he referred to his recent experiences in London and [illegible]

Imagination and Common Sense in Science.

Imagination is required in original scientific research, says Prof. Theodore W. Richards of Harvard, the distinguished chemist, for he who lacks imagination will see only that which he is told to see. Continuing, in a recent article, Professor Richards says:

"Perhaps the most easily traceable record of this immediate effect of the scientific imagination is to be found in the life of Faraday, because he committed his wildest dreams to the pages of existing notebooks. Faraday's originality ranged at large over the whole field of chemistry and physics; to him nothing seemed too strange to be possible, no relation too unlikely to be unworthy of thought. But with this extraordinary disposition to dream things before undreamt, he possessed the steadying power of judgment which enabled him to dissociate his dreams from the reality. He always sought to test each hypothesis by actual experiment, and cheerfully recorded every overthrow when he was convinced of its finality. Experiment served to keep him scientifically sane, and day-dreams inspired his enthusiastic nature to undertake further experiment. Thus each helped the other, with a rare cumulative effect. Without imagination, Faraday could not have made most of his discoveries; but without profound common sense, he would have ended in a madhouse.

"The example of Faraday serves also to emphasize the indisputable fact that imagination alone is not a sufficient intellectual outfit for the scientific man. At least one other attribute is essential, namely, good judgment, or common sense, to select between the various possible interpretations of fact and theory presented by the imagination. So emphatically is this true that Huxley maintained science to be nothing more than systematized common sense.

"Imagination, then, and good judgment, are necessary, if science is to grow."

Central Electric Railway Meeting.

The second annual meeting and banquet of the Central Electric Railway Association will be held at the Algonquin Hotel, Dayton, Ohio, on Thursday, January 23d. The business meeting will take place at the morning session, convening at 10:30, and the election of officers will take place at the afternoon session. The following papers are on the programme: "Promotion of Traffic," by Charles F. Price, Western Ohio Railway Company, Lima, Ohio; "Telegraph Signal System," by Chauncey P. Button, Rochester, N. Y.; "Can Electric Interurban Railroads Profitably Carry Passengers at the Present Rate of Fare?" by F. W. Coen, Lake Shore Electric Railway Company, Norwalk, Ohio. The report of the standardization committee on "Fundamental Brake Rigging," will be made by R. C. Taylor, chairman, and the report of committee on "Traffic Organization," by F. D. Norveil of Anderson, chairman.

A cordial invitation is extended to all officers of the interurban railway companies to bring their private cars to Dayton for this occasion. Arrangements have been made to take care of all private equipment. Persons intending to bring their private cars should correspond with T. J. Ferneding, superintendent Dayton and Xenia Transit Company, who will take charge of all such equipment while in Dayton.

The after-dinner programme will be made a special feature of the entertainment. Many gentlemen of prominence in railway, municipal and state affairs have been invited. Mr. E. C. Spring, first president of the association, will be toastmaster at the dinner, which will be served at 6:30 p. m.

At La Grange, Ill. (a suburb of Chicago), the ordinance regulating electrical wiring is being overhauled with a view of making it stronger and establishing up-to-date methods of procedure. Applications and permits will be required before contractors are allowed to go to work. The office of inspector will probably be placed on a salary basis, the fees going into the village treasury.

WHAT TO SEE AT THE ELECTRICAL SHOW.

Beginning on Monday, January 13th, and lasting two weeks, the third annual Chicago Electrical Show will be held at the Coliseum. The management confidently predicts that it will be the largest and most elaborate exhibition of its kind ever held. About 20 per cent. more space has been sold this year than for the very successful show of 1907, and there will be many new and interesting features. Particular pains have been taken to make the interior of the Coliseum during the show more beautiful than ever as an artistic spectacle, and the exhibition itself will be of much interest and value to the popular mind as well as to the student, engineer and electrical man of affairs.

This year the Electrical Trades Exposition Company has arranged for a systematic system of decoration, illumination and booth construction. The plans were prepared at large expense by one of the leading architects of the country, and the scheme will undoubtedly be most effective.

The doors will be opened to the public at 10 a. m. each day. Aside from the large variety of exhibits representing the electrical industry, the management has provided for numerous special features, and there will be a number of meetings of electrical organizations.

On the opening night souvenir post-cards showing the interior of the Coliseum during the show will be given away. Music will be furnished throughout the show by John C. Weber's prize band of Cincinnati, assisted by Miss Blanche Mehaffey, soprano soloist.

Some of the Special Features.

One of the features of unusual interest will be a nine-room house completely furnished and equipped with all the electrical devices that can be used in the modern home. This exhibit will be made by the Commonwealth Edison Company. There will be several other exhibits showing the use of electrical household devices. In the industrial line the many lines of motor applications will be demonstrated, including novel applications in addition to standard electrical devices, machinery and apparatus in every line in which electricity is utilized. All the latest developments in electrical illuminants will be shown.

The Radio Telephone Company will exhibit a complete working installation of the wireless telephone similar to the equipment recently installed in the fleet of battleships which is now on its long cruise from Hampton Roads on the Atlantic around the Horn to the Golden Gate on the Pacific. The De Forest wireless-telegraph system will also be exhibited.

Mr. L. I. Kahn will exhibit an electrical sign writer, which is a machine similar to a typewriter, on which may be written any words or figures, and by throwing a single switch these are immediately produced in letters of light in large sign boxes or universal letters. During the show 60 of these boxes will be in use, and announcements will be made from time to time by means of this sign.

The Ozone Company of America will exhibit its process of purifying water by means of ozone. This system is adapted for purifying water in either large or small quantities.

The Thordarson Electric Manufacturing Company will exhibit a number of electrical scientific devices. Among other things there will be an electrical method of counteracting the injurious effects on vegetation of sulphurous and other injurious gases from smelters. The company will also install in the building a device for purifying the air by the introduction of quantities of ozone, which not only increases the amount of healthful elements in the air but eliminates a large portion of the dust and impurities. Demonstration of high-voltage, high-frequency current will be made on the outside of the building over the main entrance.

A model of the Brennan gyroscope car will be shown and demonstrated by Prof. W. J. Clarke in [illegible] "Wonderful Thing Electrical."

A new [illegible] which has just been completed [illegible] will be [illegible] point, the reproduction being in duplicate of the [illegible]

government has been doing extensive work in the arid and semi-arid states of the West, and in this work electrical appliances are used extensively. Mr. E. T. Perkins, engineer in charge, will give a number of illustrated lectures on the subject of reclamation.

Conventions and "Special Days."

Among the special days at the show are the following:

Tuesday, January 14th—Ladies' Souvenir Day—A beautiful hat-pin will be given to each lady visiting the show on this day.

Wednesday, January 15th—Students' Day—Special demonstration of scientific apparatus and new developments in electrical devices.

Thursday, January 16th—Society Day.

Friday, January 17th—Joint meeting of the Chicago branch of the Illuminating Engineering Society and the Northwestern Electrical Association.

Saturday, January 18th—Annual meeting of the Electrical Salesmen's Association.

Monday, January 20th—Rejuvenation of the Sons of Jove.

Tuesday, Wednesday and Thursday, January 21st, 22d and 23d—Annual convention of the International Independent Telephone Association in the Coliseum Annex hall. Miniature telephones will be distributed as souvenirs on Tuesday, January 21st.

The annual convention of the International Independent Telephone Association has increased the interest of telephone manufacturers in this show, and as a result the telephone exhibits will be perhaps the most comprehensive and interesting ever shown. The Independent telephone exhibit will be in the Annex.

What Exhibitors Announce.

Following are brief descriptions of some of the exhibits which have been secured in advance:

American Automatic Telephone Company, Rochester, N. Y.—A full sized automatic exchange will be exhibited, and there will be shown also a complete line of telephones of the company's make, as well as harmonic bells, and a section of an automatic switchboard frame of 5,000 lines with the banks and multiples.

American Clock Company, Chicago.—This company expects to exhibit its electric time systems, time stamps, time recorders and self-winding electric clocks. Its secondary clocks, time stamps and time recorders are all operated from the same master clock, and the combination can be used in office buildings and factories. The following persons will be in attendance at the exhibition: H. O. Jackson, president, and G. F. Randall, secretary, of the company, together with other representatives.

American Conduit Company, Chicago.—It is the intention to exhibit full-length samples of the various sizes of bituminized fiber conduit, as used for underground electrical construction. In addition to this, the proper methods of installing this product will be demonstrated. Engineering bulletins which contain data and other information of interest to users and prospective users of conduit will be on file. In addition to underground conduits, other adaptations of bituminized fiber conduit for use in the electrical arts will be exhibited.

American Electric Fuse Company, Muskegon, Mich.—In charge of George W. Rodormer, this company will exhibit its well-known general line, making a specialty of the following new apparatus: Small iron-frame distribution rack adaptable to small telephone-exchange work and toll stations; improved junction box; Merico soldering paste; Merico cable compound; type L building terminal box; American gas soldering iron; black enameled wire; No. 997 subscribers' station protectors; type A can-top terminal. These articles embody many new and serviceable features to interest visitors. Messrs. Frank J. Jones and J. A. Kearny will be present.

Albert and J. M. Anderson Manufacturing Company, Boston.—This company will be represented by a small exhibit of switches and line material, including electric-railway, light and power specialties.

Atlas Anchor Company, Cleveland.—A full set of anchors will be on exhibition, also tools, including a setter and auger. Mr. I. Unger will be in charge.

Automatic Electric Company, Chicago.—This exhibit will consist of a "cross-section" of an automatic telephone system, the exhibit comprising a working section of two interconnecting common-battery automatic exchanges of the 100,000 system. The exchanges are designated "B" and "K," respectively. The "B" exchange section consists of [illegible] trunking switches. The "K" exchange section consists of [illegible] party lines, or 400 telephones and trunking switches, as in exchange "B." Twelve telephones will be connected to the exhibit and calls can be made through the boards precisely the same as in the largest working exchange. A toll board, wire chief's desk and private-branch exchange will be connected to exchange "B" and operated in conjunction with it. The harmonic converter in exchange "K" supplies the four-frequency currents for ringing the party-line telephones. One of the frequencies is also used for straight line ringing. In addition to ringing, the harmonic converter also furnishes the busy signal. In the party-line board, four telephones are connected to one line and two to another. The two-position wire chief's desk to be exhibited is designed to be used in a 5,000-line exchange now being built.

Bristol Company, Waterbury, Conn.—H. P. Dennis, M. E., exhibitor for the company, has arranged to show a complete line of Bristol recording instruments for the steam, electric generating and transmission ends of electric-light and power systems. In the steam end will be shown recording thermometers for feed water, flue gases, superheated steam, and recording pressure gauges for steam pressure and vacuum, as well as stack draft. For the generating side of the power house there will be the Bristol recording voltmeter, ammeter and wattmeter for direct and alternating-current, single and polyphase. One of the new shunt ammeters recently produced will be on exhibition. For the transmission system a complete line of portable voltmeters, ammeters and wattmeters will be shown.

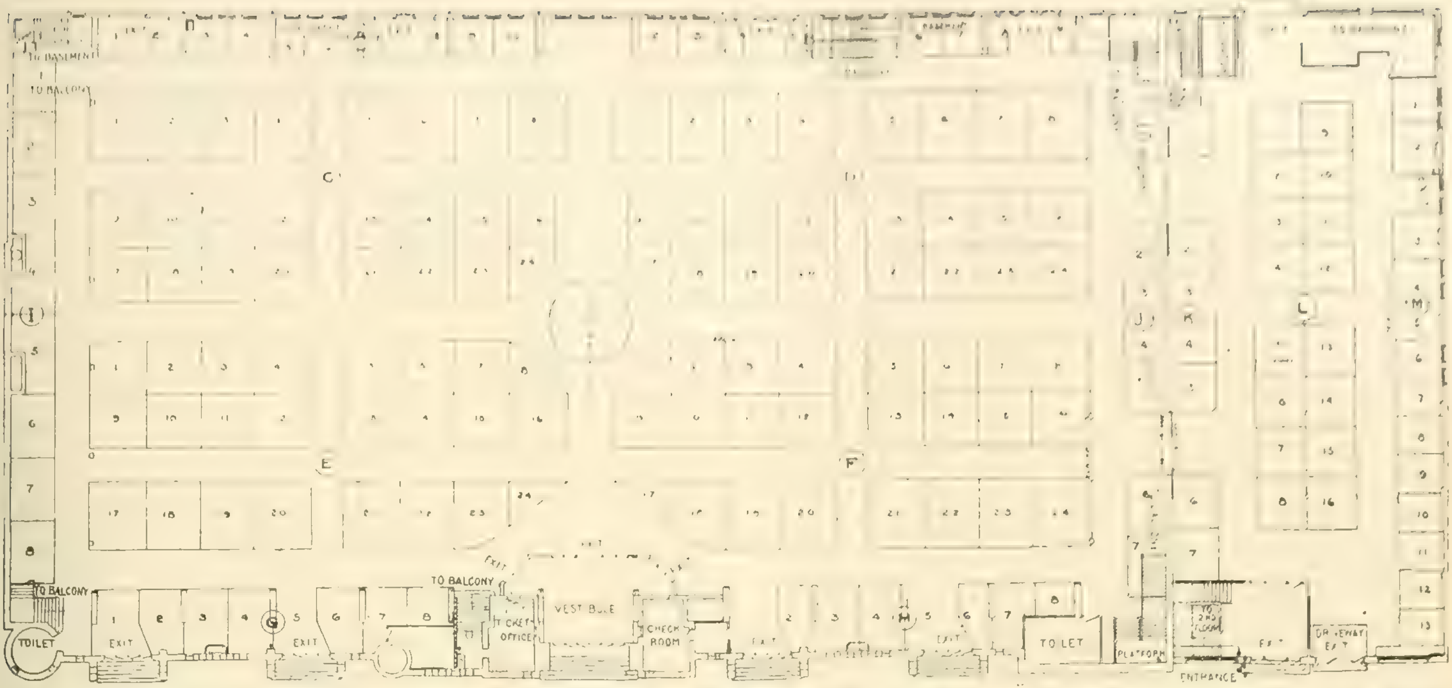
Chicago Fuse Wire and Manufacturing Company, Chicago.—There will be five large display boards, one covering Union enclosed fuses, one on Union enclosed fuse blocks, one on Union switch boxes, one on Union outlet conduit boxes and covers and one on fuse wire and fuse links. The exhibit will be in charge of A. S. Merrill of the sales department and Clarence T. McDonald, engineer.

Commonwealth Edison Company, Chicago.—The chief feature of this interesting exhibit will consist of the various apartments of a modern home. The different rooms will be furnished with electrical household appliances as follows: Vestibule and Reception Hall—Foot warmer, French silk-hat iron; Living Room—Electric grate, electric piano, electroliers, electric fan, picture lights, cigar lighter, piano lamp and portables; Dining Room—Coffee percolator, teakettle, chafing dish, tray, electric chime; Butler's Pantry—One-half griddle, hot-water urn, plate warmer, oval food warmer, electric toaster, refrigerating machine; Kitchen—Waffle iron, frying pans, electric range, carpet sweeper, plate warmer, coffee grinder, polishing machines, dish-washing machine, floor polisher, meat grinder, ice-cream freezer, ventilating fan; Laundry—Clothes-washing machine, irons of different sizes, water heater, vacuum cleaner, mangle (electrically heated), ironing machine, copper boiler, suspension arm; Bed Room—Heating pad, curling-iron heater, baby milk warmer, electric radiator, massage outfit, foot warmer, electric clock; Bath Room—Instantaneous water heater, luminous radiator, hair dryer, shaving mug, curling iron; Sewing Room and Nursery—sewing machine, nursery bottle, hot-water heater, luminous radiator, electrical toys, sewing-room iron.

Crane Company, Chicago.—An interesting feature of the exhibit will be the display of a new line of valves and fittings for superheated steam, made of cast-steel. The valves have pure nickel seats and nickel-steel stems. Automatic and emergency valves of several different types will be shown, as well as steam traps, steam and oil separators, expansion joints, a new bracket for large piping, and many other power-plant accessories. The purely electrical feature of the exhibit will be a gate valve operated by a motor attached directly to the stem. The motor is stopped automatically when the opening or closing movement is completed, the switch requiring no attention after it is thrown into the open or closed position. The motor seats the valve tightly, making it unnecessary to use the hand wheel. The exhibit will be in charge of J. A. Minwegan.

Arthur O. Einstein, Chicago.—The following lines, being goods manufactured by the several factories represented by Mr. Einstein, will be exhibited: Pratt galvanized conduit outlet boxes and covers, manufactured by the Pratt Chuck Company of Frankfort, N. Y.; knife switches, from the Trio Manufacturing Company of Rock Island, Ill., punched clip knife switches up to and including 300 amperes; flexible conduit connectors and couplings, from William A. Bonnell of New York city (galvanized couplings and connectors for steel-armored flexible conductors); rubber gum and friction tapes, from the Clifton Manufacturing Company, Boston, Mass.

Electric Storage Battery Company, Philadelphia.—This company will exhibit a large line of storage-battery material, the principal items being a G-51 Chloride accumulator element in a tank of that size, having a capacity of 4,000 ampere-hours, the type of plate used for railway lighting and telephone work; an E 21 Chloride accumulator el-



F. Alexander Manufacturing Company, New York.—Arc lamps. B 4, 5.
American Automatic Telephone Company, Rochester, N. Y.—Telephones, etc. K 1.
American Clock Company, Chicago.—Electrical self-winding clocks, time systems, stamps and time recorders. H 4.
American Conduit Company, New York.—Underground conduits. East half of F 20.
American Electric Fuse Company, Muskegon, Mich.—Telephone specialties. M 2.
American Electric Novelty and Manufacturing Company, Chicago.—Dry batteries and electrical novelties. E 7.
American Steel and Wire Company, Chicago.—Bare and covered wire for electrical purposes. D 17, 18.
American Telephone Journal, New York. M 10.
Albert & J. M. Anderson Manufacturing Company, Boston.—Switches and line material. A 2.
Appleton Electric Company, Chicago.—Telephone supplies and wirelets. A 7.
Atlas Anchor Company, Cleveland.—Anchors and tools. West half of F 20.
M. B. Austin & Co., Chicago.—Bare and insulated wire, conduits and electrical supplies. F 4.
Auto Igniter Company, New York.—Igniters and small electrical novelties, lamps, etc. G 7.
Automatic Electric Company, Chicago.—Automatic telephone systems. L 13, 14.
B. S. Barnard & Co., New York.—Telephone, telegraph and electric-light conduits. West half of C 8.
Benjamin Electric Manufacturing Company, Chicago.—Lighting specialties, wireless clusters. H 3.
Big "4" Manufacturing Company, Chicago.—Automatic electric advertising signs. B 10.
C. F. Birtman, Chicago.—Electrotherapeutic apparatus. E 13, 14.
Bristol Company, New York.—Recording instruments, etc. A 5.
H. B. Camp Company, New York.—Conduits. F 12.
Central Telephone and Electric Company, St. Louis.—Telephones and telephone apparatus. M 5.
Central Electric Company, Chicago.—General electrical supplies. D 9.
Century Telephone Construction Company, Buffalo, N. Y.—Telephones. K 4, 5.
Chicago Lamp and Reflector Company, Chicago.—Art glass and fixtures. B 8, 9.
Chicago Telephone Supply Company, Elkhart, Ind.—Telephones. M 4.
Chicago Fuse Wire and Manufacturing Company, Chicago.—Enclosed fuses and blocks, switches, outlet boxes, etc. West half of D 4.
Chicago Telephone Company. — Telephone service. D 19, 20.
Chicago Pneumatic Tool Company, Chicago.—Portable electric tools. E 5, 6.
Commonwealth Edison Company, Chicago.—Central-station light and power service. I 1 to 8.
Frank B. Cook, Chicago.—Telephone protectors and accessories. M 6, 7, 8.
S. H. Couch Company, Boston.—Interior telephones. East half of J 6.
Crane Company, Chicago. — Electrically controlled steam valves and fittings. C 4.
John F. Cullerton, Chicago.—Electrical advertising machine. J 1.
Crescent Manufacturing Company, Valparaiso, Ind.—Lamp guards, solder, etc. A 10.
Colonial Art Glass Company, Chicago. — Portables, domes, fixtures, art glass. G 3, 4.
Dean Electric Company, Elyria, Ohio.—Telephones. L 11, 12.
Joseph Dixon Crucible Company, Jersey City, N. J.—Motor brushes, graphite lubricants, crucibles, graphite productions. A 4.
Dossert & Company, New York.—Copper-clad wire, joints, connectors, terminals, etc. C 21.
Duplex Metals Company, New York.—Copper-clad wire, sheets, etc. East half of C 5.
A. O. Einstein, Chicago.—Manufacturers' agent. West half of E 12.
Electric Appliance Company, Chicago. General electrical supplies. E 8, 16.
Electrician Publishing Company, Chicago.—Electrical publications. E 20.
Electrical Review, New York.—Electrical publication. East half of F 22.
Electric Storage Battery Company, Philadelphia.—Storage batteries for all purposes. F 5.
Electrical World, New York.—Electrical publication. East half of F 23.
Electrocraft Publishing Company, Detroit, Mich.—Electrical publication. H 8.
Electrical Record, Chicago.—Electrical publication. West half of F 22.
Electric City Publishing Company, Chicago.—Electrical publication. C 2, 3.
Erwin & Company, Chicago.—Electric pumping machinery. D 3.
Excelsior Manufacturing Company, Chicago. C 8.
Federal Electric Company, Chicago.—Electric signs, fixtures, sockets and specialties. J 3, 4.
Fort Wayne Electric Works, Fort Wayne, Ind.—Fans, motors, generators, etc. C 13.
General Compressed Air and Vacuum Machinery Company, St. Louis.—Mechanical cleaning apparatus. F 17, 18, 19.
General Electric Company, Schenectady, N. Y.—General electrical supplies, machinery and apparatus. F 1, 2, 9, 10, 11.
A. Grothwell, New York.—Insulating paints. East half of D 4.
Dr. G. W. Haverstick, St. Louis.—Ocean breeze fans. B half of 5.
International Correspondence Schools, Scranton, Pa.—Students' work, text books, etc. H 7.
International Telephone Manufacturing Company, Chicago.—Telephones, transmitophones, telephone apparatus, switchboard equipment, electric automobile whistles, etc. M 11.
Illinois Electric Renovator Scales Company, Chicago.—Electric vacuum cleaning process. E 4.
Jewell Electrical Instrument Company, Chicago.—Electrical instruments. G 8.
H. W. Johns-Manville Company, Chicago.—Asbestos and magnesia products, electrical supplies, etc. E 15.
Kellogg Switchboard and Supply Company, Chicago.—Telephones, switchboards and supplies. F 14, 15.
Mathias Klein & Sons, Chicago.—Electrical tools. East half of D 1.
J. Lang Electric Company, Chicago.—Switches, regulators, etc. A 6.
Lindstrom-Smith Company, Chicago.—Vibrators, vibrator chairs, signs and specialties. East half of F 23.
Manhattan Electrical Supply Company, Chicago.—Batteries and electrical specialties. East half of F 13.
Manufacturers' Record, Baltimore. — Industrial and financial publication. West half of F 13.
W. N. Matthews & Bro., St. Louis.—Specialties. F 6.
Moline Incandescent Lamp Company, Moline, Ill.—Incandescent lamps. B 3.
Monarch Electric and Wire Company, Chicago.—Bare and insulated wire and general supplies. C 23, 24.
Monarch Telephone Manufacturing Company, Chicago.—Telephones switchboards, etc. L 1, 2.
McDowell, Stocker & Company, Chicago.—Motor-driven machinery. E 18.
McRoy Clay Works, Chicago.—Underground conduit. East half of F 21.
Moon Vibrator Company, Chicago.—Vibrators. West half of D 1.
National Electric Lamp Association, Cleveland.—Incandescent lamps. E 21, 22, 23, 24.
North Electric Company, Cleveland.—Telephones. K 6, 7.
Nungesser Electric Battery Company, Chicago.—Dry batteries. B 7.
North Shore Electric Company, Chicago.—Central-station light and power. E 2, 10.
Oshkosh Electric Manufacturing Company, Oshkosh, Wis. D 2.
Ozone Company of America, Chicago.—Ozone water purification system. A 3.
F. W. Pardee, Chicago.—Electrical manufacturers' agent. J 5.
Radio Telephone Company, New York.—Wireless apparatus. E 19.
John A. Roebling's Sons Company, Trenton, N. J.—Bare and insulated wires and cables. C 16.
Roth Bros. & Company, Chicago.—Motors, generators, grinders, etc. F 7.
Robbins & Myers Company, Springfield, Ohio.—Fans, small dynamos and motors. C 12.
Simplex Electric Heating Company, Cambridge, Mass.—Cooking utensils, irons, insulated wire, etc. C 19, 20.
Shelton Electric Company, Chicago.—Vibrators. C 14.
Solar Electric Company, Chicago.—Signs and specialties. B 6.
Spalding-Bates Company, Chicago.—Incandescent lamp removers. A 3.
Sterling Electric Company, La Fayette, Ind.—Telephones. K 2, 3.
Stolz Electrophone Company, Chicago.—Electrophones. A 8.
Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.—Telephones and apparatus, switchboards and switchboard equipment, cables, cord, etc. L 7, 8.
Studebaker Bros. Manufacturing Company, Chicago.—Electric automobiles, etc. C 10.
Swedish-American Telephone Company, Chicago.—Telephones. L 9, 10.
Swedish Electric Vibrator Company, Chicago.—Electric massage vibrators. D 12.
Telephony Publishing Company, Chicago.—Telephone publication. M 9.
Thordarson Electric Manufacturing Company, Chicago.—Electrical scientific devices, high-frequency apparatus, etc. D 11.
United Clock Company, Chicago.—Electric clocks. J 2.
Universal Manufacturing Company, Chicago.—Flat-rate controllers for central stations. C 22.
United States Conduit and Construction Company, St. Louis.—Interlocking concrete conduits. West half of C 5.
United States Reclamation Service. F 3.
Vivax Storage Battery Company, Chicago.—Storage batteries for automobiles, etc. West half of F 21.
Vote-Berger Company, La Crosse, Wis.—Telephones and switchboards, guys, anchors and two-ball adjusters. L 3, 4.
Wagner Electric Manufacturing Company, St. Louis.—Electrical instruments, transformers and motors. D 10.
Western Electric Company, Chicago.—Motors, generators, fans, telephones and general electrical supplies. D 5, 6, 7, 13, 14, 15, 21, 22, 23.
Western Electrician, Chicago.—Electrical publication. E 20.

DIAGRAM OF EXHIBIT SPACES AT CHICAGO ELECTRICAL SHOW.

ment in tank and an F-15 Chloride accumulator element in glass jar. These F types are used for small lighting and telephone plants. For railway work there will be a two-compartment 11-ECS car-lighting tank, a 13 EP element and a smaller battery of the Exide type for signal service, also the special 10-volt battery made up for the Missouri Pacific, of a portable type, and the 7 S jar used as a special by the Harriman Lines. For electric-vehicle work there will be exhibited Exide batteries, both for propulsion and sparking. The exhibit will be in charge of Godfrey H. Atkin, manager of the Chicago office, assisted by J. M. S. Waring, district engineer, and Messrs. Bauer, Marshall and Rath.

Fort Wayne Electric Works, Fort Wayne, Ind.—Included in the exhibit will be the company's line of type K wattmeters, forms SAA and SAB for single-phase circuits, form MAB for multiphase circuits; its prepayment wattmeter and its new type KM-1 calibrator for alternating current. The company will also exhibit its standard type A transformers, its various types of arc lamps, both alternating and direct-current, series-multiple and power-circuit types. A complete line of fan motors, desk type, universal bracket, revolving type, dragon bracket type and telephone-booth fan motors will be shown. It is intended to have a complete line of direct-current and alternating-current power motors on exhibition, and these will be in a greater part connected to power circuits, so that they can be operated. In alternating current both single-phase and multiphase motors will be shown.

General Compressed Air and Vacuum Machinery Company, St. Louis.—Seven different outfits for cleaning by means of the compressed air and the vacuum system will be shown. The first outfit will be the portable wagon with papier-mache horse exhibited at Jamestown, representing the class C outfit used in house-to-house cleaning. A two-wheel portable compressed air and vacuum outfit for steam and electric-railway car cleaning will be shown. There will be two other portable outfits and three stationary outfits. The exhibits, shown in practical operation, will be in charge of Thomas

F. Clohesey, sales manager, assisted by A. S. Foote, district manager of Chicago, and several other gentlemen.

General Electric Company, Schenectady, N. Y.—This exhibit will be devoted principally to cooking and heating devices, among which will be shown luminous radiators, coffee percolators, chafing dishes, water heaters, complete cooking and baking outfits and flat irons. All of these articles will be shown in actual use and visitors will be served with electrically cooked delicacies in an elaborately furnished dining-room. An interesting feature of the exhibit will be the color booth, in which color values will be compared under various artificial lights, including the enclosed arc, incandescent, Nernst and Welsbach. This will be the first actual comparison of this nature that has been shown at a Chicago show and should prove of interest to managers of clothing and drygoods stores. Of further interest will be mutoscope pictures of the Schenectady (N. Y.) factory.

International Telephone Manufacturing Company, Chicago.—In addition to its regular telephone exchange apparatus this company will exhibit its International transmitophone, telephograph, new auricurophone and loud-speaking telephone equipment for various purposes, which will be of interest to the general public as well as to those who are directly interested in the telephone business. There will also be exhibited a full line of central-energy exchange telephones, generator call local-battery toll line and rural-line instruments for neighborhood selective systems and ring-through party-line service, central-energy lamp-signal multiple and trunking switchboards, self-restoring magneto drop boards, magneto lamp-signal convertible switchboards and private plant intercommunicating equipment.

H. W. Johns-Manville Company, New York.—The Victor combination meters which made their first appearance at last year's show will be exhibited in a complete line of both stationary and portable types. The added attraction this year is Linolite, a new system of lighting. The company's booth is lighted by means of Linolite, which tends to show off the features of the system to advantage. Linolite, which means "line-o-light," has been developed especially for window, stage and showcase lighting as well as the illumination of desks, pictures and room interiors. Linolite is a new departure from the ordinary bulb lamp. Another item of interest in this exhibit is asbestos wood, a fibrous substitute for wood, marble, slate and fiber for fireproof construction and as an electrical insulation. A complete line of Noark fuses and fuse devices will also be shown as well as many other specialties. The company will be represented by H. M. Frantz, manager electrical department of the Chicago office; F. C. Frumveller and A. M. Chamberlin of the Chicago office; A. M. Erskine, manager electrical department, St. Louis office; M. H. Crosswell, manager electrical department, Milwaukee office; G. A. Saylor, Milwaukee office, and W. F. Little, electrical engineer, New York office.

Kellogg Switchboard and Supply Company, Chicago.—The exhibit will contain the various apparatus relating to all branches of telephony, as also an oscillograph for showing the various wave forms of pole changers, magneto generators, voice currents, etc. The pole-changer operation will be shown by the oscillograph under the exact operating conditions of four-party selective and eight-party selective signaling. The wave forms of voice currents will show the essentials of transmitted design. The varied effects of capacity and inductance on telephone lines will be brought out in the waves of magneto generators. The exhibit proper contains both common and local-battery switchboards, telephone and pole changers; telephones for railway use, both wall-type and desk-type telephones; display boards showing the high quality of workmanship on small parts such as relays, receivers, jacks, drops, etc.; samples of all kinds of switchboard cords, receiver cords, desk-stand cords, etc., samples of magnet wire of all grades—in short all apparatus relating to the telephone industry.

Mathias Klein & Sons, Chicago.—This firm will show in its exhibit a full line of lineman's, wireman's and construction tools.

Lindstrom, Smith Company, Chicago.—This company will show electric massage vibrators and electric specialties. The company intends to demon- [illegible] chair or rocker can be made a "vibrating chair" with a newly patented device [illegible] the Swedish movement can be obtained by this means.

McDowell, Stocker & Co., Chicago.—An exhibit of individual motor-driven machines will be [illegible] two styles of motor-driven engine lathes, a motor-driven riveting machine and a motor-driven punch press. On this punch press aluminum metal souvenirs of [illegible]

W. N. Matthews & Brother, [illegible] Working demonstrations will be presented to show the use of Kearney cable clamps, Stombaugh guy anchors, Hargis cable-splicing joints, Callahan cable [illegible]

specialties. The exhibit will be in charge of Claude L. Matthews, assisted by Victor L. Crawford and Orville R. Johann.

Moline Incandescent Lamp Company, Moline, Ill.—The company will exhibit a full line of its lamps, including the new Moline Jewel, Meridian type, the Moline Jewel metallic filament and a line of regular Meridian types, as well as Imperial, candelabra and special lamps. The exhibit will be in charge of F. T. Wright, manager of the Chicago branch. Theodore Mueller, R. H. Mills and C. R. Wood of the home office will also be in attendance.

Monarch Electric and Wire Company, Chicago.—An exhibit will be made consisting of goods for which this company is the manufacturer or manufacturer's agent, as follows: Monarch special brand weatherproof wires and cables, Monarch galvanized strand, National India Rubber Company's rubber-covered wires and cables, Siemens and Nurnberg flaming arc lamps, Radiant arc lamps, Marquette arc lamps, Bryan-Marsh incandescent lamps; Faries Manufacturing Company, H. T. Paiste Company.

National Electric Lamp Association, Cleveland.—It is expected to have an exhibition of high-efficiency lamps and to devote the entire time and energy of the representatives to the demonstration of the quality of light produced by these lamps. Many novel features will be shown, none of which have ever been shown before.

North Shore Electric Company, Chicago.—Electrical appliances which may be used in the household will be shown in this booth, consisting of a complete cooking outfit and the various appliances which may be attached to a lamp socket. There will also be exhibited a complete washing outfit for residence use, an electrically driven pump for residence use, electric dishwasher and an electrical vacuum-cleaning system. A portion of the booth will be fitted up as a reception room, in which will be shown very elaborate art glass lamps, together with an electrically operated piano, which will be operated at all times during the show.

F. W. Pardee, Chicago.—Mr. Pardee will exhibit the line of goods manufactured by the various firms he represents. Rock Island dry cells will be shown in all sizes and there will be exhibited a full line of wire made by the Wire and Telephone Company of America. There will be an exhibit of receiver shells, mouthpieces, switch handles, knobs and various special molded pieces made by the Electrose Manufacturing Company of Brooklyn, N. Y., also a complete line of electrical porcelains, including knobs, cleats, cartridge fuse blocks, tie buttons, fuseless rosettes, attachment plugs and weatherproof sockets manufactured by the Peru Electric Manufacturing Company of Peru, Ind., and a line of inner arc globes manufactured by the Lippincott Glass Company of Alexandria, Ind.

Phoenix Glass Company, New York.—This company will exhibit its lines of glassware for electric light, consisting of a variety of designs of rich cut, etched and decorated glassware, suitable for lighting fixtures. Inner globes for enclosed arc systems will also be shown. A fine display will be made of decorated devices for electric portables. The exhibit is in charge of the Chicago office representatives, Messrs. E. H. Fox and C. C. Fricke, who extend a cordial invitation to visit the booth.

Simplex Electric Heating Company, Cambridge, Mass.—A display will be made of representative goods of this company's manufacture covering the complete line. Many of the articles shown will be new and up-to-date, not having been exhibited previously, representing improvements in electric heating, not only in the shape and style of the articles but in the application of electric heating to domestic, factory and office uses. About fifty styles, shapes and sizes of laundry and tailor's irons will be shown; electric chafing dishes, coffee percolators and other dining-room accessories of new and attractive shapes; in fact, everything in electric-heating appliances from a little curling-iron heater for the dressing room to a 30-gallon kitchen boiler. A complete electric range will be in operation showing the convenience of cooking by electricity, and will demonstrate for the benefit of visitors the ease and convenience of electric cooking.

Spalding-Bates Company, Chicago.—This company will show a low-priced machine which washes, dusts, removes and replaces electric bulbs at any height and at any angle from the floor without the use of ladders and scaffolding.

United States Conduit and Construction Company, St. Louis.—There will be on exhibition samples of a new multiple conduit that requires neither encasing, tile or tubing in connection with its construction and which is said to insure a perfect alignment and a clean, dry and durable conduit without increasing the present cost of construction.

Vote-Berger Company, La Crosse, Wis.—Display will be in charge of A. J. Shoephoester and P. W. Goodman. Chief Engineer C. D. Enochs, Assistant Chief Engineer J. N. Wallace and Secretary M. I. Berger will be in attendance during the telephone convention. There will be a complete multiple section of the ballast common-battery switchboard in actual operation, ringing machines, power board, charging machines and storage batteries, the display being along the lines of a miniature common-battery telephone exchange office. One of the company's ballast common-battery PBX switchboards and one of its magneto express switchboards will be shown. The exhibit of common-battery and magneto telephones will include in addition to the company's regular wall instruments and pendent telephone the direct-current common-battery telephone. This telephone, built without induction coil and without impedance coil, is a companion to the ballast switchboard, the board without relays. A complete line of D. & T. anchors for guying poles and two-ball adjusters for incandescent lamps will be displayed.

Wagner Electric Manufacturing Company, St. Louis.—The exhibit will include a five-horsepower single-phase Wagner motor of the new type BA, in the new style frame of modern design. There will also be on exhibition a 10-horsepower three-phase induction motor with the new starter. During the last few months the Wagner company brought out an entirely new type of induction-motor starter for polyphase motors, the switching device being in an entirely separate case from the auto-transformer part of the starter and the switching device so arranged that the running fuses are cut out for starting, or separate starting fuses may be provided. The company has changed its complete transformer line, building at the present time what is termed "high-efficiency" and "standard-lighting" type of transformers. A very complete line of switchboard and portable indicating instruments will be shown, covering complete lines of direct-current and alternating-current instruments. Those in charge of the exhibit will be W. A. Layman, general manager; F. N. Jewett, Chicago district manager; C. B. Richardson, engineer, and C. C. Warner, salesman.

Manufacture of Tungsten Lamps.

Less than two years ago, when the tantalum lamp with a mean horizontal efficiency of two watts per candle was first placed upon the market, in this country, it was considered a wonderful improvement in the art of manufacturing lamps. Now, however, another illuminant bids fair to outshine the tantalum in many respects.

As readers of the Western Electrician are aware, the Tungsten Electric Lamp Company was organized with a capital of $100,000 under the laws of Ohio on October 29th last. The incorporators are among the oldest and most reliable lamp manufacturers in the country. Their names are as follows: Messrs. G. G. Lockwood, A. C. Garrison, H. B. Vanzwoll, A. S. Terry, L. P. Sawyer, H. H. Geary, J. C. Fish, H. C. Rice, E. H. Haughton, E. W. Gillmer, J. B. Estabrook, W. D. Packard, William Coale, E. J. Kulas, J. E. Randall and T. W. Frech, Jr.

Mr. Frech is president and manager. Mr. Randall is vice-president and supervising engineer of the company. These two gentlemen possess experience acquired after years of work confined entirely to the production and study of incandescent illuminants. Mr. Frech's career has been devoted, chiefly, to the commercial manufacturing end of the business. He had previously risen from a small position to that of superintendent, manager and supervising manager in the carbon-lamp industry. Mr. Randall has given his attention to the technical side. As far back as 1886, he was a lamp engineer for the Thomson-Houston Company in Lynn, Mass. His time has been spent in research work, experimenting, testing, etc., with valuable results.

Messrs. Frech and Randall took several trips abroad, where they studied the laboratory work taking place on tungsten lamps, and obtained exact information regarding the manufacturing operations employed in commercially producing them. After the final return of these gentlemen to this country, they, in conjunction with others, finally succeeded in overcoming certain conditions found in the foreign tungsten which would have made a success in this country less certain. The Tungsten Electric Lamp Company was then formed. The gentlemen interested were so confident of favorable results that they took over in Cleveland, for a factory, a concrete building 55 by 112 feet in ground dimensions, with four stories and a basement, the total floor area being approximately 30,000 square feet. The capacity of this most up-to-date plant for the construction of the latest electric incandescent illuminant is now less than 2,000,000 lamps per year, but can be increased as time goes on.

The lamp is now being produced in the following sizes: Forty-watt and 60-watt units for multiple work, and 4, 5.5, 6.6 and 7.5-ampere selections, with total wattages of 40, 50 and 75 watts for street series service. The mean horizontal candlepower efficiency is 1.25 watts per candle. The quality of the light delivered by this new metal-filament illuminant is white, causing all colors to be shown in their true values and producing other results similar to those obtained by daylight.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. [illegible]

L.—Industrial Applications.

Up to the present time these articles have considered the general principles of electrical machinery and their application to central-station work in the electric-lighting and electric-railway field. While these two applications of electric power are the most extensive ones in point of size and financial investment, there remain numerous industrial applications that present problems quite as important and often much more intricate than central-station practice.

By far the most important of the many industrial uses of electricity is motor driving.

Motor Driving.

As a source of power for operating practically every class of machinery the electric motor has proved its superiority over every kind of mechanical power, and it can safely be asserted that there is no industry or operation involving the use of mechanical power that cannot be more efficiently operated by the use of electric motors than by any other agency.

The reasons for the superiority of the electric drive are sometimes very obvious, and in other cases they are obscure, depending upon the class of service the motors have to perform, but there is hardly an industry in which electric motors have not been tried, and they have been able in every case to offer some gain over former drives, either in the way of increased economy of power, increased production, or increased adaptability and convenience. In many motor applications all of these advantages obtain.

The electric motor possesses characteristics which vary so broadly as to adapt it to different services which have diametrically opposed requirements. The motor may be wound to give a constant speed at all loads, a variable speed, depending upon the load, or it may be adjustable in speed between wide ranges, obtained by means of a controller. It is also capable of operating equally well in either a forward or reverse direction, and can be started, stopped, adjusted or reversed by the simple movement of a handle.

The motor may be mounted in any location, however inaccessible, and controlled from any distant point. Some type of motor can therefore always be selected which will fulfill any possible conditions which the driven machine may impose; and it is apparent that no other method of transmission of power can compete with the electric motor in the matter of flexibility.

As the electric motor has become a fixture in all kinds of industrial establishments, it is important to understand first the particular advantages of the motor over the forms of drive it has superseded, and, second, to study the requirements of different industries with a view to selecting for each case that type of motor which best fits the requirements of the service to which it is to be applied.

Some of the more important advantages of the motor drive are as follows:

Flexibility.

One of the most important features which has led to a very general adoption of motor driving is the flexibility of the motor drive. In many manufacturing establishments different processes requiring power are performed in different buildings which may be more or less scattered. With the electric drive the power plant for the entire factory may be located in any part of the factory, or, if desirable, at any point remote from the factory. This power can be utilized in any point of the factory by simply locating a motor wherever desired and carrying the necessary wires to it. The motor can be located in practically inaccessible places, if necessary, and it may be set upon the floor, the wall or the ceiling, if it is not of extremely large capacity. It may, in fact, be placed just where the power is required without reference to any other conditions.

If the transmission system from the generator to the motor is not extremely long, the loss of power will be almost negligible.

The motor drive is also extremely favorable to the location of machines just where they are needed, so that the work can pass directly through the shop from one machine to the next, and thus [illegible] of the plant [illegible] to appreciate [illegible] to contrast [illegible] motor drive [illegible] forms of mechanical drive. Take, for example, the case of scattered buildings. [illegible] plying power from a central [illegible] plant to a group of buildings is either to employ rope drives, or else carry the steam piping from the boiler plant to the various buildings and install a small engine for each building. In some cases also a separate boiler plant may have to be installed for each building.

The losses in case of rope drive are very large, due to a constant heavy friction load, and the possibility is always present that a breakage of the rope or cable may shut down the whole plant for a considerable time until repairs can be made. The difficulty of carrying steam piping to any distance with efficient results is obvious, as the loss by condensation, especially in severe weather, is very great, and has frequently been found so serious as to suspend the operation of a plant. The expense of establishing separate boiler and engine plants of comparatively small capacity in a number of scattered buildings is also apparent. Not only will these small plants operate much less efficiently in the matter of coal consumption than one large plant, but the cost of attendance is practically multiplied by the number of plants installed.

In the case of scattered buildings, therefore, not only the flexibility, but the actual economy in power production is greatly increased by the motor drive, as the transmission losses in the latter case would rarely exceed 10 or 12 per cent., while with any form of mechanical drive, or by carrying steam piping to engines at different points, the losses may be easily as high as 50 per cent. or more.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

BOOK TABLE.

The Elements of Electrical Engineering (Vol. I, Direct Currents). By Wm. S. Franklin and Wm. Esty. New York: The Macmillan Company. 1907. Pp. ($5\frac{1}{2}$ by $8\frac{3}{8}$ inches), xiv, 518, with 265 illustrations. Price, $4.50.

This book, which first appeared in January, 1906, has, in less than two years reached its fourth edition. This fact is ample proof that the work has fulfilled satisfactorily its aim to give to students of technical schools and colleges a clear and concise treatment of the elements of this broad field. The authors are the professors of physics and of electrical engineering, respectively, at Lehigh University, and their combined experience in teaching the subject for 13 years has shown them the necessity for giving in a text book on such a live subject as electrotechnology more than a mere demonstration of the fundamental principles. For this reason there have been incorporated in the text a large number of illustrations and practical examples. There have also been added in the last appendix some 60 pages of carefully selected problems supplementing the information given in the body of the book.

An excellent idea of the scope of this treatise is obtained from a list of the main topics treated, which are: The dynamo, its operation as a generator and as a motor; power losses and efficiencies of generators and motors; ratings and guarantees; station equipment and practical operation of dynamos; storage batteries; electrical distribution and wiring; electric lighting and photometry. In appended chapters are considered in more detail the following subjects: Magnetism of iron; characteristic curves of dynamo-electric machinery and armature windings. While this work has been particularly adapted for students' use, it is also suitable for anyone seeking a condensed up-to-date technical treatise on the generation, distribution and utilization of electric power by direct current.

The Elements of Electrical Engineering (Vol. II., Alternating Currents). By Wm. S. Franklin and Wm. Esty. New York: The Macmillan Company. 1907. Pp. viii, 378, with 302 illustrations. Price, $3.50.

In this volume, which has just been published, the same aims and methods have been carried out as characterized Vol. I. The fundamental principles of alternating currents are lucidly explained and many of the phenomena made more understandable by considering mechanical analogies. The various types of alternating-current machinery are discussed from the theoretical and practical viewpoints. The principal machines so considered are the alternator, synchronous motor, rotary converter, transformer and induction motor. In each case the single-phase and polyphase machines are separately considered and then compared. Transmission lines are briefly [illegible]

[illegible] than an electrical point of view, and the book [illegible] chanics to practical design. The work consists of many mathematical deductions supplemented by practical explanations and discussions. The designs of a "V" ring and a shrink-ring commutator are carried out in detail and the methods of assembling fully explained and illustrated. Various types of commutators are described and illustrated and [illegible] There are tables giving the various dimensions of the segments of different-sized commutators found in practice. The appendix contains the mathematical derivation of expressions for the deflection, stress, bending moment and centrifugal force as applying to the various styles of commutators. This volume should be a valuable addition to the library of students, draftsmen and engineers engaged in the design of electrical machinery.

Handy Copper Wire Tables and Formulæ. Compiled by P. B. Down, A. M. I. M. E. London: The Electrician Printing and Publishing Company, and New York: D. Van Nostrand Co. 1907. Pp. [illegible] by [illegible] inches, 34, with 24 pages for memoranda. Price, $1.

This book contains useful information and data on conducting metals and resistance alloys. It includes the wire tables in both Standard and Birmingham gauges with the corresponding weights and resistances for bare wire and for bare stranded cable. There are several pages of tables on magnet coils and formulæ for the calculation of length, weight, potential drop and resistance of copper wires. The conversion factors from the English to the metric system of weights and measures are given, as are also some data on resistance wires and a table showing the relative values of the Standard (English), Birmingham and Brown & Sharpe gauges. This book, however, contains little of value not found in a first-class electrical handbook. Over a third of the book is filled with advertisements.

Galveston Central-station Extensions.

The Brush Electric Light and Power Company of Galveston, Tex., which has been completely remodeling its plant and practically doubling the capacity, in response to urgent demands from customers for increased service, recently installed two Allis-Chalmers steam turbines and generators of 1,500 kilowatts normal rating, with liberal overload capacity, and converted four of the smaller existing dynamos into motor-generator sets of 400 kilowatts output, mounting them two by two on common bed-plates with Allis-Chalmers induction motors of 300 horsepower each. To the steam-producing plant, consisting of 1,200 horsepower in Heine boilers, has been added sufficient capacity in Eric and Stirling water-tube boilers, operating under a pressure of 150 pounds, to provide for the increase in the electric generating system.

The first of the new units to be installed was a 500-kilowatt machine to deliver two-phase, 60-cycle current with a pressure of 2,300 volts, running at 3,600 revolutions per minute; and, soon after this had been placed in operation, it was followed by a unit of 1,000 kilowatts capacity, at 1,800 revolutions per minute, with the same service characteristics.

Both turbines operate condensing, water for this purpose being taken from Galveston Bay and lifted by an induction-motor-driven centrifugal pump to two Tomlinson condensers, with discharge directly to the city sewer system, the condensed steam, which is entirely free from oil or other impurities, going, of course, directly to the feed-water heaters. All of this auxiliary apparatus, as well as exciters, switchboards, etc., was also supplied by the builders of the new turbo-generator units.

The ordering of the turbines was hastened by an accident to the power house, which occurred during a heavy electrical storm some months ago, at which time lightning entered the station, despite the usual protective apparatus, and resulted in the breaking of a large driving belt connecting the flywheel of one of the principal engines to its generator. As a consequence, the engine "ran away" and completely wrecked itself. This, of course, is an occurrence which would not be possible with direct-connected turbine units.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Short Cuts to More Resident Business.

By H. S. E.

How often people quote the old saying, "It's better to be born lucky than rich." But, do you know, Mr. Central Station Manager, that there is something better than either, and that is to be born with a boundless capacity for and delight in one's chosen work. Ask any successful man living and he will frankly acknowledge that he found far greater joy in the game of amassing money than in the mere possession of it.

You may depend upon it that luck and riches will wait on the manager who is so brimful of energy and enthusiasm over his work that his mind is constantly overflowing with new ideas for pushing the sale of electric current. It's as catching as measles, too—this enthusiasm—for it leads a man to evolve schemes and write advertising and carry on demonstrations that catch right hold of people, convincing them that for certain purposes there is nothing like electricity, and that they must have it to enjoy the full benefits and advantages that this modern life affords them.

Elaborate advertising campaigns for the purpose of educating the people in the uses and advantages of electricity for all commercial and domestic purposes are all right in their way, but usually they are too expensive and necessitate a great deal more detail work and solicitation than the average central-station manager cares to expend—especially those in small cities or towns.

More economical, more directly resultful, and easier ways can be employed by electrical companies to further their sale of juice. I shall call them "Short Cuts to More Business."

Let us, in this article, devote our attention to that branch of your service that naturally proves most attractive and valuable—your resident business.

This end of your business can best be worked up and increased by looking to the wiring of new homes, flats, barns, etc., and requires only the services of one or two solicitors, depending upon the size of your town. Often the manager himself or one of his assistants is all that is required.

It takes no high-class and expensive educational literature or follow-up advertising to add such prospective business to your service. A personal appeal to the architect or builder or future owner of the building will accomplish more than all the advertising the world ever knew or heard about, and a solicitor or manager who is up in his business will land the prospect nine out of ten times. If you fail to interest the builder or contractor, go to the owner or future tenant, but be determined to wire the building before completed.

So much for one of the "Short Cuts."

Now as to the wiring of old residences, built before electricity became an economical commodity for home lighting, or which, for some reason or other, were put up without being wired for electric light.

The best method of obtaining the business of such places is by offering special wiring inducements—either an attractive price or the offering of an electric flatiron, sewing-machine motor, heating pad, electric plate, or chafing dish, as a premium, if the wiring is done during a certain period. These special offers can be brought to the attention of house owners by a little newspaper advertising, circular letters well gotten up, and well-written mailing cards or folders or by personal solicitation. Let the householder pay so much a month, if he likes, and have the price arranged so that a good discount can be offered for cash.

In the case of a rented house, a number of central stations have found the plan of paying for part of the cost of wiring themselves very successful. They go to the tenant and say, "Mr. Tenant, if you will pay one-third of the cost of wiring your [illegible]

that he will be money ahead by wiring the house. Show him where there are dollars and cents in it for him, and you've got him.

Go at it like this:

"Now, look here, Mr. Property Owner, I don't care whether you're going to live in this house yourself or rent it, but as long as the open flames are used for lighting, you know you'll have to redecorate this house every two years at least, probably every year.

"If you live here, you want your walls and ceilings clean and fresh, and your home a good, healthy abiding place. If you rent this place, your tenant will kick for the same things, and you can't have them as long as kerosene and gas are used for lighting; the smoke and soot and obnoxious gases make it impossible. The only remedy is electric light. Houses where electric lights are used do not require redecorating more than once every six years or so.

"Just take a pencil and a sheet of paper and do a little figuring, and I'll irrefutably prove to you that wiring this house will save you money. Suppose it costs you $100 to repaper and redecorate this house. In twelve years, providing you have done it every other year, you will have spent $600 for this purpose, whereas if electric lights are used the amount spent will amount to exactly $200.

"Quite a difference, isn't there? You can figure the cost of wiring and the interest on your investment, and still be a good deal ahead, besides reducing your fire risk and gaining all the advantages and added comforts that electricity affords."

Many other arguments can be added to these, but I simply give these as an example.

Business obtained along these lines can be classified under the head of new-residence connections, and it naturally comes on peak load. When a central-station manager has this part of his business well developed and coming along in nice shape, he should look to these same customers for day load or load-leveling business.

The most efficient and the only short-cut method of obtaining a good paying day load from your resident customers is by introducing the various household electrical appliances by means of the ever-attractive free-trial offer, and by educating the people with practical demonstrations.

Take, for example, the electric flatiron, the sewing-machine and washing-machine motors, the heating pad, the radiator, the baby-food warmer, etc. These are all articles which can be placed out on free trial and sold to your customers at enough profit to pay you for the entire cost of your campaign. The experience of most central stations who have tried placing the electric flatiron on 30 days' free trial has been that nearly 80 per cent. of the irons are accepted and paid for. Of course the sale of the other devices would not average quite as well, but at any event it is impossible to lose anything by their introduction.

To popularize the numerous electrical cooking utensils there is nothing that can take the place of good, interesting demonstrations, carried on by a good demonstrator. Invitations, gotten up in the usual manner, should be sent out to the ladies of your city or town, and notices should be inserted in your local papers.

I have heard of central stations adopting the scheme of presenting the ladies of a church with a complete electrical cooking outfit for use at church suppers and banquets, and of selling a number of complete outfits on the strength of the gift. The church workers become accustomed to the new and superior methods of cooking, and were not satisfied until their own homes were equipped in like manner.

Getting 'em started is half the battle—and before you can enthuse others you must enthuse yourself.

The Lighting of Small Residences.

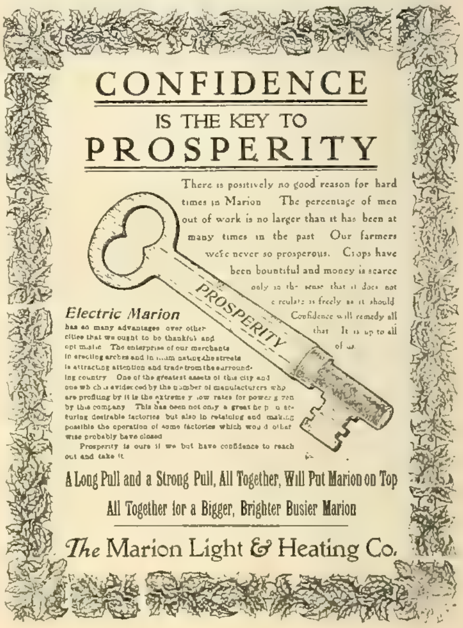
No problems connected with electric-light practice occur with greater frequency than those relating to the lighting of residences; yet after all these years the average house lighting still follows the old gas practice, making little allowance for the different requirements in various rooms, or for the greater flexibility of the electrical means of lighting. Logically the parlor, living room, dining room, kitchen and bedroom each demand a distinct arrangement of lights and reflectors, for the ability to place lamps in various positions and to utilize [illegible]

effective use of the electric light than could be possible with the invariably vertical gas flames. The more intelligently and efficiently electric lighting is planned, the more will it outclass its gas competitors, so the best interests of our central stations justify a careful study of house-lighting problems.

The subject as a whole was discussed to some extent at last January's meeting of the Northwestern Electrical Association, and at next week's meeting of this organization in Milwaukee those present will have an opportunity to consider the matter more thoroughly. Realizing its importance, the Commonwealth Edison Company is to have a model cottage, or rather suite of rooms, at next week's Chicago Electrical Show, which will be lighted according to the recommendations of prominent illuminating engineers. Then the Chicago section of the Illuminating Engineering Society, which will hold its January meeting at the exposition, will devote its session to a discussion of this same theme, thus adding the judgment and experience of others to the object lesson presented by the local lighting company. The extent to which house lighting can be improved by the application of the simplest principles of illuminating engineering, will be an eye-opener to many. Hence the central-station men, contractors and consulting engineers of the Middle West ought to be glad of this unusual opportunity to study the matter simultaneously from both its theoretical and practical aspects.

Central-station Confidence and Cheer.

The accompanying reproduction of a full-page "ad" in a Marion (Ind.) daily newspaper shows that the Marion Light and Heating Company has itself the confidence which it enjoins on others.



A FULL-PAGE DAILY NEWSPAPER "AD" IN MARION, IND.

Published during the holiday season, this prominent announcement comes with a message of good cheer. "Electric Marion has so many advantages over other cities," says the company, "that we ought to be thankful and optimistic." The company points out, with reason, what its low power rates have done for the community.

Mr. Plaice Organizes the Thornapple Club.

Mr. F. H. Plaice, whose remarkable record in building up the central-station business at New Bremen, Ohio, is known to the readers of the Western Electrician, has transferred his activities to Hastings, Mich., where he is now manager of the Thornapple Gas and Electric Company. This company generates electricity by waterpower and also supplies gas. Evidences of Mr. Plaice's energy and versatility are already seen. On the day after Christmas the company gave a dinner at a local hotel to all its employes who could be possibly spared and to the representatives of the press. Covers were laid for 24 persons. Mr. Plaice made a little speech, which was reported at length in the papers, saying that it was the purpose of the gath- [illegible]

tween the employees themselves and between them and the community they served. He distributed gifts amounting to [illegible] to the employees, each amount being proportional to length of service. Hereafter, he said, the dinner would be an annual affair. Better service to users was promised and also free lamp renewals. But the overhauling of the plant meant a large expense, and many new customers must be secured. The speaker proposed the organization of the "Thornapple Club," the object of which is to report 365 new customers, one for each day in the year, at the next annual dinner. The idea was received with approval, and the club was then and there established. A number of other speeches and suggestions were made, and the first annual dinner of the company was a great success in every way.

Another plan of Mr. Plaice relates to house wiring. He makes the people of Hastings, Middlesville, Lake Odessa and Nashville the following offer: The company will wire a five-room house ready for service with one two-light fixture for $10; a seven-room house with two two-light fixtures for $15, and a 12-room house with three two-light fixtures for $25. But not more than 20 houses will be wired on this basis in any one month. Houses must be wired complete, including cellar and porch light in houses of seven rooms and over. A three-light fixture may be substituted for a two-light one by payment of $1 extra. Extra outlets complete with pendant drop will be installed at $1.50 each.

A New Measuring Instrument for Alternating Currents and Potentials.

By John M. Lea.

The field of measurement comprises two different kinds of currents—direct or unidirectional and alternating or periodic. The practical measurement of the unidirectional currents and potentials is very satisfactorily accomplished by the type of instrument making use of a powerful permanent magnet and a very light pivoted coil. The fundamental principle of this instrument was invented by Messrs. Deprez and D'Arsonval and it is exemplified in varying designs involving the same general principle. In practical measurement of alternating currents and potentials, however, much more difficulty is experienced, and here the types of measuring instruments now in use are all deficient in several respects compared to the best direct-current meters, and as a result the proficiency and accuracy of alternating-current measurements are much inferior to the direct-current measurements.

The most common of alternating-current measuring instruments are the dynamometer, hot-wire, induction and "magnetic vane" or electromagnetic types. The "repulsion" type of induction meter is as valuable as any of these, and in addition is very efficient and has a scale which is more even than any alternating-current ammeter or voltmeter.

It is important that scales be evenly divided when accuracy is considered, because the evenly spaced intermediate "short-line" divisions between calibrated points mean something, as they are located with a high degree of accuracy when the "large divisions" are evenly spaced throughout. When, however, the distance between the successive calibrated points is varying greatly it is more likely that the even intermediate divisions will not be in the right place.

The "repulsion" meter for alternating-current measurements is the one to which the title of this article refers. It was developed, designed and patented by the writer within the last two years (application filed June 4, 1906, allowed November 12, 1907), and has been manufactured and put on the market by the International Electric Meter Company of Chicago.

The principle and design of this instrument are entirely new. The instrument responds quickly and positively to sudden changes in potential differences or current strengths. The moving system has little inertia and relatively high torque, is light, rigid and durable. The calibration is permanent and accurate.

An idea of the appearance of the movement may be had by reference to Fig. 1. Fig. 2 shows the moving element or coil with index and pivots. The coil stamping, which is composed of aluminum, is only eight mils in thickness and is made so nearly balanced that very little counterweight need be added to the moving parts for poising or balancing, and therefore the whole system is extremely light. This is an advantage for electrical measuring instruments. When complete with pointer, counterweights and pivots the weight is only 35 grains, or about 2⅓ grams.

The power required for the operation of the "repulsion" meter does not increase in the same proportion as in other types because the current decreases as the voltage capacity of the meter increases. For example—a 500-volt voltmeter has a full-scale current of approximately 0.007 ampere and consumes less than three watts. The impedance is about 137 ohms per volt, or 68,500 ohms, [illegible] an alternating-current instrument.

[illegible] hundred per cent. overload for some time because [illegible] fact that the controlling springs, which are neces- [illegible]

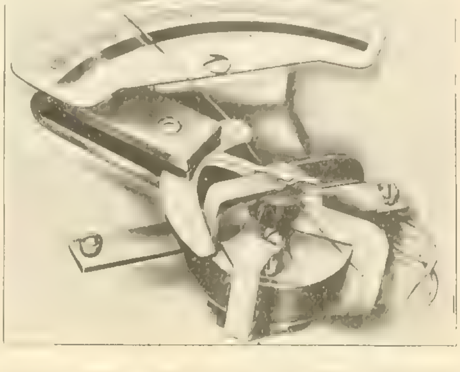


FIG. 1. NEW ALTERNATING-CURRENT MEASURING INSTRUMENT.

nitely and its accuracy is not impaired either by "current heat" or the aging of the iron core.

Referring to the diagrammatic drawing, Fig. 3, a clearer idea of the instrument may be obtained. Essentially this instrument embodies the principle of a short-circuited transformer, consisting of a primary or exciting coil (A) adapted to carry the current or a part of the current to be measured, and a secondary element or closed coil (B) linked in inductive relation to the primary by a suitable laminated iron core (C), constructed to give a completely closed (no air-gap) magnetic circuit. The primary and secondary are so mounted as to have a relative movement under the influence of their mutual repulsion when the primary is traversed by an alternating current. Such movement of the secondary (B) is opposed by two phosphor-bronze spiral springs (coiled or acting in opposite directions to eliminate "zero trouble"), so that the extent of movement will be dependent upon the strength of the primary current and will indicate such strength of current. To increase the sensitiveness of the instrument the supplementary or adjustable secondary circuit (D), which has an attractive

FIG. 2. MOVING ELEMENT OF NEW METER.

effect, was provided upon the core near the extremity of the swing of coil (B). The magnitude of this effect is proportional to the distance of this secondary from the end of the swing of the coil (B). This feature is made use of in adjusting the contour of the scale in calibration, and the result is an even scale through 70 per cent. of deflection.

The movable secondary coil (B) is arranged to oscillate along the curve of the core (C) between the fixed primary (A) and the adjustable or fixed secondary (D), being simultaneously repelled by the primary and attracted by the secondary. The action of the coil (D) allows a considerable reduction in the section of the coil (B), as it may be said to carry part of the active induced current. This allows the use of a metal of zero temperature coefficient and thereby greatly reduces the temperature coefficient of the meter.

The vane (E), which is a part of the coil stamping, is adjusted to swing freely and with a large amount of clearance between the poles of a strong permanent magnet (F) which acts as a dampener on the oscillations of the moving element but does not cause any friction or in the least affect the accuracy of the calibration. This magnet is not affected by the action of the alternating flux, as it is mounted in a position where there is very little leakage, the magnetic density in the core being exceedingly low.

The primary principle upon which this meter operates, that which produces the torque, is known [illegible] is equal to the average instantaneous torques during the period.

In the case at hand, a flat disk or one-turn coil enclosing an iron core, the coil will have a considerable self-inductance. The effect of the self-inductance is to cause the induced current to lag behind the induced pressure, the induced pressure being 90° in phase, behind the magnetism. In this case the instantaneous values of force, when plotted in a curve, will give a larger negative than positive value, and the result will be a repulsive action. Referring to Fig. 4, it is seen that the induced current and magnetism act in opposite directions, most of the time, when they have a difference of [illegible] (A) is attractive and by (B) repulsive, and the dotted lines represent power loops, the downward being negative or repulsive.

Had there been no self-inductance to the coil the induced current would have been only 90° out of phase with the magnetism, and the resultant force during the period would have been zero.

An alternating current is also induced in the supplementary secondary circuit, which is practically in the same phase as the current in the movable secondary, and the magnetic leakage flux of the first threads the second in the proper way

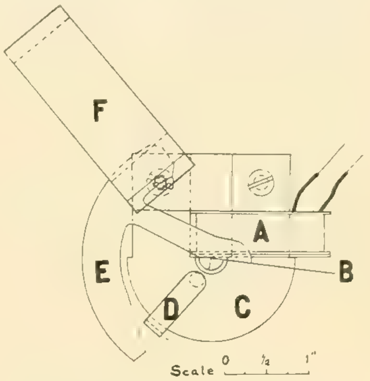


FIG. 3. DIAGRAM SHOWING PRINCIPLE OF NEW METER.

to cause an attractive effect which tends to increase the movement produced by the repulsive effect of the primary.

Should a measuring instrument having a dynamic action be subjected to two currents of different frequency, there would be a greater impedance drop at the higher frequency, without any change in exciting current. In the case of a "repulsion" meter this condition is changed. A change in frequency causes a change in exciting current, and the impedance drop will be greater or less, depending upon the amount of resistance and reactance in the circuit. The following explanation should make this clear:

It is a well-known fact that the hysteresis loss in an iron core is proportional to the frequency and also to the 1.2 to 1.6 power of the induction. In the "repulsion" meter, virtually a short-circuited transformer, the induction is nearly inversely proportional to the frequency. Consequently, the hysteresis loss would vary somewhere between the 0.2 and 0.6 power of the induction. The Foucault current loss only remains to be considered, and it varies as the square of both the frequency and

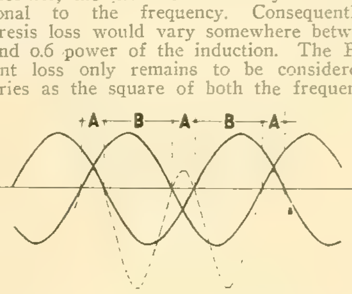


FIG. 4. CURVES OF INDUCED CURRENT AND MAGNETISM.

the induction, and as these quantities are inversely proportional, the Foucault current losses would not change upon change of frequency except a small amount caused by the leakage induction. So the only change in the current due to core or iron losses would be a small amount caused by the hysteresis loss, and as the induction in the iron decreases there would be a small proportional decrease in exciting current in a change to a higher frequency, the voltage or deflection remaining constant.

The magnetizing current also changes with a change in frequency, and is a variable, because of the change in the permeability due to changes in magnetic density. Now both the magnetizing

and hysteresis components of the exciting current cause a decrease in the primary current at higher frequency, and vice versa, and this change between 30 and 60 cycles is approximately 3½ per cent. of the total current. This condition would, of course, cause a relative error in either a current or voltage measuring instrument, but for the compensating effect of other features.

Because of the demagnetizing effect of the secondaries, and also because of the extreme narrowness of the coils, along the core, and their position relative to each other, a considerable magnetic leakage field is produced between them. This has the effect of giving the coils a large self-inductance, and the greater the deflection of the coil the greater this effect. This feature makes possible the compensation of this design of meter. That is, the compensation is accomplished, in the case of a voltmeter, when the fall of potential across the meter or the change in current is practically independent of the current frequency within wide limits.

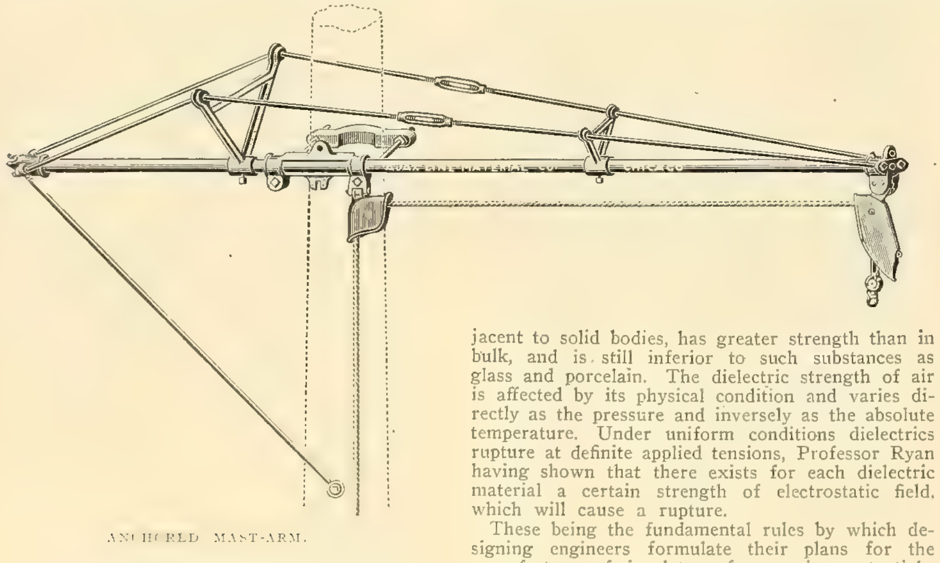
The compensation of ammeters, like that of voltmeters, is accomplished by proportioning the ratio of the CR drop to the self-inductive drop, but in the case of the ammeter the pressure across the meter must increase the proper amount at a higher frequency to cause an increase in the current in a shunt across the primary coil just sufficient to make up for the decrease in current in the primary.

Changes in the wave form of the primary current have no appreciable effect on the indication of this meter, as the greatest possible change, caused by change in wave form, is only four or five per cent. of the core loss, while the probable change is much less, and besides this, the core loss is only a very small part of the total power required to overcome the C^2R loss in the coils and other losses.

The "repulsion" type of induction meter, herein described, has a power factor of 60 to 70 per cent., and, as the reactance is not affected by temperature changes, the meter is inherently less affected by this cause than others with a higher power factor.

An Anchored Mast-arm.

Prominent among New England contributions to modern outdoor lighting devices is the side mast-arm, consisting of a truss extending alongside the pole, with its rear end held down by a tail-rod. When this was introduced in the West its reputation for firmness was severely shaken, as the occasional high winds would rock the whole truss



ANCHORED MAST-ARM.

sideways, thus swaying the lamp and causing the moving shadows which interfere so seriously with effective street lighting. Numerous attempts have been made to overcome this by slipping side-braces over the piping and fastening these to the pole by lag-screws, but the small rounded edges of these screws have rarely proven adequate to withstand strains caused by the wind acting with so great [illegible] at the end of the fixture.

Now the problem is thought to be solved in the [illegible] mast-arm, designed by Albert Scheible, and represented herewith. This follows the old New England practice as far as the truss proper is concerned, but adds distinctive western touches in a reinforced tail-cap at one end and a safety pulley at the other end of the fixture. The [illegible] at the pole by a plate having two sleeves, from which heavy bolts run to a girder-shaped strap at the back of the pole. On tightening the bolts the bearing surfaces of this strap are drawn into the pole, thus giving flat bearings to withstand any swaying strain of the [illegible] and the anchoring device can readily be tightened if [illegible] fixture should always merit the term "rigid." It [illegible] Chicago.

High-tension Insulators.[1]

By C. E. Delafield.

The science of properly and safely insulating line voltages of high potential has not kept pace with the demands of transmission engineers, and today we are face to face with the problem of successfully transmitting potentials in excess of 100,000 volts. In California power is transmitted at 60,000 volts more than 200 miles, but great line losses are suffered and the investment in copper is heavy. An increase in voltage from 60,000 to 150,000 would make it possible to deliver this power with reasonable losses and in much greater quantity. As an illustration of the possibilities of delivering power at 150,000 volts, it would be possible to deliver the power generated at Niagara Falls economically to Boston, New York or Philadelphia, and, apparently, the principal hindrance to this consummation at the present time is in the fact that there is not on the market what might be termed a successful insulator for this enormous voltage, although the merits of a number of different types of insulators are at the present time being advocated for this purpose.

The design of an insulator for high voltages (quoting the words of Gerry) should involve a consideration of all of the effects of electrical tension on the dielectrics in the vicinity of the conductors. In the case of a line insulator, air is always a dielectric in combination with wood, porcelain, glass or other materials, and, wherever there is a difference of electrical potential, there exists in the surrounding media a certain state of strain called an electrostatic field. This state of strain is the result of electrical stress applied to the insulating material. It frequently happens, when several dielectric materials are subjected to the same electrostatic field, that one or more of the materials will be strained beyond the limit and fail, although the others will stand the electrical tension. Air adjacent to powerful dielectrics frequently fails in this manner, thus giving rise to the well-known brush discharge.

The structural failure of air from an engineering standpoint has been studied by a number of investigators, including Dr. C. P. Steinmetz, Dr. F. A. C. Perrine, Prof. Harris J. Ryan, Mr. M. H. Gerry and others, and, as the result of their published investigations, it is well known that air at the ordinary pressures and temperatures has a much lower dielectric value and strength than the common insulating materials. Air in thin films, adjacent to solid bodies, has greater strength than in bulk, and is still inferior to such substances as glass and porcelain. The dielectric strength of air is affected by its physical condition and varies directly as the pressure and inversely as the absolute temperature. Under uniform conditions dielectrics rupture at definite applied tensions, Professor Ryan having shown that there exists for each dielectric material a certain strength of electrostatic field, which will cause a rupture.

These being the fundamental rules by which designing engineers formulate their plans for the manufacture of insulators for varying potentials, it can well be seen that the various forms of insulators on the market today are the results of working out these rules by different individuals looking at the same thing from a different standpoint. That is to say, climatic and geographical conditions exert considerable influence in the design of an insulator. Insulators suitable for dry atmospheric conditions would not be suitable for a condition where sea fogs and dust exist, and there is no question that a correct solution will soon be forthcoming for a standard insulator for voltages of 75,000 and upward. In fact, as noted before, the different manufacturers are now experimenting toward that end.

Looking over the history of high-tension transmission, it is only about 15 years since we looked with wonder on the Frankfort-Lauffen transmission line in Germany, of 30,000 volts over 100 miles. Today there are thousands of miles of long-distance transmission at voltages ranging from 11,000 to 65,000 volts, and great credit is due the engineers who have designed and carried out this work in the face of almost insurmountable obstacles. The progress of high-tension transmission has been very rapid, and in all of the various branches, with the exception of the line insulators, it is now possible to handle voltages in excess of 75,000 volts, there being no difficulty whatever in the designing and manufacturing of successful transformers and switchboard apparatus for these high potentials. It should be taken into consideration, in the future designing and laying out of transmission lines, the possibility of increasing the present voltage to the voltage that may be possible a year or more from now, so that large quantities of power may be economically distributed over long distances.

It has been demonstrated by practice that very large generating units can be successfully operated and that both steam-turbine and hydro-electric plants can be operated successfully, and the one question to be decided is, how can large powers that are so successfully generated be distributed over long distances economically, taking into consideration the high price of copper and aluminum. The answer to this question is, by high voltages only. Up to the present time the commonly accepted form of insulator is what is known as the pin type, meaning by that an insulator having for its resting place a pin embedded in, or fastened to, a cross-arm, this pin being of wood or metal. Present practice has demonstrated that wood can be safely accepted for insulator pins up to 25,000 or 30,000 volts. Beyond that it is advisable, for mechanical reasons, to use malleable iron, but the so-called pin type of insulator has reached such dimensions, in the endeavor to meet the requirements for higher voltages, that it seems to be the consensus of opinion of the leading high-tension engineers that this type of insulator has reached the limit of good line construction, and, when one stops to think of the dimensions of an insulator used on a 60,000-volt transmission, one is inclined to think that the engineers are correct.

Not only is it a difficult matter, from a mechanical viewpoint, to find a pin that will take the necessary stress incident to an insulator of this large size and weight, but the problem of manufacture, from the viewpoint of the pottery, is one that is exceedingly difficult, so that, apparently, it is necessary to make a radical departure from the present practice of pin insulation in order to take care of the various difficulties that are encountered in the construction of insulators for the higher voltages, and it is the belief of the writer, and also of other engineers, that a suspended form of insulator will be the type which will be used, it being, from a mechanical standpoint, a comparatively simple matter to suspend any desired weight, and, from an electrical standpoint, it seems possible so to design an insulator that it will be mechanically strong, and a good dielectric as well.

The suspended type of insulator would have the advantage that ample arcing distance could be provided without making the insulator topheavy and difficult to manufacture. It should be so designed that arcing cannot occur until the voltage is sufficient to rupture the air and cause the current to arc from end to end, this feature being of great importance where the insulators are mounted on steel towers, which is conceded to be the best engineering practice. On high-voltage lines where steel towers are used, the pin type of insulator for 100,000 volts or higher would seemingly be almost an impossibility, owing to the size necessary to take care of the surges and other line disturbances and owing to the fact that the earth potential is carried into the head of the insulator by the steel pin and through the metal towers.

An ideal insulator for all conditions of high-voltage stress should be one that would take care of climatic conditions, such as fogs, dust deposits, salt spray, etc., and should have as few still-air spaces as possible. That is to say, it should expose a large part of its surface to the wind and should have a long leakage distance of small area. In the designing of a type of porcelain insulator for this class of work, it should be borne in mind that cemented parts, if there are any, should be under compression and not under tension, owing to the strains to which it may be subjected to from expansion and contraction. There should be as few still-air spaces as possible, to avoid the accumulation of dust, insects, etc., and there should be nothing but porcelain, well vitrified, between the points of opposite potential. Engineers are now at work along these lines, and, as the result, a number of plans have been proposed embodying more or less of these ideas, and it is only a question of a short time before the successful insulator will be evolved for these higher tensions, if it has not already come to pass.

Leaving for the time being the open question of extraordinary potentials, we will take up the question of high-tension transmission as it exists today. Continuous operation of a transmission system is an absolute essential, and depends to a large extent on the effectiveness of the insulator used. In this paper the writer only aims to discuss the qualities of porcelain insulators, as it is now generally conceded that porcelain is superior to glass for the manufacture of high-tension insulators, and, in fact, supersedes glass wherever the question of cost is not a paramount problem.

[1] [illegible] Canadian [illegible] September [illegible] 1907. [illegible]

In the designing of an insulator for any given voltage, and especially for the higher voltages, there are three considerations of primary importance: first, electrical design, second the mechanical strength, and third, the quality of the material.

In the electrical design consideration must be taken of the dielectric strength of the adjacent air, so that sufficient distance be allowed between the points at which the line voltage is impressed that it will not arc over to the pin or cross-arm under ordinary working conditions. In other words, make the potential gradient as gradual as possible from line wire to ground. These points of impressed voltage may vary greatly in an insulator of poor manufacture, although of the same electrical design. For instance, in two insulators of the same general design and different manufacture, the one having the greatest electrostatic capacity, and, therefore, the greatest electrostatic field, will suffer from brush discharge and arcing-over sooner than one having less electrostatic capacity and, therefore, less electrostatic field. In another case, two insulators of the same design but of different manufacture, the one possessing a body of greatest density and which is the most vitreous, will carry ordinary working voltages and line disturbances with less trouble than an insulator that does not possess these qualifications.

Due care must be exercised in the manufacture of porcelain insulators to secure the necessary dielectric strength between the tie wire or top groove and the point inside the insulator which is in closest proximity to the head of the pin, providing that pin is made of iron, which is usually the case in voltages in excess of 30,000, and in many cases misfortune has come to the engineer who depended to a large extent on the pin and cross-arm for additional insulating qualities. Practice dictates the fact that on the insulator alone should be the reliance of the engineer for his insulation, and all insulators, whether of porcelain or glass, should be tested with approximately three times the full line voltage brought to the inside of the insulator head. The entire burden of correct and sufficient insulation should be placed on the insulator itself; thus a large number of line troubles would be prevented.

It has been the unfortunate habit of some engineers to consider the cost of the insulator of paramount importance, and when one takes into consideration the importance of the insulators to the construction of a line, one is always led to wonder why, by the additional cost of a few cents to each insulator, a reasonable factor of safety is not obtained. It is, however, pleasing to note that many engineers are profiting by the sad experience of their brothers and are securing their insulators based on specifications that insure a reasonable factor of safety, and, in fact, are in some cases going to the other extreme and not only require the manufacturer to guarantee their insulators to stand a rigid test, both before and after erection, but in one case which the writer recently noticed, an additional clause was inserted requesting the manufacturers to guarantee that the railroad would not break them in transit, which, we will have to agree, was rather a severe test.

Reverting once more to the electrical design, it is necessary, in the design of an insulator, that the factor of safety be sufficiently large so that the abnormal electrical strains that may be, and are, occasionaly brought to bear, will not cause a puncture and consequently a shutdown of the line. For instance, an insulator designed to carry 50,000 volts should stand a dry test of approximately 150,000 volts, thus giving a fair factor of safety to enable it to withstand the possible surge voltages caused by short-circuits, etc. This very fact of requiring a reasonable factor of safety in the electrical and mechanical design of an insulator has decided the limiting possibilities of the pin type of insulator as approximately 60,000 volts line voltage, as, to secure a factor of safety of three, it would be necessary to build an insulator of mammoth proportions and uncertain body, having a weight that is almost prohibitive to pin work. This brings us again to the conclusion that the only method of securing a proper factor of safety on the higher voltages would be to use a suspended type of insulator.

Having discussed the engineering design of a high-tension porcelain insulator, the writer thinks it might be of interest to take up its composition and the difficulties of manufacture, concluding with the tests to which all insulators should be submitted before being placed on the line.

The porcelain of which a high-tension insulator is made is composed of certain proportions of English ball, China clay, some domestic clay commonly called Tennessee, and some feldspar and quartz. The clay forms the body and gives the proper mechanical strength, while the function of the feldspar and quartz is to act as a flux and thoroughly permeate all the parts of the insulator, thus making a thoroughly vitreous mass when subjected to a sufficient heat. This mixture, having gone through the various steps of grinding, is forced through a filter of copper or silk cloth of 110 mesh to remove all impurities, and is then formed in the various shapes and designs suitable for the purpose [illegible] placed in the [illegible].

After [illegible] removed [illegible] the glaze solution and are again placed in the drying room [illegible] and subjected to [illegible] Porcelain [illegible] give the insulator the necessary color and also a smooth, even surface, in order that dust and rain may be easily dispelled. Ordinary unglazed porcelain would come from the kilns a pure white color with a comparatively rough surface, which would hold the dirt and moisture, so that it is necessary to glaze the insulator in order that a smooth, glassy surface may be obtained, as well as the desired color. If, in baking, the insulator is not subjected to the proper amount of heat, the body of the clay will not be thoroughly vitrified. If, on the other hand, the insulator is subjected to too much heat the body of the clay will be porous. Therefore, it is necessary that the insulator be subjected to the exact amount of heat necessary to secure the desired results.

In determining the exact amount of heat to which these insulators shall be subjected, ordinary thermometers are not used, but a small, carefully prepared cone of predetermined composition is utilized, which is placed at intervals in the kilns and is observed through small orifices by the attendant. These cones assume an erect position under any degree of heat below the desired one. As soon as the predetermined point has been reached, however, the cones melt and form glaze, and at this point the heat is turned off and the ovens allowed to slowly cool, so that the ware may be thoroughly annealed. This process cannot be hastened, but takes a certain well-defined time for its operation. When removed from the kiln the insulators are then subjected to a most rigid electrical and mechanical test to determine their qualifications for the work which they are designed to do, and all those not coming up to the specifications should be rejected at this time. A certain number of all insulators coming from the kilns are subjected to two electrical tests, one a dry test to determine the dielectric strength of the porcelain body, and the other a precipitation test to determine as nearly as possible the action of the insulator under most severe climatic conditions.

The only objection that has been offered to porcelain as the composition of which the insulator should be made is the fact that in no other way than the above described can a porcelain insulator be properly tested, whereas the defects that might occur in glass can be detected by the eye. Unless an insulator is thoroughly vitreous and is practically non-absorbent and shows a fracture similar to glass, it is unfit for use under high-potential stress. An ideal insulator would be one having a minimum amount of electrostatic capacity with a maximum amount of mechanical strength, but in the pin type of insulator a strange phenomenon exists, inasmuch as it is necessary to sacrifice one condition to some extent to obtain the other good points, and an insulator of successful design is one which exhibits a happy medium.

Magnitude of Westinghouse Interests.

In an appreciation of the great work accomplished by George Westinghouse the Railroad Gazette notes that there are 21 American and 10 foreign Westinghouse companies, with 210 officers, $120,000,000 capital, $90,000,000 annual output, 24 factories, with 7,000,000 feet of floor space, and an army of 38,000 employes. And these huge machines are not simply notable because they make most of the automatic brakes and a fair share of the signals, draft gear and electric-light, power and traction materials for the civilized world. Their beneficent power and influence is due rather to the original investigation, invention and design and development which have been an incentive and a spur to other engineers and manufacturers.

The principal American companies are: American Brake Company, Atha Steel Casting Company, Bryant Electric Company, Canadian Westinghouse Company, Cooper Hewitt Electric Company, East Pittsburg Improvement Company, Nernst Lamp Company, R. D. Nuttall Company, Perkins Electric Switch Manufacturing Company, Pittsburg Meter Company, Security Investment Company, Union Switch and Signal Company, Westinghouse Air Brake Company, Westinghouse Automatic Air and Steam Coupler Company, Westinghouse, Church, Kerr & Co., Westinghouse Electric and Manufacturing Company, Westinghouse Foundry Company, Westinghouse Inter-Works Railway Company, Westinghouse Lamp Company, Westinghouse Machine Company, Westinghouse Traction Brake Company.

The principal European companies are: The British Westinghouse Electric and Manufacturing Company, Limited; Societe Anonyme Westinghouse, La Havre, France; Societe Electrique Westinghouse De Russie; Traction and Power Securities Company, London; Westinghouse, Cooper Hewitt Company, Limited, London; Westinghouse Elektricitats-Aktiengesellschaft; Westinghouse Metal Filament Lamp Company, Limited, London; West- [illegible] Freni.

[illegible] turbines, mechanical stokers, air compressors. For installation and construction work, one of the larger corporations is occupied exclusively as designing and [illegible] the Boston South Terminal, and now has the mechanical and electrical engineering and equipment of the Pennsylvania's New York terminal, involving an expenditure of $25,000,000.

The Manitoba Telephone System Sold.

The entire telephone system in Manitoba belonging to the Bell company has been purchased by the Manitoba government for $3,300,000, and the province will take possession on January 15th. This decision was arrived at on December 31st, after the valuation made by the experts had been fully considered. Negotiations for the sale of the system were opened by C. F. Size, president, who when he saw the Manitoba government really meant to build a government telephone system, came up from Montreal and offered to sell all holdings of the company in Manitoba for $4,000,000. This offer was rejected, and finally the sum mentioned was accepted.

In Alberta and Saskatchewan the government lines are encroaching seriously on the Bell company's business, and it is expected these provincial governments will likewise receive an offer from the company to sell its lines and exchanges in those provinces.

In an interview Premier Roblin said that the telephone system acquired from the Bell company will be run by a commission, but as far as possible the present employes will be retained. At the present time there are approximately 14,000 subscribers in Manitoba, with 1,250 "long-distance" lines and approximately the same mileage of rural lines. There are about 100 exchanges in the province and several large toll offices are maintained. The rates charged annually by the Bell company vary according to the number of subscribers at the exchange. In Winnipeg the rates are $50 for business and $30 for residence telephones, and these rates vary down to $24 and $18 respectively. An effort will be made to reduce these rates.

Telephone News from the Northwest.

The annual report of the Northwestern Telephone Exchange Company shows gross earnings for the past year of $1,453,415.48, as compared with $1,209,711.58 for the year before.

George N. Bandy has sold his interests in the Hawkeye Telephone Company of Perry, Iowa, to Brenton Bros., and will retire from active connection with the business. Mr. Bandy was the originator of the business, and the lines have always been known as the "Bandy lines." The consideration was $350,000. Charles R. Brenton succeeds Mr. Bandy as president and D. M. Griswold will probably be secretary and general manager. Mr. Bandy expects to take a rest for some weeks.

At Mason City, Iowa, the city officials are seeking some method of regulating telephone rentals, there being vigorous complaint upon the matter. The law is believed to be that the city has no power over telephone charges, that lying with the Legislature.

The Corn Belt Telephone Company of Waterloo, Iowa, has increased its business since July 1, 1905, from 2,500 instruments to 8,500. R.

Preparations are being made for the biggest convention ever held by the International Independent Telephone Association, to be held in connection with the big exhibit of Independent telephone appliances at the Chicago Electrical Show in the Coliseum. The dates of the meeting are January 21st, 22d and 23d, with the various committee meetings on the 20th. Convention headquarters will be maintained and committees will meet at the New Southern Hotel, about a block and a half from the Coliseum. Besides the business and entertainment features, and the attractions of the show, the programme contains a long list of good papers and addresses. The association has now established general headquarters in the Monadnock Building, Chicago, where Mr. J. A. Harney, assistant secretary, is in charge. Theodore Gary, Macon, Mo., is president of the association. Good progress in the Independent telephone movement is reported.

Automatic Telephony.[1]

By Franklin J. Truby

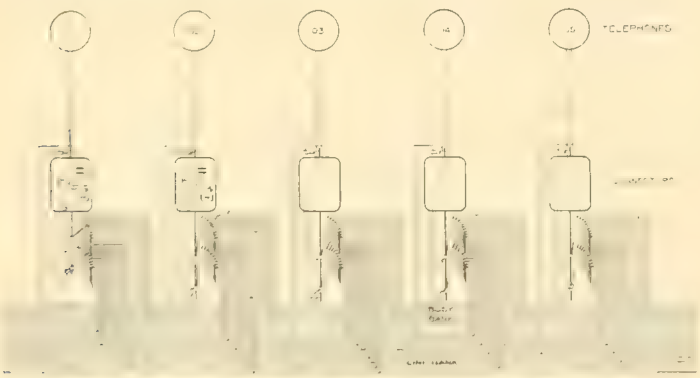
Part I.

It is probable that no field of electrical work is destined to be of greater service to mankind in promoting social amenities and commercial interchange than telephony. The time is long past when an appreciation of the telephone as an economic factor resulted in removing it from the class of so-called luxuries and placing it among the competitive necessities.

The deficiencies of any system along a particular line of activity become accentuated in proportion to its growth. In manual telephony, for instance, we find a system unable to keep pace with the requirements which public service demands. While it cannot be said that the manual systems are destined to become obsolete, it seems evident that they have reached the limit of their capabilities in many respects.

Among the requisites of an ideal telephone system may be mentioned high ratio between quality and cost, speed and precision in calling, unlimited service, privacy of conversation and simplicity of construction. None of these requirements is entirely satisfied by large manual exchanges.

The advantages offered by the automatic operation of exchanges are so numerous and attractive that this problem is now engaging the attention of every manufacturer in the field. Nor is the problem any longer speculative. More than a hundred exchanges of the Strowger type in successful operation are demonstrating the advantages of inanimate mechanism, properly directed and under direct control of the subscriber.



[illegible]

[illegible] mechanical operations may be comprehended by [illegible]

[1] [illegible]

100 pairs of lines entering the exchange. The problem presented is the connection of any one pair of lines with any other pair, automatically, by an operation performed by the subscriber at his telephone.

Let us assemble 100 groups of contacts, so-called "banks," each bank consisting of 100 pairs of contacts arranged in a vertical series of 10 levels, each level containing 10 pairs of contacts. Let these contacts be multipled together, that is, let every pair of contacts in any bank be connected with every corresponding pair of contacts throughout the bank series. Let the 100 pairs of lines thus obtained end in a terminal strip at one end of the bank series and connect each pair with a pair of lines from the subscriber's station. It is then evident that we have 100 pairs of lines connected to 10,000 pairs of contacts, and that all of these 100 pairs of lines may be reached from any one of the 100 banks multipled together.

If we now mount above each bank a mechanism capable of imparting, at the will of the subscriber at his station, a vertical and rotary motion to a shaft in such a manner that the lines attached to a pair of contacts or wipers rigidly fastened to the shaft may engage the bank contacts, it is seen at once that the connection of one line with another may readily be effected. The mechanism or "connector switch" for this purpose is manipulated by the subscriber operating over his line upon a pair of electromagnets. It is evident that each pair of lines from the telephones must terminate in three pairs of leads at the exchange, one pair going to the wipers, another pair to the electromagnets, and a third pair, called the "normals," to the bank terminal contacts.

In addition to the line-bank contacts as described another similar series of single-bank contacts multipled together in the same manner is mounted above the line banks. These are known as the private banks and are used in effecting the "trunk release" and protecting a busy line or trunk. The manner in which this is done will be taken up in order.

[illegible]

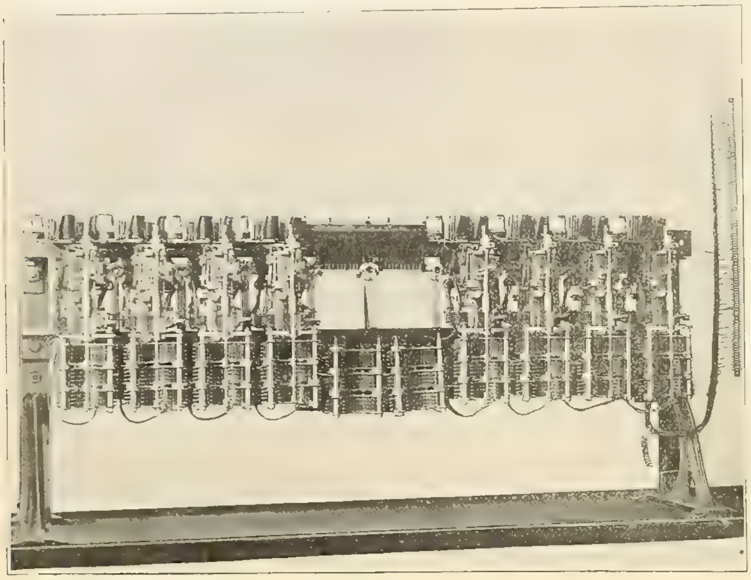


FIG. 1. SECTION OF TEN BANKS OF CONTACTS, WITH TERMINAL SWITCH ATTACHED.

FIG. 1A. SECTION OF A SINGLE BANK.

mounted upon a shelf. A section of a single bank (Fig. 1A) is given also, showing its construction and the method of insulating the contacts.

In Fig. 2 are shown, graphically, five stations, illustrating the manner in which connection is made from one station to another through the banks.

This arrangement represents the simplest manner of taking care of 100 subscribers or less. In practice, however, some degree of simplicity is sacrificed for economy of space and material and easier manipulation. Experience has demonstrated the fact that seldom more than 20 per cent. of exchange subscribers are conversing at any one time; that is, only 10 per cent. of the individual switches or "connectors" are simultaneously employed. It has been found possible, therefore, to introduce a simple and compact mechanism, called the "line switch," which selects automatically for each subscriber one of ten connectors, the other 90 now being discarded.

Each line switch operates upon a single row of 10 bank contacts only. The specific nature of these banks and the operation of the switch in selecting a particular one of ten contacts will be given under a detailed description of the line switch. It is sufficient to state here that the 100 rows of bank contacts corresponding to the 100 individual line switches have the corresponding contacts of each row multiplied together as in the case of the original connector banks described. These multiples terminate in 10 leads which are connected respectively to the relays of the 10 connectors. Normal leads are carried from the line switch to the connector bank terminal contacts. The 10 connectors are now in a position to perform through the aid of the line switch all the work hitherto requiring the entire hundred. The operation of the line switch requires no additional effort of the subscriber. When the receiver is taken from the hook and the dial started downward the line is automatically connected with a connector and the return of the dial when the dial is released operates the connector as though the lines were originally connected to it. The line switch is merely a convenient auxiliary of the system and in no sense a fundamental part of it.

By now grouping together two exchanges of 100 capacity each it is evident that 200 subscribers may communicate with one another, provided some method of intercommunication between the two groups can be devised. For this purpose it is necessary to insert between the line switch and connector another switch similar to the connector and mounted above banks multipled together in like manner as the connector banks. These switches are called selectors, since their sole function is to select a connector in one of two groups.

Obviously no more selectors are needed than connectors. Hence the 10 terminals of each 100 line switch banks are carried respectively to the relays of 10 first selectors. The banks of these 20 selectors are multipled together and the terminals of the first level of 10 contacts conducted to the 10 connectors of one group, while the terminals from the second level are carried to the 10 connectors of the other group.

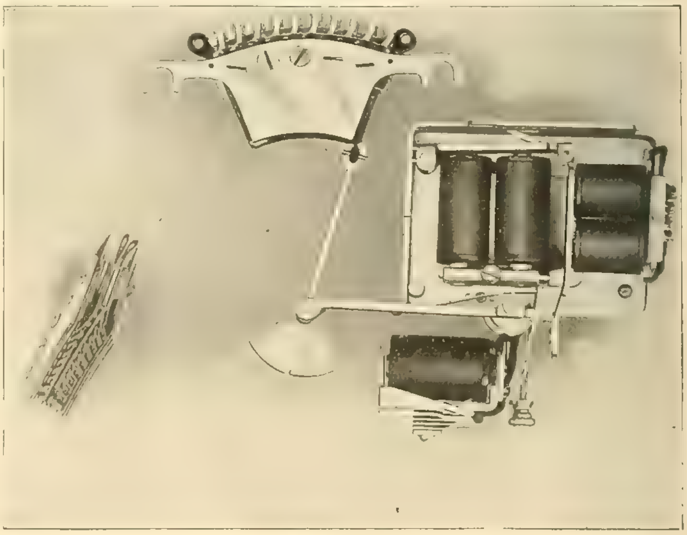


FIG. 3. LINE SWITCH.

A subscriber now wishing to call a number in the second group steps up the shaft of the particular selector to which his line is automatically attached by the line switch to the second row of contacts and engages the first contact of that row with his line wipers. His line is thereby joined directly to a connector of that group and he proceeds to make his call as in the original exchange of 100. Any one of the 200 subscribers by engaging the first contact of the second level of his particular bank will attach his line to the same connector, provided it is not already occupied. Should another subscriber, however, occupy a multiple of the con-

tact leading to that connector the wipers of the selector of the second person calling will be turned automatically to the second pair of bank contacts.

In case two or more contacts are busy the wipers will continue to rotate until a disengaged connector is found. The method of procedure in this case as well as the manner in which a subscriber is prevented from engaging a busy line will be explained in detail farther on.

Since eight rows more of the 10 pairs of contacts in each selector bank remain, it is seen that the exchange may be increased to 1,000 capacity by the addition of 100 line switches, 10 first selectors and 10 connectors for each additional 100 subscribers. As this means merely the extension of the multiples already in use so as to include those added the operation is exceedingly simple. This method of installation by which an exchange may

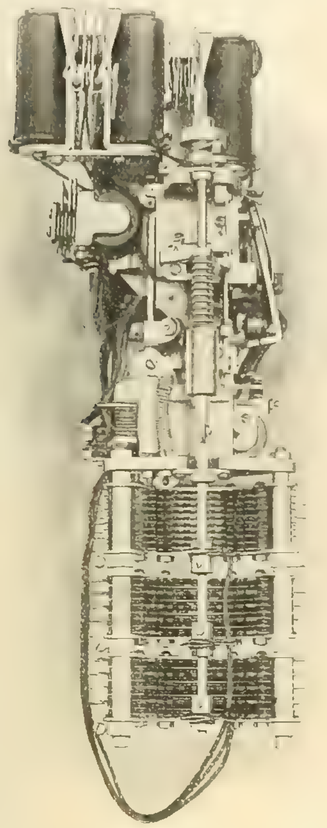


FIG. 3. COMMON-BATTERY CONNECTOR.

be said to consist of a combination of smaller exchanges, connection between which is obtained by employing a certain percentage of so-called trunk lines, is called the "trunking" system, and is the only system that is practicable for large exchanges.

As an exchange of 1,000 capacity is formed of 10 exchanges of 100 capacity each, so an exchange of 10,000 capacity is similarly derived by grouping 10 exchanges of 1,000 capacity and connecting them with the regular percentage of trunk lines. In this case it becomes necessary to interpose between the first selectors and connectors another switch called the second selector. As before, we have one line switch for each subscriber and 10 per cent. each of first selectors, second selectors and connectors. The first selector now picks out a second selector in a particular thousand group. A second selector which is not busy having been obtained, a connector is selected after the regular manner and the connection completed as in the first instance. Each group of 100 first selectors has access to 10 second selectors in each of the thousand groups of which the exchange is composed, the line switch bank contacts being multipled together in groups of 1,000 and not throughout the entire 10,000 as might be inferred. Similarly the 100 second selectors of each thousand group have access to 10 connectors in each of the hundred groups composing the thousand.

By combining ten 10,000 groups we may, by the addition of a third selector, construct an exchange of 100,000 capacity and so on ad libitum. In practice it is not customary to group all the participating smaller exchanges in one building. Thus, a 10,000 exchange may consist of two sections of 5,000 each several miles apart and connected by the necessary number of trunk lines.

Figs. 3 and 4 represent respectively a common-battery connector and line switch. The frame, which is the same for all switches except the line switch, is composed of a light non-magnetic metallic base, while the type of switch is formed by attaching to this the parts required in each instance in order to attain the desired end. It is not the purpose to enter into a detailed description of mechanical construction further than is required for [illegible] the system. The common-battery system only will be described, as this represents the latest in automatic practice.

[To be continued.]

Spanish Telephone Extensions.

[illegible] from native firms for the installation of a telephone system connecting with the French wires at the frontier towns of Irun and Portbou, the details being as follows:

The line will start from Madrid and at Zaragoza branch off in two directions, one passing through Pamplona, Tolosa and San Sebastian to Irun, and the other following the line through Lerida to Barcelona and Tarragona, and thence on through Gerona to Portbou on the French frontier, thus establishing communication between Barcelona and France. Stations will be placed at all the towns named above. The work will have to be commenced before July, 1908, and terminated within the year. The contractors will be required to link up several other towns lying near the main route.

Tenders are also solicited for the construction and working of telephone systems connecting Madrid with Coruna and Ferrol, with Pontevedra by way of Orense and Vigo, on to Gijon, Santander and several other smaller towns. This will be known as the Northwestern system. Another, the Southeastern system, will connect Madrid with Cartagena, Albacete, Alicante and Murcia, Almeria, Lorca, Linares, Jaen, Granada, Baza and Motril. Another system, to be known as the Southern Telephone system, will link up Madrid with Cadiz, passing through Ciudad Real, Almaden, Cordova, Seville and Jerez; with Malaga, by way of Bobadilla, and with Huelva, Caceres, Badajoz and Zafra.

Inasmuch as only native firms are invited to compete for these contracts, their interest for American exporters lies in the fact that large orders will naturally be given by the contractors for wire, posts, insulators and other material as soon as the contracts are finally signed, which it is expected will be in January next. American firms may or may not think it worth while to send representatives here to solicit orders. At present the telephone companies of Spain buy their wires principally in Germany and their apparatus in Paris and Stockholm. It would naturally be difficult to persuade the companies to change the system now in use. On the other hand, some of our long-distance apparatus might be profitably introduced here.

Indiana Telephone Items.

At the beginning of 1908 there are in Indiana 400 Independent telephone exchanges, 40,000 miles of toll lines and over 40,000 telephones in the homes of farmers. Franchises have been granted in every county in the state but one. Twenty millions of capital, represented by 15,000 individual stockholders, is invested in Independent telephone property in the state.

William H. Winship has been chosen assistant superintendent of the Home Telephone Company of Goshen and will be in personal charge of the Elkhart office. W. H. Shoots will give more of his time to the Goshen office. Hugh Harter has resigned and will go into business for himself.

There has been opposition to the advance in rates for telephone service in several locations. The Seymour Home Telephone Company advanced the rate of business telephones from $2.25 to $2.50 a month and residence telephones from $1.25 to $1.50 a month. Already more than 150 telephones have been ordered out, and not a physician in the city can be called today by telephone. Nearly 800 patrons of the Bloomington Home Telephone Company within the last few days signed petitions which were presented to the company asking that the proposed increased rates shall not become effective, and stating that if they are increased every signer will disconnect his telephone. The Hope Telephone Company, after deciding to increase rates, reconsidered its decision and will allow the rates to remain the same as heretofore.

The Mutual Telephone Company of Mooresville has been incorporated with a capital stock of $7,000. The company proposes to construct a telephone system in Mooresville. The directors are J. W. York, J. W. Miles, Oscar Robbins, Elis Stone and R. D. Sellers. S.

GENERAL TELEPHONE NEWS

The Montana Independent Telephone Company is about to start construction work on its new plant in Anaconda, Mont.

The Howell Telephone and Telegraph Company of Kinder, La., has been incorporated with a capital of $25,000.

The Glenn County Telephone Company has been incorporated at Willows, Cal., with a capital stock of $100,000. The directors are J. C. Campbell, A. F. Lindstrom, C. S. Donohoe, C. K. Sweet and C. L. Schaad. Mr. Campbell is president, and Mr. Lindstrom, secretary of the company.

CORRESPONDENCE.

Continental Europe.

[illegible] the subway tunnel. At present there are installed [illegible] there is erected one rotary machine of 700 kilowatts. [illegible] battery and several reserve transformers besides several smaller groups which serve for the lighting of the plant, the railroad signals and the different pumps for the air fans and the water supply.

One of the largest hydraulic systems of Italy will be the new turbine plant and pole-line network which the Ligurian company is now undertaking. It was originally designed to give current for the Royal Arsenal at Spezzia, on the west coast, but as it will have an excess of current, measures are taken to supply private lighting and power from its lines. In the future this may give a great increase to the industries which it is hoped to establish at Spezzia, and its position as a seaport will much favor this. The hydraulic supply is secured from natural and artificial basins in the Apennine region. In the turbine plant there are already set up 13,000 horsepower in machines and the plant works on the three-phase 33,000-volt system. Power lines go eastward to the cities of Parma and Reggio and the remainder pass to the west and supply Sargana and Spezzia.

In the Mediterranean region of France the Energie Electrique Company is now undertaking an increase in its system of hydraulic plants and pole-lines, which is now one of the most extensive in Europe, if not actually the largest. At present the different hydraulic and steam plants are supplying nearly 60,000 horsepower to Nice, Cannes, Monte Carlo and other coast points. Of this, 40,000 horsepower is furnished by the hydraulic plants. When all the projected plants and lines are finished the total capacity will be 150,000 horsepower and over. At present the largest plant is the Brillane station, and it has a capacity of 15,000 horsepower.

In Norway the movement in favor of changing over the leading sections of the state railroads to the electric system is very active. In view of the good results which have been obtained in the recent experimental sections in Sweden, it appears that the government has about decided to undertake the change upon a section to begin with, and this will be upon the line between Chistiania and Drammen. Current can be secured for this purpose from a large hydraulic plant in the southern part of the country. A. DE C.

Great Britain.

London, December 27.—The work in connection with the conversion of a portion of the London, Brighton and South Coast Railway to the single-phase system of electric traction has at last reached a practical stage. The supports for the overhead wires are being erected and these are seen to take the form of lattice-work columns from which are stretched an arm covering two tracks. The poles are about 12 inches square at the base, where they are deeply embedded in concrete. The cable ducts which will carry the feeders are carried alongside the track close to the poles and are supported off the ground by short struts. A new generating plant is being installed in the power house of one of the London electricity supply companies to furnish the necessary supply of energy. The reason for using bracket-arm construction on some portions of the route is that there are other tracks running parallel with the one being converted, but where this difficulty does not occur I understand that cross-suspension will be used.

Considerable attention is just now being devoted to the use of peat as a fuel for generating electrical energy. Particularly significant in this connection is the bill of a new electric power company for the northeast of Ireland, the promoters of which seek to acquire an area of 500 acres of peat lands in connection with the undertaking. The chief difficulty, of course, in the commercial use of peat is to deprive it of a good portion of its moisture; it contains about 90 per cent., and it is estimated that peat with 45 per cent. of moisture could be used in gas producers. So much attention has been given to the question of securing the raw material that a new dredger has been perfected by which it is estimated that 100 tons of peat can be secured and reduced to 50 tons containing 40 per cent. of moisture at a cost of about $30.

The County of London Electric Supply Company has just ordered a 2,500-kilowatt Curtis turbo-generating set from the British Thomson-Houston Company of Rugby. This is the fifth machine of this type that has been ordered by the County of London company, and the aggregate capacity of all the machines is 10,000 kilowatts.

The annual general meeting of the Underground Electric Railways Company of London held on Monday was probably the shortest on record for several years. It lasted about three minutes, for the reason that Sir George Gibb, who presided, preferred to reserve all his remarks until early in the new year, when a scheme will be brought forward for dealing with the company's finances.

A few months ago I mentioned that experiments were being carried out at the gardens of the Royal Botanical Society by Mr. B. H. Thwaite upon the effect of electricity on plant life. Until now these experiments have been unofficial, although the society has facilitated them by granting the use of one of their glass houses. A strong committee has now been formed, however, officially to take charge of the experiments, and the day-by-day tabulated results will be issued as periodical reports. G.

New England.

Boston, January 4.—During the last two years over 500,000 feet of copper wire has been stolen in the state of Massachusetts. Two thousand feet of electric wire was stolen the other day in Hingham. Three men have been arrested charged with the theft.

The Marlboro Electric Machine and Lamp Company, employing 275 operatives, has decided to remove its business from Marlboro to Central Falls, R. I. The reasons given are inability to secure help and lack of interest on the part of the citizens of Marlboro. The company has a capacity of 17,000 lamps daily. It has been in business in Marlboro for fifteen years.

The Alumni Association of the Massachusetts Institute of Technology announces its annual meeting for January 10th. Among the speakers will be Governor Guild of Massachusetts, President John H. Findlay of the College of the City of New York, Dr. Arthur A. Noyes, 1886, acting president of the Institute, Joseph P. Gray, 1877, president of the Boston Manufacturers' Fire Insurance Company, and Francis R. Hart, 1889, treasurer of the Institute.

The Boston Elevated Railway has begun to distribute $60,000 of gold to its employes. About 4,000 men will benefit by this. All employes who have been employed for over six months, and who have rendered continuous service without being reported for delinquencies and without having violated any of the company's rules, are eligible. This is the fifth distribution of this nature that has been made by the company.

The New York, New Haven and Hartford has issued a statement explaining the recent delays and irregularities of the new electrical service of the system between Stamford and New York. The statement gives assurance that the defects will be immediately remedied.

An order has been discussed by the Common Council of Boston contemplating municipal ownership of gas and electric plants. The order was defeated at a previous meeting. B.

New York.

New York city, January 4.—A regular electric train carrying officials will make a trial run through the Hudson River tunnels tomorrow from Hoboken, N. J., to Christopher Street station, this city. The distance is two miles. The cars are of the steel type with side and end doors, pneumatically operated. The only thing which now stands in the way of the opening of the tunnel lines from Hoboken to Nineteenth Street and Sixth Avenue, New York, is the cross-over or intersection at Sixth Avenue and Ninth Street. At this point the Ninth Street line branches off from the Sixth Avenue line. This has been anunusually difficult piece of work, but is now nearly completed.

The Society of Municipal Engineers of the city of New York will celebrate its fifth anniversary with a public dinner next Tuesday. The society now has a membership of 550 from the ranks of chief and assistant engineers of Greater New York. Its headquarters are in the Engineering Societies' Building. As an organization it has been a great help to the city in the solution of important problems. Committees of the society have been at work on standardizing of specifications in various lines.

Stockholders of the Metropolitan Street Railway, representing 15,000 out of the 95,000 shares [illegible] meeting met on Tuesday and formed a new stockholders' protective committee. The object of this committee is avowedly to seek restitution of moneys diverted from the treasury of the Metropolitan Street Railway and to place the responsibility for alleged mismanagement of traction properties through civil and criminal pro- [illegible]

[illegible] before the Board of Estimate the New Haven Railroad yesterday officially admitted it owned control not only of the New York and Portchester Railroad Company but [illegible] Railway Company. The revelation surprised those [illegible] both of the proposed electric lines, they would [illegible] only admitted the ownership but asserted his com- [illegible] from the Bronx to Portchester. He said it would be a two-track line from the Harlem River to One-hundred-and-seventy-seventh Street; four tracks from One-hundred-and-seventy-seventh Street to the city line and two tracks from there to Portchester.

Marking the tenth anniversary of Greater New York, Controller Metz on Tuesday made a forceful plea for what, in his opinion, the decade had developed as the city's greatest need, namely, freedom to expand its expenditures. His figures showed that in 1908 the city would probably need for improvements $100,000,000 more than would be obtainable by the issuing of bonds. In order to make desired and even imperative improvements, he said, it would be necessary to extend the debt limit. He favors the plan of excluding dock bonds and subway bonds, which are self-sustaining from earnings, from calculation in figuring the total of bonds against the debt limit, and is to urge a constitutional amendment for that purpose before the Legislature.

The Public Service Commission on Tuesday decided to build an East Side subway to connect with the tunnels and bridges and also tap remote sections in the Bronx. It will begin as a four-track subway at the Battery and parallel the old subway up as far as Forty-second Street; there it will swing straight up Lexington Avenue to the Harlem River. Dipping under the Harlem, it will extend to a point near the intersection of East One-hundred-and-thirty-eighth Street, where it will split into two arms. One will extend through the Bronx to Pelham Bay Park by way of Southern Boulevard and Westchester turnpike. The other will extend up Gerard Avenue and Jerome Avenue to Woodlawn road. It is the plan to build almost the entire subway underground and to do away as far as can be with the unsightly "L" section feature of the present subway. The engineers estimate this subway will cost $60,000,000. The commission will ask the Board of Estimate to authorize the subway.

Pay-as-you-enter cars will be in operation on the Fourth and Madison Avenue line of the New York City Railway within two months. That seems sure, for 136 of them already have arrived here from the Brill shops in Philadelphia. The cars have been stored in the barn of the company at Broadway and Two-hundred-and-twenty-first Street. There they are being put in readiness for operation. W.

Michigan.

Detroit, January 4.—Linden has received another lighting proposal, and the Council is now considering the offer of the Shiawassee Electric Light Company and the Light and Power Company of Fenton. The Shiawassee company offers 50-candlepower lamps at $12 per annum each, and the Fenton company 32-candlepower lamps at the same price. The Shiawassee people will give 24-hour service.

The Detroit United Railway has completed the cut-off at Grass Lake on the Detroit, Jackson and Chicago line and has reduced the running time of the limited cars. When the improvements to the power house and roadbed are completed further reduction in running time of both limited and local cars will be made. Negotiations are under way with the Michigan United Railway to give through limited service between Detroit and Kalamazoo.

The Detroit United Railway will continue to carry mail between Detroit and Port Huron, a compromise having been effected with the Postoffice authorities. Mail will be carried on regular passenger cars and distributed at the larger towns instead of on mail cars.

The Council of Dundee has granted a 30-year franchise for a street railway. The franchise provides for a maximum rate of two cents a mile and a minimum fare of five cents. Tracks must be laid in three years.

The Shiawassee Light and Power Company has applied for a franchise in Owosso. If this is granted, the Owosso Light and Power Company, which was recently incorporated, will not develop the waterpower on the Shiawassee River, for which it controls the flowage rights.

The city of Petoskey has received a proposal from William L. McManus for the purchase of the municipal electric-light plant.

The installation of a new engine and generator at the Birmingham plant of the Detroit United Railway has been completed. This, together with the new feed wires which are being strung, will greatly improve the power on the Pontiac division. D.

Indiana.

Indianapolis, January 4.—The Indianapolis-Cairo Traction Company has been incorporated for the purpose of constructing and operating an electric railway from Indianapolis to Cairo, Ill., to connect the Indiana and Illinois coal fields. The authorized capital stock of the new company is $10,000,000. The company has taken over the Eel River Railroad Company, its right-of-way and grade contemplated for a steam road along the same route a little over two years ago. The officers of the new company say that a contract is about closed with a New York firm to finance the enterprise. In addition to A. L. Hassler of York, Pa., who is president, the following-named Indianapolis men are directors in the company: W. S. Buell, John T. Figg and Charles McDermott.

The city authorities of Decatur are contemplating replacing the present street-lighting system with an alternating-current system, the work to begin next May.

The trustees of the Central Indiana Hospital for the Insane are in the market for the furnishing and installation of one direct-current generator direct-connected to a steam unit (engine or turbine), with foundations, steam connection, switchboard panel and all necessary connections.

The citizens of Knightstown have voted favorably on the question of issuing bonds to secure money with which to reconstruct the municipal light plant. The vote was very light, there being little interest shown in the matter. The Council will now invite bids for the reconstruction and re-equipment of the plant.

The Indianapolis and Louisville Traction Company has ordered plans for the construction of an east and west line between Scottsburg and Madison, with the view of ultimately extending the system to Cincinnati. The Louisville and Northern Railway and Light Company, in conjunction with the Indianapolis and Louisville line, contemplates constructing a line from Charlestown to Madison.

The interurban lines running into Indianapolis, of which there are 12, are now handling at the Union Terminal Station 430 passenger cars a day.

The Union Traction Company of Indiana common stock will receive a dividend of two-thirds of one per cent., payable January 10th.

Recently prepared statistics show that during the last year the electric railways of Indiana increased their mileage something over 400 miles, making a total of 1,550 miles in the state. The longest line in operation in the state is that of the Terre Haute, Indianapolis and Eastern Traction Company, which operates 350 miles, the next largest is the Indiana Union Traction Company, 331 miles; the Fort Wayne and Wabash Valley Traction ranks third with 150 miles, and the Indianapolis and Cincinnati Traction Company operates 108 miles. The remaining 27 companies operate lines less than 100 miles in length. All of these lines are well constructed and admirably equipped. The prospects are good for further extension the present year. The terminal station in Indianapolis ranks first in the country.

The Retherford Bros.' Gas and Manufacturing Company, capitalized at $60,000, has incorporated to manufacture electrical equipment and supplies at Terre Haute.

D. E. Berry & Co. of Evansville, with a capital of $10,000, have incorporated to establish a plant for the manufacture of electrical machinery, equipment and fixtures of all kinds. D. Earl Berry is president.

Cyrus Brousman will soon ask for bids for the installation of an electric plant in connection with his hotel in Saratoga, Ind. The plant will be of sufficient capacity to light the town, business houses and dwellings. It is proposed to run the dynamos by a large gasoline engine.

The disagreement between the officers of the Indiana Union Traction Company and the members of the executive board of the Amalgamated Association of Street and Electric Railway Employes culminated in a strike of the employes of the company operating the city lines in Muncie and Marion. The importation of strike breakers precipitated rioting and a destruction of property and injury of those who attempted to operate the cars. The State Militia is now patrolling the streets of Muncie and cars are being operated under the protection of the local authorities, assisted by the state guards. Rivalry between the Amalgamated Association and the Electric Railway Trainmen's Union is believed by some to be responsible for the trouble.

The City Council of Crawfordsville is considering very seriously a proposition from a New York company for the sale of the city electric-light plant, and the further proposition, in case of no sale, to furnish the city with a new plant to be paid for in 10 annual installments. The offer for the purchase of the plant is $46,000. A majority of the Council favor the repair of the old plant, if it can be paid for on the installment plan, while the minority of the Council and the mayor favor the sale of the plant because it has been a money loser to the city ever since it was constructed. S. S.

Illinois.

Peoria, January 4.—The Vaughn Electric Company of Decatur has been incorporated with a capital of $5,000 to carry on an electric business. The incorporators are J. L. Vaughn, L. Cochran and B. M. Rhoads.

The Utilities Company of Springfield is planning some improvements to the plant, including an addition to the power house and two new 500-horsepower boilers, together with a new steel stack. A new centrifugal pump will be installed, operated by a 175-horsepower motor. In all it calls for an expenditure of about $35,000.

The money to pay damages of the wreck on the

Illinois Central Traction Company [illegible] was expected to be [illegible] and must give the company [illegible] ing them money.

A large increase [illegible] shown in the [illegible] Illinois Traction Company for [illegible] gross earnings over the corresponding [illegible] year amount to $[illegible] [illegible] $20,180. An increase of $[illegible] gross earnings for the last 11 months [illegible] crease of $270,1[illegible] in the net earnings.

The Utilities Company of Springfield [illegible] 12 of the new General Electric Company [illegible] netic arc lights, having installed them in place of the old street lights.

At a conference held this week between the governor and the Internal Improvement [illegible] Springfield it was decided to have the commission measure the flow of the rivers that can be made suitable for commerce. The getting together of testimony to be used by the attorney-general in his suit to enjoin the private company from continuing the work on the dam at Dresden Heights was discussed. A campaign will be carried on this fall to help carry the proposition to authorize the Legislature to vote a $20,000,000 bond issue to improve the Desplaines and Illinois rivers with a view to having the deep waterway from the Gulf to the Lakes.

The Illinois Traction Company has accepted the franchise recently granted by the Streator Common Council, and, according to the agreement between the city councils of that city and Ottawa work must be commenced not later than the first of March of this year and the company must spend at least $100,000 the first year. An agreement with the Council of the city of Ottawa is contingent upon the acceptance of the Streator franchise, and it calls for the building of a new bridge across the Illinois River, the city agreeing to pay $35,000 toward the cost of it, the bridge to be used for the road and for wagon traffic. The Ottawa car line and both the telephone companies are to use the bridge and will also bear part of the expense.

The Peoria Railway Company is installing a block system on two of the lines that have a single track. V. N.

Ohio.

Toledo, January 4.—The open-winter weather experienced thus far has proven of considerable benefit to local electricians. While there is not the same activity in building operations as during the regular season, there is nevertheless considerable work under way. The prospects now seem to be good for next season.

The last barrier in the way of the completion of the Columbus, Marion and Bucyrus electric railway was wiped out recently by the payment of $2,700 to the Caldwell heirs for right-of-way. This completes the route, and the work is well under way.

The Wilson Electric Company of Canton has opened a branch store at Massillon. The new firm will make a specialty of wiring and electrical repair work. W. C. Johnson will have charge of the Massillon branch.

R. R. Hayes of Wapakoneta, trainmaster of the Western Ohio Electric Railway, has resigned to accept the position of superintendent of the Northern Indiana Traction Line, running between Michigan City and Goshen. His headquarters will be at Elkhart, Ind. He started as dispatcher with the Western Ohio six years ago.

New machinery is being installed at the power house of the Mansfield Railway, Light and Power Company at Mansfield. A large rotary transformer has already been put in position, and three others will be placed at different points between Mansfield and Ashland. A new engine and other machinery will be installed soon. H. L. S.

Northwestern States.

Minneapolis, January 4.—An ambitious scheme in electric railroading is projected by S. A. Phillips, as reported from Fargo, N. D. A company to be known as the St. Paul, Minneapolis & Seattle Electric Railway Company is being promoted to build an electric road from the Twin Cities to Fargo, N. D., thence by degrees to the Pacific coast. The plan involves separate exits from the Twin Cities in order to save time between the cities, instead of running from one to the other.

The new interurban road at Albia, Iowa, has been put in operation, although some of the work is not entirely completed.

The new dam in the Mississippi River at Minneapolis, just completed by the Minneapolis Mill Company and the Pillsbury-Washburn Flour Mills Company, has been leased to the Minneapolis General Electric Company.

George Sinn has bought the electric-light plant at Sherburn, Minn., from Peter B. Jensen.

E. S. Cameron has sold his interest in the electric-light plant at Wahpeton, N. D., to H. C. Schneider and E. M. Davidson. R.

Dominion of Canada.

Winnipeg, January 4.—The city of Port Arthur, Ontario, will expend $8,000 on the purchase of a [illegible]

[illegible] pany.

[illegible] for its electric light plant.

H. W. Kent, general superintendent of the British [illegible] G. H. [illegible] offices at Vancouver, B. C.

The board of control, Winnipeg, Man., has instructed the city engineer to obtain prices of electric street sprinklers for use on the electric car lines in the city. H. N. Ruttan, city engineer, may be addressed. R.

Pacific Slope.

San Francisco, January 4.—A lot fronting on Market Street and extending through to Stevenson Street, between Sixth and Seventh Streets, has been purchased as a site for a central office building for the use of the Home Telephone Company of San Francisco. The Home company also has an exchange site on Grant Avenue, near Bush Street.

John Nicholl has been awarded a franchise for an electric railway at Richmond, Cal.

The Board of Supervisors of Kings County, Cal., has finally awarded a street-railway franchise in that county to F. S. Granger of Hanford.

R. P. Fairbanks and James Swamson, representing the Telluride Power Company of Telluride, Colo., are in Nevada examining power sites along the Carson River. They announce that they contemplate building several electrical plants along that river to furnish power for adjacent mining camps.

The Kings River Power Company, with headquarters at Los Angeles, Cal., has filed notice of the appropriation of 25,000 inches of water from Kings River in Fresno County, to be used in the generation of electrical power for transmission to San Francisco, Los Angeles and Fresno.

Carl Shrader of Needles, Cal., has secured an electric-lighting and power franchise at Needles.

A. F. Gressler of Bisbee, Ariz., and W. D. West of Chicago have bought the electric-light and gas plant of Cottee and James at Phœnix, Ariz. The new owners give out that both the electric and gas plants will be increased in capacity.

A committee recently appointed to report on the feasibility of establishing a municipal electric-lighting plant at Portland, Ore., has submitted a report to Mayor Lane favoring the municipal plant.

The Board of Supervisors of San Francisco passed an ordinance last night requiring all overhead wires, excepting the feed and trolley wires of the electric railroads, to be buried within three years within the district bounded by Fulsome, Twelfth, Franklin, Fell, Van Ness, Bush, Dupont, Washington, Kearny, Montgomery Avenue, Washington Street and the water front. An additional ordinance will be passed requiring the immediate burial of the feed wires of the electric railroads. President Britton of the San Francisco Gas and Electric Company protested strongly, saying that it is impossible to raise money to carry out the provision of the ordinance.

President Josselyn of the Portland Railroad, Light and Power Company announces a number of changes and improvements for the immediate future. Electric block signals will be installed on the Mount Scott line, and a new dispatching system is being arranged for the Cazadero and Oregon City divisions of the system. The company has secured the Terminal Block at First and Pine streets, where a union station will be erected and to which a number of officials will be moved. During the last few days 40 new cars have been received for the Portland railway system and 15 for the Oregon waterpower system.

The Nielson-Smith Electric Company has been incorporated at Santa Barbara, Cal., with a capital stock of $25,000. The directors are F. M. Nielson, B. C. Smith, R. W. Ealand, C. W. Nielson and H. F. Nielson.

The Nevada-California Power Company has arranged to reduce the electric-lighting rates in Goldfield, Nev., 25 or 30 per cent. from the rates now ruling.

The Western Power Company has just completed the purchase of an entire block of land at White and Prospect streets, Oakland, Cal., upon which a sub-station will be built. The company's high-tension line will be run from its power plant at Big Bend on the Feather River to the new substation. A steam auxiliary plant of 30,000 horsepower is to be erected at Sessions Basin at the foot of Sixth Avenue, Oakland.

The City Council of Pasadena, Cal., has altered its plans for calling a bond election for the completion of the Pasadena municipal electric-lighting plant. The call will be for an issue of $50,000 instead of $200,000, as was at first intended.

[illegible]

PERSONAL.

[illegible]

[illegible] company's exchange at Bemidji, Minn.

[illegible] Chattanooga Electric Company of Chattanooga, Tenn.

Mr. Richard T. Laffin, who recently resigned the vice-presidency and general management of the [illegible] now has about 50 miles of electric railway.

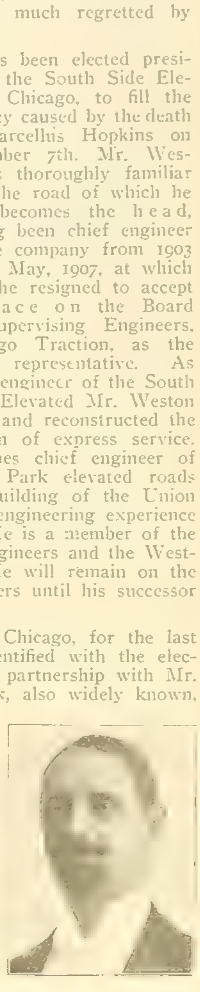
Dr. Coleman Sellers died at his home in Philadelphia on December 28th in his eighty-first year. Dr. Coleman was a distinguished engineer and was identified with many important projects. In the earlier power plants at Niagara Falls he was instrumental in the adoption of the form of hydraulic equipment to be used. He is survived by two sons and a daughter.

Mr. J. L. Dunbar, president of the Dunbar Electrical Supply Company, Oklahoma City, Okla., and district representative of the Commercial Electrical Supply Company of St. Louis, died on New Years day, in the latter city, after a short illness. Mr. Dunbar was well known to southwestern electrical men, and his death will be much regretted by friends in that section.

Mr. Charles V. Weston has been elected president and general manager of the South Side Elevated Railroad Company, of Chicago, to fill the vacancy caused by the death of Marcellus Hopkins on December 7th. Mr. Weston is thoroughly familiar with the road of which he now becomes the head, having been chief engineer of the company from 1903 up to May, 1907, at which time he resigned to accept a place on the Board of Supervising Engineers, Chicago Traction, as the city's representative. As chief engineer of the South Side Elevated Mr. Weston planned the various branches and reconstructed the main line for the installation of express service. He has been at various times chief engineer of the Northwestern and Oak Park elevated roads and he was active in the building of the Union Loop. In other respects his engineering experience has covered a wide range. He is a member of the American Society of Civil Engineers and the Western Society of Engineers. He will remain on the Board of Supervising Engineers until his successor is appointed.

CHARLES V. WESTON.

Mr. E. F. Kirkpatrick of Chicago, for the last twenty years prominently identified with the electrical business, has formed a partnership with Mr. B. S. Barnard of New York, also widely known, and the two will manufacture underground conduits and clay products under the firm name of B. S. Barnard & Co. In 1887 Mr. Kirkpatrick entered the employment of the Westinghouse Electric and Manufacturing Company in the Pittsburg office, later going to the Cincinnati branch, and in 1891 to the Chicago office. From 1896 to 1899 he was in the Chicago office of the Fort Wayne Electric Works and then became district manager of the Siemens & Halske Electric Company. When this company was absorbed by the General Electric Company he was the only salesman retained. In 1901 Mr. Kirkpatrick went with the McRoy Clay Works, remaining until January 1, 1908. Mr. Kirkpatrick will be vice-president of B. S. Barnard & Co. and will [illegible] Chicago office at [illegible] Monadnock Building. [illegible]



[illegible] KIRKPATRICK.

men enjoy a high social standing in their respective cities. Mr. Kirkpatrick is a member of the Chicago Athletic Club and other social organizations. He has many warm personal friends who will be glad to see him prosper in his new undertaking.

Mr. Charles W. Gennett, Jr., will be in charge of the new branch office and chemical laboratory which Robert W. Hunt & Co., inspecting and consulting engineers, have decided to establish in St. Louis. He graduated with the degree of mechanical engineer from Cornell University in 1898, and was employed in the drafting room of the Baldwin Locomotive Works, and later in the inspecting and testing department of the Southern Railway Company. During the latter part of his connection with that organization he was in charge of inspection work in Pittsburg and the West. Since then and up to the time of entering the service of Robert W. Hunt & Co., he was the western sales agent of the Atha Steel Casting Company, with headquarters in Chicago.

ELECTRIC LIGHTING.

F. P. Hooper contemplates establishing an electric-light plant in Lead, S. D.

Anadarko, Okla., contemplates issuing $75,000 in electric-light bonds to improve the plant.

John T. Burke has applied for a 25-year franchise for an electric-light system in Columbus, Neb.

The Springdale (Ark.) Electric Light and Power Company has been granted a 25-year electric-light franchise.

The Southern Light and Power Company of Salisaw, Okla., has been incorporated with a capital stock of $20,000.

The Consolidated Light and Telephone Company of Las Vegas, N. M., has been granted a franchise for an electric-light plant and transmission system in Las Vegas.

Graft and gross fraud are charged in indictments of the grand jury against the city electric street-lighting department of St. Joseph, Mo. Irregularities are said to have extended over a period of five years.

Philip M. Sharpless, a wealthy manufacturer of West Chester, Pa., has bought the old Meldrum tilt-mill property, consisting of house, mill and several acres of land, on Valley Creek, and will use it for an electric plant, to be operated by water-power, to furnish electricity for the lighting of his big mansion and extensive property, "The Ridge," near town. The estate occupies more than 1,000 acres.

At Hinsdale, Ill. (a suburb of Chicago), an ordinance, modeled after those in force at Toledo, Ohio, and Iola, Kan., for the regulation of electrical wiring and apparatus, has been adopted by the Village Board of Trustees and is now in force. Electricians desiring to do electrical wiring must register with the superintendent of the municipal lighting plant and secure a certificate of registration. The National Electrical Code is the established standard for wiring. The inspector is arranging to ground all transformer secondaries and will require all old wiring to be overhauled before ground connections are made.

The development of small waterpowers in Wisconsin is bringing with it lower lighting rates in many of the towns. Recently the city of Owosso received a proposition from the Shiawassee Light and Power Company of Corunna to furnish arc lights at $50 a year. The current would come from the company's dam and power house at Shiawasseetown. The company already lights Corunna and several other towns. It has two other power sites, one at Newburg with a 10-foot head and one at West Haven, where there is a 15-foot head. Owosso is now lighted under contract until 1909 by the Owosso and Corunna Electric Company at $75 a light.

In his annual report City Electrician R. H. Manahan of Los Angeles, Cal., recommends that the latest edition of the National Electrical Code be incorporated in the present electric ordinance and that the use of iron conduit for all concealed work within fire limits be made mandatory. Referring to the petition for the ornamental lighting of Sunset Boulevard he suggests the use of arc lamps, placed at intervals of 250 feet and mounted on ornamental brackets on the existing poles. During the year the expenditures for street lighting amounted to $171,165, made up as follows: Arc lighting, $139,771.65; ornamental post lighting, $30,412.47; tunnel lighting, $980.90.

ELECTRIC RAILWAYS.

[illegible] department of the [illegible] that it [illegible] electric system of the company to all other towns [illegible]

cisco via the Alameda Mole, the Oakland pier being left largely to the overland traffic.

In the year 1907 the Illinois Traction System expended $2,738,000 on extensions and improvements. This amount represents only a part of the total expenditure on some of the projects. The plan of the company for the year 1908 is to finish the work that is now under way. There is enough of this to call for much money, and it is not likely that any new extensions will be undertaken.

Secretary of War Taft has decided to create one of the new regimental posts at Bagulio, in the Philippines, and asks for an appropriation for the purpose. He also urges an enlargement of Fort McKinley reservation, near Manila, by 6,000 acres at a cost of $185,000, and the construction of an electric railway from Camp Overton, on the north shore of Mindanao, to Camp Keithley, on Lake Lanao, in the center of the Moro country.

The pay-as-you-enter plan of collecting fares tried in Pittsburg proved a failure, principally because the old equipment was used with no special arrangement for the guidance of passengers as provided on the new cars now operated with marked success in Chicago. Patrons did not adapt themselves to the plan and became impatient with the delays at the door. The plan was abandoned when a woman boarded the car with a child on one arm and some large bundles under the other. The conductor demanded her fare and the woman mumbled unintelligibly, but could not make the conductor understand that her nickel was waiting to be taken from between her teeth. The car waited and the entrance was becoming congested, when in the excitement the woman swallowed the nickel.

POWER TRANSMISSION.

The first electric power produced by the Sanitary District of Chicago to be used for industrial purposes was turned into the woodworking factory of W. M. and G. A. Gardner, Twelfth Street and Forty-sixth Avenue, Chicago, on January 2d. One hundred horsepower was turned into the plant.

The Kings Hill Irrigation and Power Company, which was organized at Boise, Idaho, has filed articles of incorporation at Reno, Nev. The company, which is capitalized at $1,000,000, plans to erect a large power plant on the Truckee River near Reno. The incorporators are Charles Hammett, Benjamin Hammett, C. B. Hurtt, E. L. Hice and O. O. Haga, all of Boise, Idaho.

Part of the hydro-electric power plant of the Chippewa Valley Railway, Light and Power Company on the Red Cedar River at Menomonie, Wis., has been completed, and 2,500 horsepower is now available. The first current from the new plant was sent over the transmission line to Eau Claire on December 21st, the switch being thrown by the young grandson of President O. H. Ingraham of the light and power company.

Denver reports say that the Central Colorado Power Company, capital $22,500,000, and the Eastern Colorado Power Company, a subsidiary organization, which practically ceased work on extensive canals and reservoirs connected with electric power schemes when the Knickerbocker Trust Company failed, will resume operations with increased forces soon. The companies will eventually supply all of eastern and central Colorado with electric power, it is said.

SOCIETIES AND SCHOOLS.

A special meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineers' Building, No. 33 West Thirty-ninth Street, New York city, January 24, 1908, at 8 p. m. At this meeting the following papers will be presented for discussion: "Electrical Engineering Education," by Charles P. Steinmetz, chief electrician of the General Electric Company, Schenectady, N. Y.; "The Best Engineering Education," by Charles F. Scott, consulting engineer of the Westinghouse Electric and Manufacturing Company, Pittsburg.

WIRELESS COMMUNICATION.

The Minneapolis Wireless Telegraph Company has been formed to install a system of wireless communication between Minneapolis, St. Paul, Duluth, Milwaukee, Chicago and Detroit. The International Vailograph Company is said to be interested in the new concern. The Minneapolis station will be on top of the Guaranty Loan Building. In St. Paul the station will be on top of the Ryan Hotel.

In the case of Marconi versus Shoemaker as to priority of invention in signaling by electromagnetic waves, which was an appeal taken by Mr. Shoemaker from a decision of the examiners-in-chief of the United States Patent Office, in which priority of invention had been awarded to Marconi, that decision has been confirmed by the commissioner of patents. The invention in issue relates to magnetic detectors or receivers for wireless telegraphy.

PUBLICATIONS.

A serviceable calendar for 1908 has been issued by the Hazard Manufacturing Company of Wilkes-Barre, Pa. This company is a large manufacturer of wire rope, insulated wire, various kinds of cables, etc.

The December issue of Peerless Drives is devoted to the application of electric power to machine drive in industrial establishments. Some interesting data are given, including a table showing the average load factors in manufacturing plants. The magazine is published by the Peerless Electric Company of Warren, Ohio, manufacturer of dynamos, motors, etc.

The proceedings of the thirtieth convention of the National Electric Light Association have been published by the executive committee in the usual attractive and substantial form. Vol. I contains the papers, reports and discussions at the Washington convention of June 4 to 7, 1907. It has about 700 pages. Vol. II contains the commercial programme and Question Box of the Washington convention and has about 400 pages.

The Germania Electric Lamp Company of Newark, N. J., has published an excellently illustrated catalogue of its standard and reflector types of incandescent lamps. The company claims quality as the principal feature of its lamps, and in the catalogue illustrates and describes the various styles and types of lamps it makes. Several pages are also devoted to Germania reflectors, together with a number of interesting light distribution diagrams.

The Western Electric Company has issued a very complete catalogue of telephone apparatus and supplies. The book has 180 pages and goes in detail into the necessities of telephone companies and users. All the instruments, tools, batteries, charging generators, switchboards, line material, etc., are well illustrated. The buildings occupied by the company in the principal cities of the country are shown. The catalogue is conveniently arranged and will be valuable to purchasers of telephone apparatus and supplies.

The United States Conduit and Construction Company, Victoria Building, St. Louis, has published an interesting booklet on conduits. It describes a new sectional concrete conduit so designed that it easily can be placed and maintained in correct position, in relation to the sections, thus insuring a perfect alignment and a clean, dry and durable conduit. Cables can be laid as the conduit is laid, eliminating manholes between stations, if desired, since the cables can be exposed at any point by taking the ducts apart. The sections lock both ways and the joints are laid up with mortar. No casing, tiling or tubing of any kind is required. There are some good illustrations of two, three and four-multiple conduits of different numbers of ducts.

A very complete switchboard bulletin, No. 19, has just been published by the F. Bissell Company of Toledo, Ohio. This bulletin lists direct-current Security switchboards covering the usual requirements of 125 and 250-volt direct-current service for isolated and central-station plants. Forty-two types of boards are illustrated and described in detail and considerable space is devoted to instruments, switches and parts for attachment to the boards. The bulletin is so arranged that anyone can arrive at an intelligent cost of a board to meet his requirements without writing to the manufacturer. This convenience and the large amount of information will be appreciated. This company also makes boards for 500-volt direct current and for high and low-tension alternating current. Boards to meet special requirements will be made according to specifications. Copies of the new bulletin will be sent on request.

TRADE NEWS.

A German merchant writes to the Bureau of Manufactures (file No. 1797) that he desires the names of American manufacturers and exporters of apparatus for oiling electrical machinery.

A member of a foreign legation (file No. 1756, Bureau of Manufactures) located at Washington desires to receive American catalogues and price lists of hardware, electrical appliances, automobiles, agricultural implements, tools, etc., as his government makes extensive purchases of goods in these classifications.

The Benjamin Electric Manufacturing Company announces that the Dale Company has purchased a license from the Benjamin company to market the line of wireless clusters which the United States Circuit Court of Appeals for the Second Circuit recently held to infringe the Benjamin patents. The Dale Company has made settlement of all past infringement not only by the Dale Company but by those who have purchased, used or sold Dale wireless clusters. In view of this settlement by the Dale Company, all those who have sold or used the infringing Dale clusters are freed from any legal action that might otherwise have been brought

against them by the Benjamin company on account of such sale or use. The Benjamin wireless clusters are marketed under the Benjamin patents owned by the Benjamin company, and the Dale Company is now authorized to market the Dale wireless clusters under the same patents.

The arrangement under the proposed plan whereby the receivership of the Westinghouse Machine Company may be dissolved and the business restored to the stockholders contemplates that the company shall issue $7,200,000 of three-year six per cent. notes for its existing indebtedness. These notes are to be secured by the company's bonds at 85 per cent. of their face value as collateral and are to be in denominations of $500 or multiples thereof. Claims of less than $1,000 are to be paid in cash. On claims exceeding $1,000 the creditor will receive the six per cent notes to the amount of the nearest multiple of $500 not in excess of the claim, the balance to be paid in cash. It is agreed further that the company will not pay dividends to its stockholders until provision has been made for the payment of all of the notes outstanding.

BUSINESS.

The American Thread Company, Watuppa, Mass., recently purchased a duplicate of the 1,500-kilowatt Allis-Chalmers steam turbo-alternator ordered some months ago. The second unit was bought through the [illegible]

The [illegible] Bannard & Co. [illegible] conduit will be furnished from the eastern or the western factory.

Dossert & Co., New York, have received orders from the American Car and Foundry Company, Berwick, Pa., for 720 Dossert solderless two-way [illegible] cars now being constructed for the Pennsylvania Railroad Company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 31, 1907.

874,932. Hair-clipping Device. Isaac N. Brigham, Melrose Park, Ill., assignor to the Electro Automatic Safety Razor Company, Orange, Cal. Application filed April 23, 1907.

A miniature electric motor imparts a reciprocating motion to the cutting blade, which is mounted in a housing provided with guideways and guard fingers.

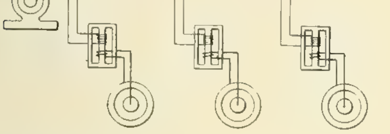
874,938. Machine and Apparatus for Manufacturing Filaments for Electric Incandescent Lamps. Francis M. F. Cazin, Hoboken, N. J. Application filed August 27, 1903.

The apparatus comprises an exhaustible receptacle, means for squirting prospective fillets or glowers into the receptacle and means for simultaneously forming the fillet into its final shape.

874,941. Electric Clock. Ulysses L. Collins, St. Louis, Mo., assignor to the Collins Electric Clock Company, St. Louis, Mo. Application filed March 13, 1907.

The armature of an electromagnet is pivoted so as to wind up a spring. An arm is pivoted to the magnet core so as to open and close the circuit.

874,944. Art of Electric Smelting. Frank Creelman, New York, N. Y., assignor to the Willson Carbide Works Company of St. Catherines, Ltd., St. Catherines, Canada. Application filed January 5, 1904.



NO. 874,944.—ELECTRIC SMELTING.

This process of electric smelting consists in subjecting the material to be smelted to electric energy of substantially uniform amperage notwithstanding variations in the internal resistance of the furnace, and regulating the furnace by means of the variations in electromotive force occurring at its terminals to restore the normal internal resistance. (See cut.)

874,952. Gas-gun. William S. Franklin, Bethlehem, Pa. Application filed February 19, 1907.

A battery and spark coil are provided for igniting the charge.

874,955. Sparking Mechanism for Explosion Engines. Louis A. Gianoli, Paris, France. Application filed January 29, 1907.

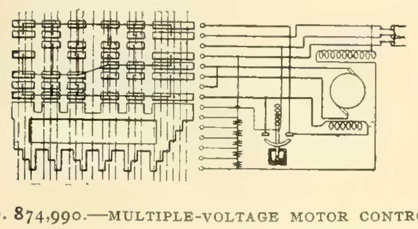
A magneto generator has its armature connected to a rotary gear meshing with two planetary gears that make connection with a number of stationary contacts.

874,977. Incandescent Electric Lamp. Charles L. R. E. Menges, The Hague, Netherlands. Application filed May 22, 1899.

The filament is formed by producing in the shape of the incandescent conductor a mixture of an oxygen compound of titanium, carbon and a non-conducting substance and heating the mixture by an electric current until the metallic titanium is reduced from its compounds.

874,979. Trolley-harp. William J. Murphy, Bridgeport, Conn., assignor to Frank B. Kennedy, New Haven, Conn. Application filed July 20, 1904. Renewed October 31, 1907.

This harp comprises a shank, a fixed arm provided with bearings, a trolley wheel provided with unitary trunnions which engage the bearings and a hinged upper arm, the free end of which rests over the trunnions.



NO. 874,990.—MULTIPLE-VOLTAGE MOTOR CONTROL.

874,990. Multiple-voltage System of Motor Control. William H. Powell, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed October 19, 1905.

The motor has a main and an auxiliary field winding. When the voltage across the armature is raised, the auxiliary winding is cut in to prevent a too abrupt change of speed. An automatic time device later cuts the auxiliary field out. (See cut.)

875,013. Carriage for Conveying Drums of Electric Cables. William A. Turner, Glasgow, Scotland. Application filed February 11, 1907.

The carriage has a frame built up of channels with depending plates at each side, a strap connecting the channels, sliding shoes in the channels and means for raising and lowering the shoes.

875,017. Electric Time-switch. John C. Van Slyke, Fort Collins, Colo. Application filed July 12, 1907.

A clock train controls the operation of a switch which is ordinarily locked.

875,028. Train-stop for Electric Railways. Ernst Woltmann, New York, N. Y. Application filed February 23, 1907.

A sectional third-rail or trolley road has circuits provided for cutting out any selected section.

875,029. Electric Switch, and 875,030, Switch for Electric Meters. James J. Wood, Fort Wayne, Ind. Applications filed April 28 and September 19, 1905, respectively.

The switch has a pair of contact bridges mounted on an arm that holds the bridges up to the stationary contacts against the force of a spring. A cam is arranged to hold the switch closed.

875,035. Electrical Igniting Device for Gas Stoves. Vincent C. de Ybarrondo, Los Angeles, Cal. Application filed May 20, 1907.

A spark plug is mounted contiguous to the burner.

875,040. Automatic Leak Indicator for Ships. Charles Bergström, Tammerfors, Russia. Application filed July 5, 1907.

A casing has a float suspended in it by means of a Cardan's suspension, means for opening and shutting off access to the casing and electric contacts adapted to be closed by the float.

875,057. Railway Tie. Eli T. Forrester, Washington, D. C. Application filed June 29, 1907.

This tie has an angular depressed portion forming a yoke. In this rests an insulator carrying a conductor embedded between the rails.

875,059. Hydro-electric Machine. Henry E. Fry, Dorchester, England. Application filed April 15, 1907.

The machine has a series of vertical diaphragms with horizontal slits in them placed one in advance of the other and separated by spaces. Means are provided for directing steam to the slits.

875,061. Ventilation of Electric Railway Motors. George Gibbs, New York, N. Y. Application filed July 24, 1907.

The car carries a blower connected by piping through the pivot of the trucks to the motors on them.

875,062. Method of Producing Camphor from Camphene, Isoborneol, or Other Camphor-producing Substances. Charles Glaser, Baltimore, Md. Application filed January 26, 1906.

This process of obtaining camphor consists in suspending isoborneol in a solution of sodium chlorid, passing an electric current through the mixture and separating the camphor.

875,063. Safety Car Signaling Device. George W. Goddard, Philadelphia, Pa. Application filed January 15, 1907.

In combination with a gong are means for preventing its normal operation, controlling mechanism for the same, adapted to be actuated by weight upon a selected portion of the car, and means for substituting for the gong a signal of a different character.

875,081. Telephone-dictating System or Apparatus. John W. Kelly, Jr., Camden, N. J., assignor to the General Acoustic Company. Application filed April 15, 1907.

A manager's and several stenographers' desks are connected by three-wire telephone circuits. The manager's station has a loud earpiece and several signals.

875,091. Electrical Alarm Device. Burnett Menkin, New Haven, Conn. Application filed July 18, 1905.

The pivoted hammer-carrying armature of an electric bell carries two spring contact arms. An adjustable contact screw contacts with one of the arms. An adjustable contact screw for the other arm is turned away from the pivot point of the armature.

875,104. Stop-motion for Looms. Friedrich Pick, Vienna, Austria-Hungary. Application filed July 19, 1905.

There are in combination, cooperating upper and lower heddle bars, a heddle [illegible] for the [illegible] electrical conducting material [illegible] surrounding the lower bar, and a contact [illegible] for the [illegible] bar, the portion of the loop adapted to engage the [illegible] being inclined.

875,105. Electrolytic Receiver. Fred C. Pickett, Kansas City, Mo. Application filed March 12, 1907.

A receiving point has a flattened and split end portion and an envelope of [illegible] material [illegible] the point so as to form a bridge by extending into the split portion.

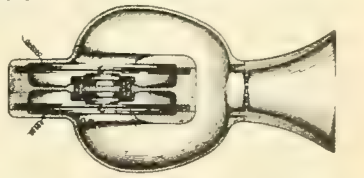
875,120. Automatic Electric Block Signal. William A. D. Short, Lexington, Ky., assignor to the Continental Signal Company. Application filed November 25, 1905.

In combination with a signal shaft is a power shaft arranged in line therewith. There are provided also an electromagnet clutch for connecting the shafts, means for controlling the clutch and means for transmitting power to the power shaft.

875,138. Telephone Transmitter. Christian Umbach, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed February 8, 1907.

This transmitter consists of a button provided with a movable electrode having an angular stud projecting therefrom, a diaphragm and means for supporting the button and diaphragm in angular relation to each other. The diaphragm has an opening through which the stud projects and a ball and socket clamping means for securing the diaphragm to the stud.

875,156. Telephone Transmitter. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed August 20, 1902. Renewed April 6, 1905.



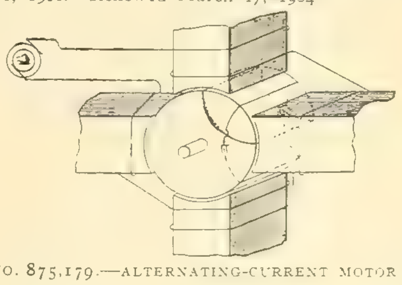
NO. 875,156.—TELEPHONE TRANSMITTER.

A pair of main diaphragms has a pair of supplemental diaphragms arranged between them. The inner diaphragms have electrode surfaces between which is granular carbon. (See cut.)

875,178. Electric Motor. Dugald C. Jackson, Madison, Wis. Application filed February 20, 1901.

A single-phase induction motor has an armature provided with electric circuits having different time constants subjected to the single-phase alternating-current field, the latter inducing currents out of phase in the armature circuits.

875,179. Alternating-current Motor. Dugald C. Jackson, Madison, Wis. Application filed April 1, 1901. Renewed March 17, 1904.



NO. 875,179.—ALTERNATING-CURRENT MOTOR.

This patent covers further details of the preceding one. (See cut.)

875,198. Electric Bond for Rails. Frank M. Marcy, Worcester, Mass. Application filed May 3, 1906.

A plug to be driven into the rail has a pocket for receiving the conductor. In driving it in hammer blows flatten out the pocket and thus wedge the conductor.

875,204. Insulated Rail-joint. Andrew Morrison, Pittsburg, Pa. Application filed April 11, 1907.

The splice bars have a rail-bearing at both head and base of the rails and insulated from them by thin strips of insulating material.

875,205. Electric Regulation. Morris Moskowitz, New York, N. Y., assignor to the United States

Light and Heating Company, New York, N. Y. Application filed January 5, 1906.

A [illegible], storage battery and work circuit are in parallel. Means for varying the voltage of the work circuit are provided and opposing electro-responsive devices controlling the voltage varying means, one of the devices being compound wound and each having a coil in the battery circuit, the coils of the compound-wound device acting cumulatively or differentially, according to the direction of current in the series coil.

875,207. Field Magnet. William D. Pomeroy, Norwood, Ohio, assignor to the Bullock Electric Company. Application filed October 30, 1903.

In a dynamo-electric machine separately removable compressible seats are provided between the coils on the pole pieces and the frame.

875,208. Process of Reducing Ferro-vanadium. Edgar F. Price, Niagara Falls, N. Y., assignor to the Central Trust Company of New York, trustee. Application filed December 29, 1906.

This process of producing low-silicon ferro-vanadium consists in producing a high-silicon ferro-vanadium by electrically smelting a charge containing vanadium oxid, silica, a source of iron and carbon, surrounding the zone of reduction and protecting the electrodes by a considerable body of the charge, and reacting on the high-silicon product with an oxidizing agent.

875,213. Secondary or Storage Battery. Hugh Rodman and George M. Howard, Philadelphia, Pa., assignors to the Electric Storage Battery Company. Application filed December 22, 1905.

Active material or material adapted to become active for the negative plates of storage batteries consists of lead or an oxid of lead containing sulphate of barium precipitated from a cold solution.

875,215. Trolley Pole. Frederick M. Ross, Newport, Ky. Application filed March 4, 1907.

A yoke is pivoted upon a post and is pressed upward by a spring. The trolley pole is also pivoted on the post and is coupled to the yoke by a latch. A trigger on the yoke disengages the latch when the pole is carried upward beyond a certain point.

875,238. Computing Meter. Warren E. Boyce, Pierce City, Mo., assignor of three-twelfths to William F. Gatewood, Pierce City, Mo., and four-twelfths to Ethelbert P. Lampkin, St. Louis, Mo. Application filed October 3, 1906.

In an electric meter there are an indicating mechanism actuated by a meter-motor, an auxiliary dial mechanism operated by a suitable weight, and an escapement regulator controlling the auxiliary mechanism.

875,258. Combined Jump-spark and Contact-spark Device. Charles R. Greuter, Wilkes-Barre, Pa., assignor to the Matheson Motor Car Company, Wilkes-Barre, Pa. Application filed June 5, 1906.

Two sparking devices are arranged for an internal combustion engine. Means are provided for actuating the devices substantially at the same time or separately.

875,259. Method of Extracting Metallic Ores and Matte. Emil Günther and Rudolf Franke, Eisleben, Germany. Application filed June 18, 1907.

Matte containing copper and nickel or concentrated copper-nickel regulus are subjected as anode to electrolytic action in a bath of copper sulphate and sulphuric acid. The anode slime is then roasted and subsequently treated with electrolyte of the previous process. The solution formed is used as electrolyte in another electrolytic process with copper-nickel regulus as anodes.

875,272. Time Stamp. Henry O. Jackson, Norfolk, Va., and Harry W. Pidgeon, Chicago, Ill., assignors to the American Clock Company. Application filed November 13, 1906.

Electric time-controlled means actuate a series of ribbons and wheels that indicate date and time of stamping.

875,279. Junction or Connecting Box. John A. McCoy, Somerville, Mass. Application filed March 19, 1906.

The end walls of the box have channels into which project the ends of a series of clips, the other ends of which project into the box for connecting with the wires. Bolts holding the clips pass through the walls and have outside fuses mounted on them.

875,280. Adjustable Hanger for Electric Lights. James McGavin, Springfield, Ill. Application filed March 2, 1906.

A revolving sheave has circumferential teeth. An [illegible] is adapted to engage these teeth so as to control the turning of the sheave.

875,284. Granular Furnace. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Application filed May 14, [illegible]

[illegible] of a refractory heating [illegible] of free granules clamped between refractory electrodes, together with a refractory hollow body embedded within the granular resistance.

875,310. Audible Alarm for Electric Cooking Vessels. James I. Ayer, Cambridgeport, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed January [illegible]

[illegible] containing a whistle.

[illegible] Bevan, [illegible] Application filed April 18, [illegible]

[illegible] entered and left.

[illegible]

Andrew J. Dull, Harrisburg, and Joseph Weatherby, Jr., New Cumberland, Pa.; said Weatherby assignor to said Dull. Application filed February 4, 1907.

The ore is first heated to desulphurize the ore and to reduce its resistance. It is then exposed to the action of an electric arc, whereof one of the electrodes can be moved so as to break off the agglomerated ore mass.

875,357. Lamp Socket. Walter R. Lambert, London, England. Application filed February 1, 1907.

A non-conducting base contains a screw shell and a central spring contact. These are connected to diametrically opposite bolts, separated on one side by a guard rib and on the other by a half ring. The line wires connect to the bolts.

875,367. Clutch Arrangement for Traveling Cranes. Andrew H. McDougall, Harvey, Ill., assignor to the Whiting Foundry Equipment Company, Harvey, Ill. Application filed May 23, 1907.

An electric motor operates the cable drums. These are connected by clutches and provided with an electric and a mechanical brake. One clutch is controlled by an alternating-current magnet.

875,376. Handle for Rotary Snap Switches. Johann G. Peterson, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Application filed November 21, 1905.

The handle has a hole with radiating grooves and a yoke whose legs fit in the grooves, in combination with a plunger having wings guided in the grooves and a spring and retaining ring held in position by the bent ends of the yoke.

875,394. Electric Heater. August Voelker, Berlin, Germany. Application filed June 6, 1906.

This heating cartridge consists of a holder containing a partition dividing it into two adjacent compartments connected at one end. These contain comminuted resistance material. The terminals connect with this at the other end.

875,406. Switch. Christian N. Bergmann, Allegheny, Pa. Application filed May 4, 1905.

The bar connecting several switch blades has a recess for each blade. A clip passes through each blade and is screwed to the bar.

875,410. Printing-telegraph Receiver. John Burry, Ridgefield Park, N. J. Application filed November 19, 1904. Renewed September 16, 1907.

There are in combination with a longitudinally adjustable type or die carrier, and means for adjusting the same, a plurality of magnets arranged to act upon the adjusting means, and means for energizing the magnets simultaneously or in different order.

875,413. Electric Signaling. Dorabji M. Daboo, Bombay, India. Application filed July 17, 1905.

An electric motor operates the signal. As soon as the signal is moved, a commutator cuts off the motor circuit and completes two local battery circuits, one containing a station indicator and the other including a locking device.

875,454. Air Brake. Edmund B. Powers, New York, N. Y. Application filed February 26, 1907.

A portable casing separately attached to the rear terminal of the train pipe contains a plunger operated by changes of pressure in the pipe so as to make and break electrical connections of a signal to the operator.

875,472. Induction Coil and Box for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Varley Duplex Magnet Company, a corporation of New Jersey. Application filed July 24, 1907.

An induction-coil unit comprises a U-shaped sheet-iron part and a non-magnetic frame assembled therewith to form a casing, and an induction coil within this casing, to which one primary and one secondary terminal are grounded.

875,483. Corn Popper. George B. Young and Joseph H. Young, El Paso, Tex. Application filed July 20, 1907.

The pan is provided with an electrical heating coil and an agitator.

875,484. Propeller. Albin A. Anderson, Mead, Neb. Application filed July 26, 1907.

This propeller has a shaft upon which the armature of a motor is directly mounted.

875,491. Alarm Circuit. Joseph F. Bastel, St. Louis, Mo. Application filed June 28, 1906.

An alarm circuit for railway rails includes conductors having spaced terminals and secured to the rails, an insulating block disposed between the contacts and fastened to the rail supporting means, and a clamp for joining the conductors together beyond the block.

875,534. Magneto Igniting Device for Explosive Engines. Henri de la Valette, Paris, France. Application filed September 7, 1905.

This magneto-electric machine has an armature, a frame mounted to swing about the axis of the armature, a magnet carried by the frame, and a distributor of induced currents also carried by the frame.

875,536. Electric Controller. Joseph Ledwinka, Philadelphia, Pa., assignor to Russell Thayer, Philadelphia, Pa. Application filed August 3, 1907.

The controller is designed to be used on a car taking current from a trolley or a storage battery. It is arranged to include a resistance in connection with the motors except when it is desired to charge the battery, and to substitute the battery for the resistance in the motor circuit when it is desired to charge the battery.

875,569. Street Indicator for Cars. Daniel W. De Sylvia, Richmond, Va. Application filed September 26, 1905.

A [illegible] rollers that are operated by electromagnets. A switch controls the current to either magnet, according to the direction it is desired to wind the ribbon with the street names.

875,581, System of Electric-motor Control; 875,582, Multivoltage System of Electric-motor Control; 875,583, Method of Control of Electric Motors; and 875,584, Multiple-voltage System of Control. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Applications filed May 6, 1907.

These four patents cover details of a motor-control system by multi-voltage supply. The armature has in series with it a number of resistances controlled by independently operated switches. Other switches connect the motor to the multi-voltage lines. All these switches and the field resistance are controlled by an operating motor. All switching operations take place in a predetermined and protected manner, so as to prevent sudden speed or armature-current changes.

875,596. Trolley-pole Retriever. Luther M. Perkins, Tacoma, Wash. Application filed May 6, 1907.

A pneumatic cylinder at the base of the pole is adapted to lower the pole when the piston is energized. The harp turns on a pivot when disengaged from the trolley wire and operates a valve in the cylinder to which it is connected, thus supplying the actuating pressure to the piston.

875,641. Apparatus for Refining Copper. Frank L. Antisell, New York, N. Y. Application filed July 5, 1906.

The special feature of the apparatus is a diaphragm adapted to be suspended in the electrolyte. It consists of a frame of non-conducting material, carrying removable panels of wood veneer.

875,643. Printing Telegraph. John C. Barclay, New York, N. Y., assignor to the Western Union Telegraph Company, New York, N. Y. Application filed April 22, 1905.

The apparatus comprises means operated by one class of signals in the line circuit for operating the printing mechanism in a printer, devices sensitive to another class of signals for operating the shift mechanism of the printer and other devices controlled by a third class of signals for causing repetition of the character last printed.

875,660. Printing Telegraph. Frederick J. Haig, Hyattsville, Md. Application filed August 30, 1906.

This telegraph receiver consists of a series of character-actuating magnets governed by a selector, a circuit controller in the main line of the printing circuit and a motor driving a power clutch which can be simultaneously engaged with the selector shaft and the circuit controller.

875,663. System of Control. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 6, 1907.

This patent covers further details of the system described in Nos. 875,581 to 875,584.

875,668. Process of Producing an Alloy for Use in Steel Casting. Maurice Meslans, Paris, France. Original application filed July 7, 1902. Divided and this application filed May 3, 1904.

The process of preparing an alloy of aluminium and calcium consists in electrolytically treating a calcium salt in the presence of a cathode of fused aluminium and subsequently removing the alloy formed.

875,676. Method of Preparing Silicon-monoxide Powder. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 10, 1905.

This method of producing silicon monoxid powder consists in highly heating vitreous silicon monoxid in an electric furnace in the absence of oxidizing gases, under reduced pressure.

REISSUE.

12,737. Fluid-pressure System. Walter J. Richards, Milwaukee, Wis. Application filed October 2, 1907. Original No. 858,470, dated July 2, 1907.

An electric motor drives the pump continuously. An electromagnetic mechanism is arranged for rendering the suction valves inoperative when maximum pressure is attained and for making these valves effective again when minimum pressure is reached.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 6, 1908:

444,067. Dynamo-electric Machine. A. G. Holcombe, Long Island City, N. Y.
444,104. Electric Arc Lamp. A. F. Reppy, Oakland Pier, Cal.
444,154. Electric Arc Lamp. J. J. Skinner, Boston, Mass.
444,169. Electric-motor Attachment for Reed Organs. L. K. Fuller, Brattleborough, Vt.
444,188. Electric Motor. C. J. Van Depoele, Lynn, Mass.
444,[illegible]17. Electrical Range Finder. B. A. Fiske, U. S. Navy.
444,245. Electric Annunciator. A. Hormel, New York, N. Y.
444,265. Electric Agricultural System. E. M. Bentley, New York, N. Y.
444,273. Swinging or Drop Arm for Electric Lamps. E. Cliff, Castleton, N. Y.
444,317. Electric-wire Insulating Cleat. L. S. Potter, Newton, and D. J. Cartwright, Boston, Mass.
444,330. Support for Electric Lamps. J. Chase, Rochester, N. Y.
444,358. Registering Mechanism or Counter Actuated by Electric Currents. R. Jewell, London, England.
444,374. Electric Switch. C. J. Wilson, Chicago, Ill.
444,377. Molding for Electric Wiring. G. Cutter, Chicago, Ill.
444,39[illegible]. Electrode for Secondary Batteries. S. C. C. Currie, Philadelphia, Pa.
444,397. Current-collecting Device for Electric Railways. R. M. Hunter, Philadelphia, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLII. CHICAGO, JANUARY 18, 1908

Third Annual Electrical Show Opened in Chicago.

The third annual Electrical Show given by the Electrical Trades Exposition Company was opened at the Coliseum, Chicago, on Monday night, January 13th. Events of the first few days point to complete success, and the exhibition is probably the most attractive of its kind ever attempted; certainly for convenient and systematic setting of the exhibit booths and for artistic decorations and harmonious and brilliant illumination this show has never before been equaled in the United States by an exhibition of like character. An attempt will be made to give a general descriptive outline of the show, reserving technical detail of the varied exhibits for next week's issue. The illustration on this page, reproduced from a photograph taken hurriedly for the Western Electrician before all was in entire readiness, gives a fair idea of the interior decorations and general effect.

The especial feature which the exposition company, under the direction of President Samuel Insull and Managing Director H. E. Niesz, planned for this year's show, and that which first attracts the eye, is the ceiling decoration. The booth arrangement and illumination is also a part of the general decorative scheme, and it represents a marked advance in point of convenience and symmetry over the rather haphazard arrangement of former electrical shows in Chicago.

Plans for the general decorative lighting were worked out by D. H. Burnham & Co., architects. The ceiling and top walls are concealed by gracefully draped bunting of white and gold, and following the contour of the bunting are festoons of incandescent lamps. Hung from the center of the ceiling is a row of eight electroliers, carrying 275 lamps each. These are of papier maché and of original design. On each side is a row of smaller electroliers having some 40 lights each. The large electroliers, which were designed especially for this occasion, are pointed at the bottom and four sides with settings of red. The most conspicuous feature of the decorative lighting is a great central canopy decorated with white incandescent lamps and studded with rosettes of red. Suspended from the canopy and fastened to the posts of adjacent booths are festoons of bunting over a large central space.

In the general decorative illumination there is a total of 10,000 electric lights, including 319 40-candlepower lamps on the posts and 13 40-candlepower one-lamp globes in the center feature. Of the remainder about one-third are two-candlepower lamps and the others four-candlepower. This does not include the eight eight-lamp clusters of arc lamps shown in the pictures above the large electroliers nor the thousands of electric lamps of different kinds shown by the exhibitors.

In the annex, where the Independent telephone exhibits are located, the same general scheme of booth arrangment, with white and gold decorations, is carried out. The building is 170 by 300 feet in dimensions and the ceiling at its highest point is 70 feet from the floor.

Direct current for the decorative lighting is taken from the Commonwealth Edison mains, and current for some of the industrial exhibits and motor [illegible] Company. Besides, there is the regular direct-current service of the Coliseum Building. Further details of the distribution will be given next week.

On the exterior the building is outlined with incandescent lamps, and three large electric signs announce the "Electrical Show" to the public. Passers-by are also attracted by the crackling and flashing of the high-voltage high-frequency demonstrations made on the roof over the main entrance.

THE CHICAGO ELECTRICAL SHOW OF 1908, NOW OPEN AT THE COLISEUM.

With the new aisle arrangement and systematic construction of the booths the large throng of the opening night, perhaps equal in number to that of a year ago, was able to view the attractions with comfort. Tiring of inspecting the exhibits, many of the visitors took seats in the balcony, where they could watch the merry throngs below and listen to the excellent musical programme while viewing the brilliant decorations. Every afternoon and evening popular concerts are given by John C. Weber and his large band. Instrumental and vocal solos are interspersed. Miss Blanche Mehaffey delights the visitors with her remarkable soprano voice.

Turning to the exhibits, there is much to attract the casual visitor seeking pastime and amusement, and still more to interest the technical observer who is on the lookout for new developments in all branches of the art.

Probably the most interesting exhibit in popular estimation is that of the Commonwealth Edison Company. Extending across the entire north end of the main floor is a series of nine rooms fittingly

representing a modern home beautifully furnished and equipped with all the electrical devices that are now making life easier and more comfortable in many homes. This exhibit is especially attractive to the ladies, and large numbers are always present. Much credit is due the company for this excellent and costly display.

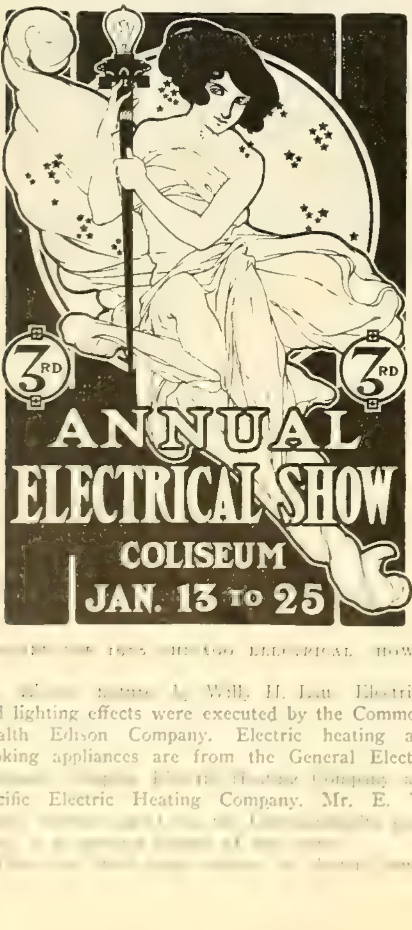
Visitors enter through the reception hall, which is equipped with three-way switches, an electric foot warmer, Hylo turn-down lamps and a silk-hat iron. Next comes the living room with its electric grate, electric piano player, electric fans, cigar lighter, telephone, beautiful fixtures, piano lamp, etc. The dining room adjoins the living room and in it are found an electric coffee percolator on the table, electric chafing dish, chime, electric tea-kettle, electric corn popper and similar devices.

The butler's pantry and the kitchen are especially interesting. In the former are installed a refrigerating machine operated by electricity, an electric plate warmer, electric toaster and water heater. The kitchen is furnished with an electric dish washer, an electric range with broilers, griddles, fry pans, etc., electric oven and other electrical devices, including coffee grinder, waffle irons, polishing machines, carpet sweeper, meat grinder, ice-cream freezer and floor-cleaning machine.

A portable vacuum cleaning outfit and an electric humidor for moistening the atmosphere in the house are kept in the laundry. Here are also found a motor-driven washing machine and wringer, electric flatirons, electric mangle and an electric ironing machine. The next room in the series is the nursery and sewing room. The sewing machine is motor-driven, and among the most useful electric devices is the nursery milk warmer. There are also a large number of electrical toys. Among the devices in the bedroom are an electric heating pad, curling-iron heater, electric vibrator for massage, electric clock, turn-down lamps, etc. The bathroom has a luminous radiator, electric shaving mug, electric hair dryer, shaving lamps, turn-down lamp, etc.

All the rooms in the electric house are handsomely furnished aside from the electrical devices. Electroliers, electric candles, luminous radiators, picture lights, etc., add to the attractiveness of the rooms. A large number of demonstrators are present to explain the use of the devices and cook food.

The "House Electrical," several views of which are given herewith, was designed for the Commonwealth Edison Company by D. H. Burnham & Co. The furnishings, draperies, paintings, bric-a-brac, rugs, tapestries, tableware, electric toys and the decorating were furnished by Marshall Field &



[illegible] ELECTRICAL SHOW.

[illegible] Electrical and lighting effects were executed by the Commonwealth Edison Company. Electric heating and cooking appliances are from the General Electric [illegible] Company and Pacific Electric Heating Company. Mr. E. W. [illegible]

[illegible]

hold devices. The Simplex Electric Heating Company has a large and attractive display, as also the North Shore Electric Company. The General Electric Company as a part of its exhibit is showing electric cooking and heating devices, and demonstrations are given. At this booth on Tuesday night a complete, dainty and appetizing meal was served to a party of ten. All of the food, in-

LOOKING DOWN THE CENTER AISLE AT CHICAGO ELECTRICAL SHOW.

cluding meat and vegetables, biscuits and coffee, cake and home-made fudges, was cooked electrically in the booth and served by Miss Potts and Mrs. Colby, assisted by Miss Lyons and Mrs. Abbott.

The most noticeable development since the last show, probably, is the advance made in new incandescent illuminants. The National Electric Lamp Association in its large booth is making a specialty of its tungsten-lamp display. The booth is illuminated with these lamps, some bare and others with glass reflectors, and there is a distinct brilliance about the exhibit. Numerous skilfully designed methods of comparing the light and efficiency of incandescent lamps are presented, and in all points the new tungsten lamp seems to take the lead. The whiteness of the light is especially noticeable. Tantalum lamps are also shown in less quantity.

One of the features of the General Electric exhibit is a demonstration of the effect of the different kinds of light on colors. Four booths are placed side by side, so arranged that light from outside sources is excluded. In each booth large pieces of silk of many different colors are arranged, the samples in each booth being exactly the same. The difference in the colors effected by the different illuminants was marked. Some colors of the silk are effected more by one kind of light than others, and vice versa.

Many other exhibitors also are showing new developments in electric lighting, extending also into the arc-light field.

In the industrial line, also, there are attractive exhibits, many practical motor installations and some novel equipments being shown. Of interest is the line of alternating-current apparatus exhibited by the Western Electric Company for the first time. This company is also making its first display of telephone apparatus at a show, having recently decided to place its product on the market for all buyers. A large display of switchboards and telephone equipment is made.

The long-distance Bell company has a booth in the main building where long-distance communication with principal cities is given free for the purpose of demonstrating the efficiency of apparatus. The Chicago Telephone Company has installed a large switchboard with complete equipment where eight operators demonstrate the working of the company's regular exchanges. The Kellogg Switchboard and Supply Company also has a large exhibit of switchboards, telephones and telephone equipment.

However, the principal telephone exhibit is in the annex, which has been turned over to the exclusive use of the Independent telephone manufacturers. Here the leading companies are exhibiting the latest designs and new developments, including the automatic systems, which will be further considered next week.

A novelty in Chicago is the De Forest system of wireless telephonic communication, exhibited by the Radio-Telephone Company of America. From a booth in the north end of the building communication is carried on with a station in the south balcony. The equipment is the same as that installed on the ships of Admiral Evans' fleet which is now making a long cruise to the Pacific.

Electrical supplies and specialties, instruments, tools, conduit, wire, line material, insulation, scientific and therapeutic devices, electrical novelties, batteries, automobiles and charging outfits, etc., all are well represented at the show, and in each line there is something of interest.

The Ozone Company of America exhibits an interesting device for purifying water by ozone intended for use in stores, schools, churches, etc. The Thordarson Electric Manufacturing Company has installed a device for purifying the air by the introduction of large quantities of ozone.

An exhibit of more than ordinary interest is the electric sign writer invented by Mr. L. I. Kahn. Installed in the south balcony of the Coliseum are three rows of universal-letter boxes with 20 boxes in a row. Each box is composed of 30 incandescent lamps, any of which lamps can be lighted at will to form an illuminated letter. By the combination of letters in the three rows of boxes signs and announcements can be flashed in big letters. The novelty of the device is that the letters are formed in the boxes simply by pressing the keys of a typewriter arrangement. This operation and the shifting of a few levers produces the contact desired and transmits the current to the boxes for the selection of the desired letter. Some difficulty in installing the connections delayed the beginning of the electric sign writing.

Demonstrations of the Brennan type of gyroscopic car were also delayed a day or two, but an exceptionally interesting exhibit is promised.

"I wonder if they have any electric snow shovels."
M'CUTCHEON'S CARTOON IN CHICAGO TRIBUNE.

In addition there are to be lectures on the subject "Wonderful Things Electrical."

In connection with the show a number of electrical organizations are to meet. Those for this week are the joint meeting of the Chicago Branch of the Illuminating Engineering Society and the Northwestern Electrical Association on Friday and the annual meeting of the Electrical Salesmen's Association on Saturday. Next week the Sons of Jove will hold a rejuvenation on Monday and the International Independent Telephone Association will hold its annual convention in the annex hall on Tuesday, Wednesday and Thursday. Several other special attractions are being arranged for next week.

The attendance at the show has been good, due partially to the fine attractions offered and partly to the efficient advertising campaign. At night large electric vans bearing large electrically illuminated signs announcing, "Electrical Show, Coliseum, Now Open," are sent through the principal streets of the city. Large posters showing the interior of the building are posted on the billboards and smaller ones of the kind illustrated herewith are also shown. The newspapers also

Living Room.

Dining Room and Butler's Pantry.

GLIMPSES OF THE "HOUSE ELECTRICAL" AT THE CHICAGO ELECTRICAL SHOW

devote considerable space to the project. One of the Chicago newspaper writers speaks of the exhibition as a "volt carnival." Everyone familiar with the work of McCutcheon, the noted cartoonist, will appreciate the accompanying reproduction of one of his cartoons in the Chicago Tribune.

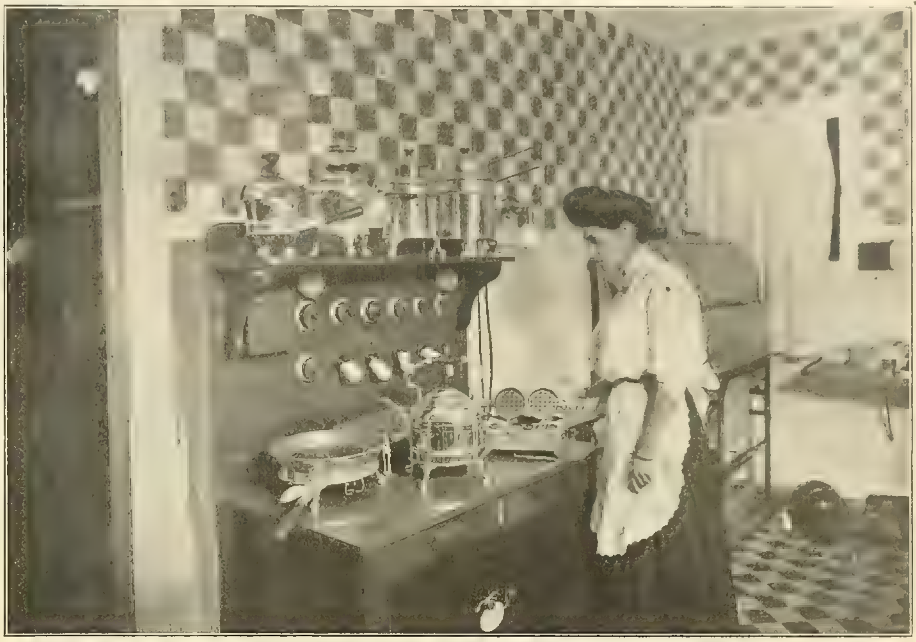
Further details of the show and the exhibits will be given in the Western Electrician next week.

Memorial Meeting in Honor of Lord Kelvin.

A public memorial service was held under the auspices of the American Institute of Electrical Engineers in the Engineers' Building, New York city, on January 12th, to pay tribute to the work and memory of the late Lord Kelvin. Prayer was offered by the Rev. Dr. W. T. Manning of Trinity Church. A resolution was unanimously adopted expressing the regret of the Institute at the death of "the greatest exponent of contemporary science; a man whose contributions to the advancement of knowledge and whose inventions for ameliorating the conditions of mankind give him place in history as one of the greatest benefactors of the human race."

President Henry G. Stott, who presided over the meeting, referred briefly to the humility of Lord Kelvin, when requesting Dr. Manning to speak of him as a Christian. The example of the great scientist in clinging steadfastly to his Christian faith was pointed out as proof that science and religion do not conflict.

Prof. Elihu Thomson, past-president of the Institute, spoke of the decedent as an electrical engineer. He said that Lord Kelvin did not believe in working for pure science only and saw a worthier motive in making available for the service of man the results of scientific discoveries. His breadth of conception and inventive genius enabled him to see the utility of many scientific principles, some of which he had himself laid bare, and to devise apparatus for the practical application of these principles. It was characteristic of his work, too, that these appliances worked in a successful manner right from the start and required little perfecting. His services in connection with the power development of Niagara and the laying of the transatlantic cables were appropriate illustrations of his engineering skill.



KITCHEN IN "HOUSE ELECTRICAL."

An address on Kelvin as a scientist was made by Prof. E. L. Nichols of Cornell University, president of the American Association for the Advancement of Science, who compared him to Von Helmholtz. His first effort was always to express the exact mathematical relation between things and then to infer the hidden relations; secondly, he tried to get at the mechanism of things when it could be seen and then to conceive it when it could not be seen. He was a great advocate of the metric system and regarded the old system as a barbarous incumbrance in computations.

ANOTHER VIEW IN THE KITCHEN.

Mr. George C. Ward, vice-president of the Commercial Cables Company and representing the Institution of Electrical Engineers, spoke of Lord Kelvin's work on submarine cables and his services to telegraphy in general. He was a pioneer in showing how to get results in these directions and kept up his interest in the developments of the art to the last.

Kelvin's services to the naval engineer were pointed out by Rear-Admiral George W. Melville, United States Navy, and his friendly relations to the American Institute of Electrical Engineers were referred to by Mr. T. C. Martin, past-president of the Institute. A sonnet, written for the occasion by Prof. W. M. Stine, was read.

Among those present at the meeting were Andrew Carnegie; Dr. M. I. Pupin, representing the American Philosophical Society; Dean Van Amringe, for the American Mathematical Society; George H. Guy, the New York Electrical Society; Dr. E. P. Roeber and Prof. J. W. Richards, for the American Electrochemical Society.

A Unique Electric Railway.

The new $3,000,000 office building erected in Washington, D. C., by the government for the members of the House is practically completed. It is connected with the Capitol by a subway, in which a small electric railway will be operated for conveying the representatives to and from their offices. The 397 rooms are free to the Congressmen, who heretofore have had to pay out of their own pockets for private offices.

The New Haven System of Single-phase Distribution with Special Reference to Sectionalization.[1]

By W. S. Murray.

The method and distance chosen for sectionalizing the high tension wires supplying power for alternating-current traction is worthy of careful consideration. Local conditions play so important a part in the correct conclusion of method and proper distance to be applied that no precedent or convention can be followed and standardization is quite out of the question.

In advance of taking up the concrete subject at hand, doubtless it will be of interest to touch upon several alternative distributing systems that were considered by the engineers of the New Haven road before the final adoption of the system of single-phase distribution and sectionalization now in service. Some of these were:

1. Three-phase, 11,000-volt generation at the power house; transmission along the right-of-way at this voltage; step-down transformers furnishing trolley voltage at 3,300; track mileage divided into three equal linear parts, each part being supplied by an individual phase.

2. The same arrangement as (1) with the exception that step-down transformers furnish 6,600 volts to trolley.

3. Three-phase, 11,000-volt generation at power house; transmission along the right-of-way at this voltage; track mileage divided into two equal linear parts, each part having its trolley connected through the transmission line to one of the three terminals of the power-house bus-bars, the remaining bus-bar being connected to the tracks, thus making a common connection for the two trolley sections.

Diagrams 1, 2 and 3, Fig. 1, represent in the simplest form the three above-described arrangements. It follows, of course, that the phased divisions in each case could be further individually subdivided into sections wherever desirable. The presentation of these three methods of distribution by no means prescribes the limit of combinations that may exist, as many others of an interesting character have been suggested.

4. Three-phase, 11,000-volt generation; transmission along the right-of-way at this voltage, only one phase being applied to all sectionalized trolley wires throughout the zone of electrification. The three phases are also carried throughout the electrification zone, and are at all points available for polyphase motors, such as would be used in railway machine shops and for the operation of motor-driven generators in local direct-current railway plants owned by the railroad company.

In Fig. 2 (which is diagram 4) there is shown diagrammatically the actual scheme of single-phase distribution which has been adopted, and is now in service.

There are advantages to be gained in any one of the above-mentioned alternatives, but the single-phase distribution as described under (4) carries with it advantages, the sum of which far outweighs the sum of the advantages in the others. In a word, the distribution, as described under [illegible] a better opportunity to distribute the load in the three-phase windings of the generators, and yet this is open to question on account of the possible unequal [illegible] tions; but the greatest and deciding disadvantage to any of the three-phase distribution schemes is the complication that results in the overhead system, together with the fact that for an equal weight of overhead copper the efficiency of the single-phase system is higher than any of the polyphase arrangements. From the foregoing, I believe it will be generally conceded that the single-phase scheme of distribution is the best.

A modification of arrangement (4), which was considered, may be mentioned; namely, 11,000-volt, three-phase generation, single-phase distribution for traction with step-down transformers distributed along the line, their secondaries furnishing 3,300 or 6,600 volts to the sectionalized trolleys. For the reason that the life hazard in using 11,000 volts was not considered to be greatly increased over that of 3,300 or 6,600 volts, and in view of the higher efficiency, lesser currents to be collected by locomotive shoe contacts, greater reliability, and the lower operating costs (no transformer substations), the advantage of the 11,000-volt direct transmission to the sectionalized trolleys was immediately apparent, and the problem became simply one of insulation.

As concerns the choice of three-phase generators in connection with single-phase distribution for traction purposes, again local conditions were the real factors that framed this conclusion. Single-phase or balanced polyphase voltages are undeniably more desirable than unbalanced ones; at the same time when proper allowance and arrangement are made for the unbalanced voltages, and there is a decided market for polyphase power, it is difficult to escape the conclusion that it is a desirable and necessary adjunct to the system. In connection with its application to the New Haven electrification, it may be said that synchronous motors will be shortly substituted for steam engines in one of our lighting plants. Such arrangements will bring about the centralization of power gen[illegible] by proper field adjustment of the synchronous motors the general power factor of the single-phase system will be raised.

An examination of the electrical connections made in and on the power house, line and locomotives would bring out the strong similarity of the New Haven system to the well-standardized direct-current (not alternating-current-direct-current) system. Indeed, I think it can be fairly said that the current in either case has the same path to follow; the only differences lie in the nature of the current (alternating and direct) and the voltage. In either case the path is from one bus-bar of the station to the feeder and trolley, thence to the locomotive, and from there to the rail and return to the other station bus-bar. In the alternating-current system are noted, of course, methods of installation common to high-tension practice.

Single-phase distribution offers an excellent opportunity for sectionalizing. As may be seen in Fig. 2, the system consists simply of the track trolleys, two auxiliary wires immediately adjacent, and the necessary switching complement. Although these auxiliary wires have been called feeder wires and while, as a matter of fact, they do serve to increase the capacity of the overhead system, this is not their principal function, as the amount of copper included in the trolleys would suffice to be within the economic figures of copper loss. The auxiliary wires are installed to serve as by-passes, in the event of it being desired to cut dead any or all of the trolley wires in any section. Thus, by this system of auxiliary by-passes, any degree of sectionalizing can be used, and any or all trolley voltages in sections can be removed without interrupting the continuity of the voltages throughout the zone.

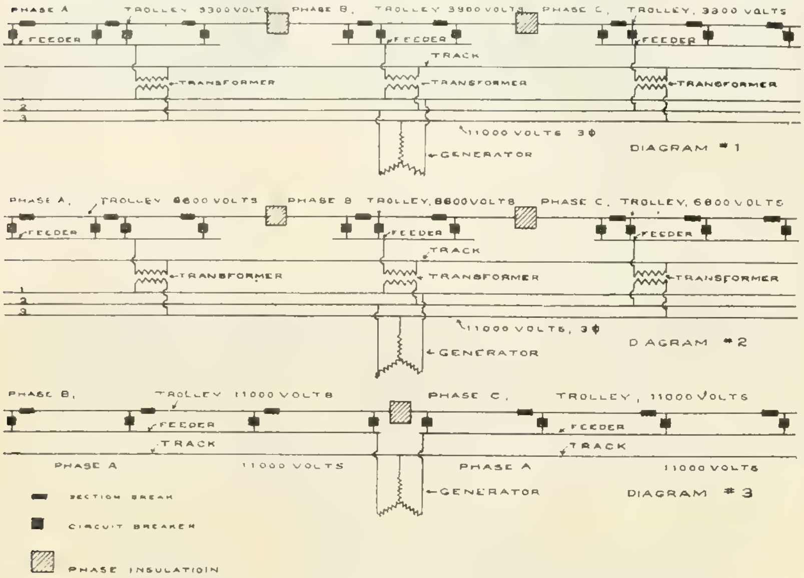


FIG. 1. PROPOSED ARRANGEMENTS FOR SINGLE-PHASE DISTRIBUTION.

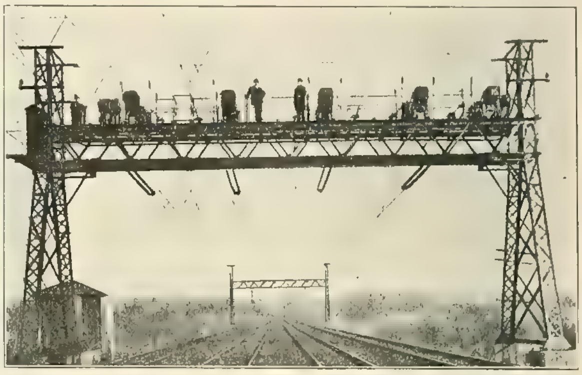


FIG. 3. SECTIONALIZING BRIDGE, OVERHEAD CONSTRUCTION.

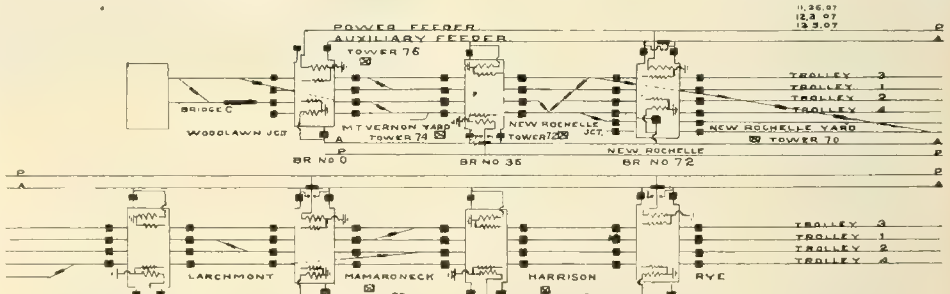


FIG. 2. SINGLE-PHASE DISTRIBUTION, NEW HAVEN RAILROAD, WOODLAWN JUNCTION TO STAMFORD.

The lengths of sections are governed entirely by local conditions. No two sections of the 14 that exist in the 21 miles of New Haven electrification are the same. The average length of sections is 1.68 miles; none of these is over 2.19 miles or less than 1.07 miles.

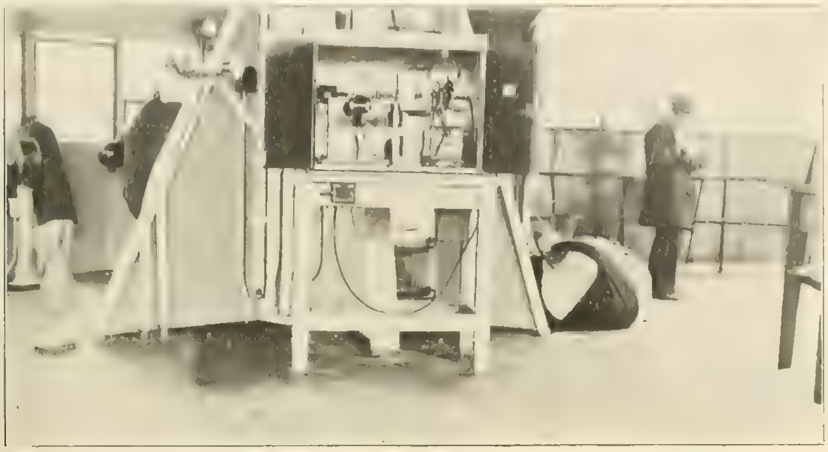
The best reason that can be assigned for the use of sections is in order that line troubles may be localized. There are many others, and some of a most important character. Indeed, it may be said that were the line absolutely immune from

[Continued on page 62.]

[illegible]

Wireless Telephones in Naval Service.

The two accompanying pictures show the De Forest radio-telephone apparatus as installed on the bridge of the United States battleship Rhode Island and on the bridge of the United States torpedo-boat destroyer Hull. These two pictures are typical of the installations on each of the vessels of the battleship fleet and torpedo-boat flotilla now en route to the Pacific under Admiral Evans. The



WIRELESS TELEPHONE OUTFIT ON BRIDGE OF U. S. S. RHODE ISLAND.

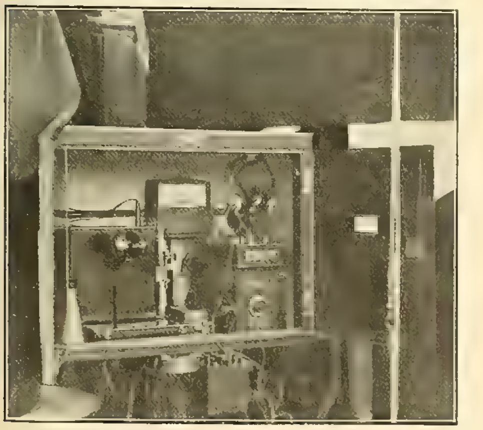
apparatus for the entire 28 installations, heretofore described in outline in the Western Electrician, was constructed, installed and tested within six weeks—a remarkable performance considering the many unforeseen difficulties attendant on a work of such novelty. During the preliminary trials messages were exchanged up to a distance of 15 miles.

An interesting and impartial but non-technical account of the actual performance of the wireless telephones under service conditions is contained in an account of the first leg of the cruise of the battleship fleet, written by Mr. Franklin Mathews, special correspondent of the Laffan News Bureau, and dated on board the U. S. S. Louisiana at Trinidad, December 24th, eight days after the fleet sailed from Hampton Roads. The following extracts are from Mr. Mathews' story:

"All the battleships are equipped with the apparatus, and there was no doubt about it, you could talk to any ship in the fleet from any other, and at times the sounds of the voices were as clear as through an ordinary telephone. At times they weren't, and there was a division of opinion among the officers as to the real value of the invention.

"Only one ship of a fleet can use the telephone at one time. While one ship is talking to another all the other ships must keep out of it, and even the ship to which the message is being sent must keep still and not break in. The receiver must wait until the sender has got all through with what he has to say, and then he can talk back.

"If an attempt is made to use the wireless telegraph while the telephone is in use the telephone goes out of commission at once, because it is ab-



WIRELESS TELEPHONE OUTFIT ON BRIDGE OF U. S. T. B. D. HULL.

solutely drowned out. The telegraph apparatus uses so much greater power that it is like a loud voice overwhelming a soft one.

"In dispatching wireless-telegraph messages from the fleet when it was about 800 miles out it became advisable to send them to the Minnesota because its apparatus is the strongest on the ships, and it could pick up Washington, Fire Island, San Juan,

after dark, apparently [illegible] had some difficulty [illegible] messages of the correspondents were therefore telephoned to the Minnesota some time during the afternoon.

"The operator at the telephone would sound a signal with some [illegible] that had the wail of a lost cat in its voice and then he would put a little megaphone into the mouthpiece of the telephone and would say, sharp and clear:

"'Minnesota; Minnesota! Minnesota! This is the Louisiana! We have a press message for you to send to the beach. We have a press message for you to send to the beach. Do you hear us? Do you hear us? Minnesota! Minnesota. This is the Louisiana! Go ahead! Go ahead!'

"Sometimes the message would fail. Sometimes the wireless, one kind or the other, would be working on other ships. Sometimes the answer would come at once, and the operator would write down the reply and hand it over to you.

"When the connection would be established fully the operator instead of reading off your press message would click it off by a telegraph key to the Minnesota's operator. That was to make sure that he would get it correctly. Peculiarly spelled words employed in cabling could not be made out by the ordinary operator, and it was taking chances to spell them out with the voice, and hence they were sent with the key, the operation really being a combination of the wireless telephone and telegraph.

"Every one of the electrical experts with the fleet is convinced that the wireless telephone is going to be of value. Most of them have talked with it clearly for distances of at least 20 miles. One difficulty is in keeping it tuned up because the wireless-telegraph apparatus is also on board.

"Some of the experts seemed to think that one service dropped in efficiency if the other were kept keyed up to its best. All were confident that as soon as certain difficulties were overcome, difficulties no more serious, they said, than the ordinary telephone encountered in the first year of its use, the apparatus would be workable as readily as a telephone on land. 'Give it time,' was the way the situation was summed up."

Horses Ride in Electric Trucks.

Pedestrians on Broadway, New York, were treated to an interesting spectacle a short time ago when three new 3½-ton Studebaker electric trucks paraded down Manhattan's chief thoroughfare. The [illegible] commercial vehicle, but the striking part of the [illegible] three trucks, the horses were the passengers, and, moreover, they seemed to enjoy the ride.

HORSES RIDE IN ELECTRIC TRUCKS.

Central American Wireless Stations.

Reports that a series of wireless-telegraph stations is to be erected at several ports on the Caribbean coast [illegible] United Fruit Company has negotiated with the De Forest Wireless Telegraph Company for the establishment of stations at Belize, Puerto Barrios, Puerto Cortez and Ceiba, probably extending the system as far south as Port Limon, Costa Rica. It is assured that wireless communication between these points and the United Staes will be in operation by the first week in February.

The United Fruit Company will serve the public, subject to censorship of all messages, retaining the privilege of refusing for transmission such messages as may appear prejudicial to its business interests. This exception to public service is due to the constant competition among the several steamship lines operating in the fruit trade between the United States and Central American ports. The business men of Ceiba are much elated and welcome the advent of the "wireless" as a factor of value to them in their commercial relations with the United States.

Electrical Utilities in Montreal.

The Montreal Street Railway Company has just closed the most successful year in its history, during which remarkable progress has been made in the extension and development of the service. It is estimated that the gross earnings of the company will show over $3,500,000, while the net earnings will amount to $1,500,000. Both these figures show large increases over the year previous. The management has under consideration elaborate plans for the extension of the company's lines, not only throughout the city, but in the suburbs, and to a number of outlying points. Operating expenses have been considerably cut down.

It is understood that the Montreal Light, Heat and Power Company does not desire to renew the contract for the lighting of the streets of Montreal. The newly incorporated company, the Beauharnois Power Company, has tendered for the lighting contract and will probably be awarded it.

Electric Express Business in Ohio.

The Cleveland Electric Package Company is about to take over all the freight and package business of the Bucyrus-Mansfield electric railway, and a new method of handling freight and baggage will be established. The company named is one which operates over all the electric roads running out of Cleveland and is conducted independent of the roads themselves, except for a general business arrangement. The company has had its express wagons delivered at the various towns and will employ agents and drivers at each place. A package depot will be established at each town on the line and a regular express conducted.

All goods shipped over the Bucyrus-Mansfield and Mansfield-Shelby lines will be called for and delivered by the express company. Probably one express car will be operated, making two round trips a day, the packages being delivered in all cases. The company's rates, it is understood, will be between 30 and 40 cents per 100 pounds. This is not particularly cheap. However, as the minimum charge has been 25 cents in the past and drayage has been charged at both ends of the line, in many cases, the express rate may be cheaper, especially for small packages.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

[illegible]

Electrical Salesmen's Association (annual meeting), Coli- [illegible]

[illegible]

THE ELECTRICAL-SHOW contagion continues to [illegible] ex-hibition, the first of its class to be successful and regularly continued. It is now announced that St. Louis is to have a show in March of this year, while the second New York electrical show will be held early in October next at Madison Square Garden.

ELECTRIC ELEVATORS have come into extended use less rapidly, perhaps, than some other types of machinry to which electric power is applied. Till quite recently central-station and other electrical interests were inclined to regard the electric elevator as an undesirable load because the heavy starting currents caused decided voltage fluctuations on the line, and it was, therefore, considered inadvisable to run electric lights and elevators from the same service wires. In the last few years, however, the electric elevator has been so far perfected that it now forms a highly desirable load, not only because it no longer causes violent voltage fluctuations, but more particularly in that it is a fairly steady long-hour load. That the electric elevator has reached a stage of development where it has to be considered in even the most difficult elevator problems is evident from its adoption in the two highest buildings in America, as was brought out in last week's meeting of the Electrical Section of the Western Society of Engineers, reported in another column of this issue. It is not likely that we shall witness a wholesale "electrification" in present elevator service, for the later hydraulic machines are doing fairly satisfactory work, but in new building and re-building construction the electric elevator is destined to play the chief role.

A LIVELY COMPETITION has been begun between American and Swedish investors in the telephone business in Mexico, which is one of the few countries where American and Swedish capital come into competition. The Mexican Telephone and Telegraph Company, which is a Bell concern with headquarters at Boston, has been operating telephone systems in the various larger cities of the country for several years. It did not hold an exclusive concession from the government, however, and when the Ericsson Telephone Company of Stockholm, Sweden, made application for a concession to install a local telephone system in the City of Mexico to compete with that of the Mexican Telephone and Telegraph Company, the government readily granted the concession. The Ericssons are large manufacturers of electrical supplies and machinery, and their installation of a telephone system in Mexico was largely in the nature of an experiment. It is said that they have invested more than $2,000,000 in Mexico in installing an underground system of conduits and establishing a telephone system to accommodate 15,000 subscribers ultimately.

The growth of the telephone in Mexico has been very rapid during the last few years. The Americans in business in that country have demanded the installation of this modern adjunct to their work, and there are now few cities without modern telephone equipment.

INVENTIONS of late years are not comparatively important, according to the Springfield (Mass.) Republican. The really important things, it maintains, are the steam engine, the power loom, the fast printing press, gas, coal-oil lamps, the railway, the steamboat, the telegraph and the submarine cable. By comparison the electrical and other devices introduced from the late '70's to the early '90's are merely luxuries. If the telephone had proved impracticable, the telegraph, says the Republican, would probably have been developed to perform the same functions, with a keyboard which anyone could operate.

This selection ignores the dynamo, the electric motor, the electric light and the telephone. If these are merely luxuries, then what are necessities? People lived and had their being before the comparatively recent day of the steam engine, the railroad and the telegraph. The luxuries of one generation may be the necessities of the next. The agonized mother who telephones to the doctor about her stricken child finds the instrument she employs a very real necessity. And as the telegraph and the [illegible] radically different in principle and operation, it is difficult to see how the former could be "developed to perform the same functions" of the telephone—that is, to transmit articulate speech—even though provided with a keyboard, as the newspaper shrewdly suggests. The Republican's list is too narrow and needs revision with additions.

A BEAUTIFUL and brilliant spectacle is provided by the third annual electrical show now in full swing in Chicago. The management of the exhibition, with taste and enterprise and a disregard of expense which deserve cordial recognition, have provided a scheme of decoration, designed by prominent architects, which elicits the unbounded praise of every beholder. Pre-eminent in the decorations, of course, are electric-lighting effects, and red and green lights are used sparingly with the ordinary bulbs to produce just the right contrast without cheapening the general effect, which is chaste, brilliant and stately. Hundreds of tungsten lamps are used in the lighting of a few of the exhibits, and from the gallery it is curious to observe how much whiter is the light from the newer lamps than that from the ordinary carbon-filament bulbs, which is yellowish by comparison. The distinction is much more marked when the two kinds of lamps are massed together than when two individual units are compared.

Not only is the exhibition beautiful but it is instructive and interesting, both to the electrician and to the man in the street. It is particularly rich in lighting appliances, household electric devices and telephone apparatus, but hardly any branch of the art is neglected, if exception be made of the street railway, power transmission and heavy machinery, which are not well suited to a popular exhibition of this character. The show is made by practical electrical men to educate the public and to set forth the advancement of the art for the benefit of the practical electrical man and the student. Very well indeed does it answer its purpose, and most worthy is it of generous support.

THE DISASTER at Boyertown, Pa., on January 12th, by which 170 persons lost their lives by the burning of the Rhoades Opera House caused a thrill of dismay to run through the country and reminded the public of the still greater losses of life due to the Iroquois Theater fire and the Slocum steamboat horror of a few years ago. One account of the fire ascribes the beginning of it to the upsetting of kerosene lamps, and of course this could have been prevented by using electricity, which, properly installed, affords the safest of all illuminants. Another contention is that the disaster was caused by the explosion of a gas tank used in connection with the illumination of a moving-picture machine. Fire underwriters have given close attention to the apparatus used in this popular and widespread means of amusement. In the "Questions and Answers" department of the Western Electrician of December 7th last, page 448, was given an account of the hazard of moving-picture machines, and the information there given has an added value in view of the Boyertown fire. It was shown that the electrical apparatus, as used almost exclusively in large cities, has little to do with the fire hazard, which mainly relates to the celluloid film, the base of which is guncotton. But in the recent deplorable fire it appears that a calcium light was used, which accounts for the gas tank. It is altogether probable, therefore, that if electric lighting had been available the Boyertown catastrophe would not have occurred. True, in the still more serious case of the Iroquois Theater fire in Chicago a tiny blaze was started by a spark from an arc lamp falling on a mass of light stage drapery. But in that case there was a most unfortunate combination of circumstances by which all protective devices were absent or failed to work, and the flame, which a man could have stamped out at first, resulted in a great disaster. The arc lamp, too, was unguarded; it seemed that everything combined to favor a terrible fatality. But, beyond question, electric lighting, properly safeguarded, is the best of all forms of illumination for theaters and public halls.

Electric Elevators for High Buildings.

The meeting of the Electrical Section, Western Society of Engineers, on January 10th was set apart for the reading and discussion of a paper on "Electric Elevators for High Buildings," prepared by J. D. Ihlder, consulting engineer for the Otis Elevator Company. On account of the illness of the author the paper was read by Mr. Smith of the Chicago office of the company. The paper was well illustrated with lantern slides. It is briefly abstracted below:

The development of the electric elevator for use in the higher buildings has been rather slow. Until the present time the hydraulic elevator has almost entirely monopolized this field. Since 1890 electric elevators have slowly come to the front. Difficulties that have had to be overcome were the complexity and unreliability of controllers, the high speed of the motors requiring reduction gearing, and the unsatisfactory nature of high-speed-drum rope driving. Now that slow-speed motors and good controllers are available, a return to simplicity in design is attainable with the result that the gearless, one-to-one, traction electric elevator is now the best type of electric elevator and the most formidable rival of the hydraulic machine.

The gearless principle has been adopted only recently, when it was found that the direct connection of the motor armature and driving sheave gave results not only perfectly reliable but highly desirable in eliminating the objectionable features of gearing. In the same way the direct traction drive was found superior to the drum drive. The one-to-one ratio permits the simplest kind of sheave and rope rigging. All these features are in line with the general rule that the simplest device is the best.

In this traction electric elevator, which is particularly adapted to high-speed service in high buildings, the motor is usually installed at the top of the hatchway, although in some cases it is placed in the basement. Four to six ⅝-inch ropes are generally used. They are run up from the car, over the driving sheave, around an idler sheave, again over the driving sheave and idler and finally down to the counterweight. Each rope thus makes two half turns over the driver, which has been found amply sufficient to give the maximum tractive effect required. The idler sheave gives a convenient way for directing the ropes so that the counterweights may be run in any desired portion of the hatchway and at the same time affords a means of bringing the ropes to another portion of the driver for their second half turn about it.

The motors used are either straight shunt or of the cumulative compound type, in which the series field is in action only at starting to give a better starting torque and is effectively cut out as soon as running speed is attained. The motors are usually about 35 horsepower and run at 60 revolutions per minute with a maximum efficiency of 87 per cent. and an average efficiency over 80 per cent. from six to 40 horsepower. The method of control is simple and automatic. In stopping, the armature is short-circuited by a low resistance and thus acts as an effective electric brake. The operator cannot lose control of his car. Safety switches at limiting points near top and bottom of the hatchway cut off the power and apply an automatic brake. Other usual safeguards are provided as well as special oil buffers at the limits of motion of the car and counterweight.

In comparing the electric and hydraulic elevators it is to be noted that the former consumes power proportional to the load. This is not true of the hydraulic machine, whose energy consumption is almost constant regardless of its live load. The traction-type electric machine does not vary in speed with load as does the hydraulic. It also makes a more rapid start and stop and therefore gives a higher speed service. Furthermore, it is equally as safe as the best hydraulic elevator. If properly installed and operated, it is more efficient than the hydraulic. On the other hand, the starting power required in the electric is greater than in the hydraulic, and this lowers its ultimate efficiency somewhat. The best comparative tests under like operative conditions showed an efficiency of 54.7 per cent. for the hydraulic elevator as compared with 70 per cent. for the electric. In each case the machine was of the type acknowledged to be the best of its class.

The discussion was opened by Chairman D. W. Roper, who declared that the design of elevators for high buildings was undoubtedly the greatest of elevator problems, and on account of the increasing importance of this class of service it deserved careful consideration. Electrical men believe their elevators are the equal or superior of the hydraulic machines.

Mr. Smith, in answer to a question about the energy consumption of the traction type, said the results obtained under average conditions with a car travel of some 20 miles a day showed an average consumption of 2.6 kilowatt-hours per car-mile.

S. M. Bushnell of the Commonwealth Edison Company stated that some years ago central-station men looked askance at the electric elevator and considered it undesirable as a load because [illegible] the heavy starting current it required and the bad effect it consequently had on the voltage of the system. Now, however, it forms a highly desirable load, since the starting currents are no longer excessive. The electric elevator he considered the last link in the chain of service supplied to office buildings from the central station. Direct comparison of the efficiencies of the electric and the straight hydraulic elevators is hard to make on account of the difficulty of measuring the input of the latter. However, where hydraulic elevators are operated by motor-driven pumps, he found that the latter require about twice the energy that the straight electric does. In a two-day test of an electric traction elevator installation 2.52 kilowatt-hours per car-mile was the average result. Results probably run up from this figure to about three in actual practice.

J. W. Mabbs, chief engineer of the Board of Trade, declared that great emphasis had been laid on the safety of the traction elevator described, yet it seemed to him a fallacy to surround with various safeguards a machine that was itself unsafe in principle. He therefore wished to present an elevator that was safe in principle and was provided with additional safeguards besides. He then gave an illustrated talk on the Mabbs electric elevators installed in the Board of Trade. These employ the driving motor as counterweight. The motor travels up and down half the height of the building, propelling itself through worm and spur-gearing meshing into vertical racks. The cars are six by six feet, an unusually large size, and the service load per car is said to be the heaviest in any building in the country. The energy consumption averages 3.44 kilowatt-hours per car-mile. The elevators they displaced took 5.5 kilowatt-hours per car-mile. The machines work with entire satisfaction, accelerate and stop rapidly and smoothly and operate efficiently and with exceptionally small maintenance costs. The use of the wormgear affords an absolute check on the car running away. These gears run smoothly in oil and give no trouble whatever.

Mr. Smith said the traction-type electric elevator he had described was adopted at the Springer Building and the Metropolitan Tower in New York city, these buildings being from 600 to 700 feet high. This was sufficient proof of the safety of that type of machine. Hydraulic elevators could have been used—in fact, they are used in the Eifel Tower in Paris.

Albert Scheible asked what were the determining elements that brought about the selection of this elevator in preference to the hydraulic. The reasons were then stated to be principally the high value of space in these buildings; the machinery for the hydraulic elevator takes up much more room than that for the electric. Furthermore the latter is fully as safe as the former and doubtless more efficient.

The discussion was concluded with the consideration of the value of tightly closing in the base of the hatchway so as to form a large air cushion for any dropping car. This plan devised by Mr. Ellithorpe, was said to be an excellent safeguard when properly installed. But if not properly designed it is a death-trap, as was proved by the fatal conclusion to an experiment by its inventor. In order to be effective the cushion must extend to one-fifth the height of the shaft, which makes the scheme almost prohibitive in expense.

Faraday Society.

A regular meeting of the Faraday Society was held on December 17, 1907, in London, England. Dr. F. Mollow Perkin, treasurer, was in the chair. Dr. F. G. Donnan, in the absence of the author, read a paper on "A Physico-chemical Study of the Complex Copper Glycocoll Sulphates," by J. T. Barker, B.Sc.

The paper dealt with the constitution of the blue solution formed when glycocoll is added to copper sulphate solution. It is probable that the concentration of the cupri-ions has been lowered by the formation of complex cupri-glycocoll kations, and experiments are described to investigate this question. Electrical measurements and the application of the mass law point to the existence of complex ions of the formula $[CuG_4]$ and the corresponding sulphate $[CuG_4]SO_4$. Freezing-point measurements on the whole confirm this. Crystallization experiments show that the first addition of glycocoll to a solution of $CuSO_4$ produces undissociated copper glycocoll with an increase of free H_2SO_4. This initial action is soon brought to a stop by the increasing H concentration, and after this further addition of glycocoll results mainly in the formation of complex copper glycocoll kations. Conductivity experiments strikingly confirm this supposition.

Dr. F. Mollow Perkin read a paper on "The Discovery of the Alkali Metals by Davy; the Bearing of the Discovery upon Industry." The lecture was illustrated with lantern slides. After a short biographical sketch the author referred to Davy's early experiments on galvanism, which began in 1800 and culminated in 1807 in the electrolytic decomposition of the fused alkalies, caustic soda and caustic potash, described on November 19th in the Bakerian lecture before the Royal Society entitled: [illegible] position of the Fixed Alkalies, and the Exhibition of the New Substances which Constitute Their [illegible] Bodies." Davy's experiments are described in detail, and it is shown that the electromotive force [illegible] the current he used something under one ampere. The subsequent experiments on the decomposition of the alkaline earths, by which calcium, strontium, barium and magnesium in the form of amalgams were obtained, are then described.

[illegible] other matters, the industrial manufacture by Wöhler in 1827 of potassium, and by Ste. Clair Deville in 1854 of sodium, Watt's suggestions 1851) for electrolyzing fused sodium chloride, Castner's chemical sodium process (1886) and his electrolytic process (1890), Rathenau and Suter's sodium process, Becker's process, and the process of Darling, who electrolyzed fused sodium nitrate, using porous partitions.

Industrial Education to Be Discussed in Chicago.

The annual meeting of the National Society for the Promotion of Industrial Education will be held in Chicago on January 23d, 24th and 25th. The meeting will open with a dinner at the Auditorium Hotel on Thursday evening. The subsequent sessions will be held in the Art Institute. On Friday three public meetings are scheduled—9:30 a. m., 2 and 8 p. m. On Saturday another public meeting will be held in the morning and the annual business meeting will take place at 3 p. m.

At the banquet and public meetings a large number of important addresses and discussions are announced. The principal themes that will be considered are: "Industrial Education as an Essential Factor in Our National Prosperity," "The Apprenticeship System as a Means of Promoting Industrial Efficiency," "The Place of the Trade School in Industrial Education," "The Wage-earner's Benefit from Industrial Education," "The True Ideal of a Public-school System that Aims to Benefit All."

Among the speakers are to be Mr. Theodore W. Robinson, first vice-president Illinois Steel Company; Dr. Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching; Hon. Carroll D. Wright, president of Clark College; Dr. V. C. Alderson, president Colorado School of Mines; Mr. E. G. Cooley, superintendent of schools, Chicago; Mr. W. R. Warner, Warner & Swasey Company, Cleveland, Ohio; Dr. Charles W. Eliot, president Harvard University. Dr. Pritchett is president of the society.

Societies Elect Officers.

At the annual meeting of the Illuminating Engineering Society in New York city on January 10th the election of officers for the ensuing year was announced to be as follows:

President—Dr. Louis Bell, Boston.

Vice-presidents—Arthur Williams of New York and C. E. Stephens of Pittsburg.

Directors—W. H. Gartley of Philadelphia, M. K. Eyre of New York and Bassett Jones, Jr., of New York.

General secretary—V. R. Lansingh, New York.

Treasurer—A. H. Elliott, New York.

The Electrical Section of the Western Society of Engineers, Chicago, elected the following-named officers at its meeting last week:

Chairman—D. W. Roper, Commonwealth Edison Company.

Vice-chairman—Henry R. King, Western Electric Company.

Member of executive committee—Edward N. Lake, Board of Supervising Engineers, Chicago Traction.

Institute Meeting in New York.

At the meeting of the American Institute of Electrical Engineers held in the Engineers' Building, New York city, on January 10th, 117 associates were elected and several associates were transferred to the grade of member.

Mr. W. S. Murray of New Haven, Conn., read a paper on "The New Haven System of Single-phase Distribution with Special Reference to Sectionalization." Mr. Ernst Alexanderson of Schenectady read a paper entitled "A Single-phase Railway Motor." Those participating in the discussion were L. B. Stillwell of New York, O. S. Lyford, Jr., of New York, B. G. Lamme of Pittsburg (communicated), W. B. Potter of Schenectady (communicated by F. H. Shepard), W. L. Slichter of Schenectady (communicated), Dr. C. P. Steinmetz of Schenectady and the authors.

Abstracts of Mr. Murray's paper and the discussion relating to it are given in this issue of the Western Electrician.

The New Haven System of Single-phase Distribution.

[Continued from page 58]

trouble, such as grounding, mechanical failures, etc., there would still be many good reasons for sectionalizing it, and these reasons will develop as the subject is further studied.

One of the most attractive features of single-phase distribution is the elimination of sub-stations with their fixed and operating charges, and, unlike the alternating-current-direct-current scheme of distribution, where the length of section is settled by the equation of load and copper to meet it, the single-phase system is not bound by these limiting electrical conditions. Line loss is forgotten in the establishment of a mechanical construction, the amount of copper in which is only a fraction of the amount required for an equivalent loss for the same amount of power transmitted in the alternating-current-direct-current systems. This convenience of transmission, with low loss, permits sectionalizing ad libitum, and the local conditions are accorded almost the entire privilege of decision. The advantage of such a relation between operation and distribution was immediately apparent to Mr. E. H. McHenry, vice-president of the New York, New Haven and Hartford Railroad Company, whose suggestion that the electrical and train-signal blocks be made co-terminus was adopted. It will be noted, then, that of the 14 electrical sections between Woodlawn and Stamford, nine of these are co-terminus with the signal towers. In each of these towers there is installed a small panel containing the pilot switches controlling the trolley (and by-pass) circuit-breakers installed on the anchor bridges. Aside from the economical features of this scheme of control, as no operators other than our present signal operators are required, the value of placing the distribution in the hands of this class of men is most important. Their constant attention to matters pertaining to the operation of trains bring about the attention which should be accorded to the distribution of current, their thorough understanding of the conditions of traffic on the various tracks permitting the most intelligent handling of electrified and de-electrified trolleys, assuring at once prompt and reliable service in the matter of handling a situation when cross-overs have to be made on electrified tracks, and while repairs are being made on others from which the voltage has been removed.

The value of placing the distribution system in the hands of the signal operators may be again illustrated by saying that should an electric train run past a stop-signal set by the operator, or should the operator desire to stop a train in his block, he has only to trip the pilot switch controlling the trolley circuit-breaker, from which the train is drawing its power, and signal the operator in the adjacent tower to do likewise. The individual value of this protective perquisite is an illustration of the use of sectionalizing outside of the question of line troubles.

As before stated, it is impossible to elect some standard distance for sectionalizing the line and then apply it to a steam road undergoing electrification. It is possible to conceive of an entirely new electric line subjected to this hypothetical course of procedure, but even in this extreme case it is difficult to escape the exceptions that could be taken to it; for example, what a strange coincidence it would be to find 50 towns just two miles apart along a railroad's right-of-way. On the other hand, how important each town would be whereat to locate a signal tower with its complement of electrical equipment.

In the discussion of sectionalization it would seem proper, therefore, that, instead of specifying the length of sections, to specify the number to be used over a given total distance; their individual length varying in accordance with the local conditions peculiarly related to them. Upon this basis it will be interesting to enumerate the following advantages and disadvantages peculiar to a choice of a "small number" and a "large number" of sections over a given distance. In this table it should be remembered that usually the items of advantage for the "small number" of sections will be items of disadvantage for the "larger number," and vice versa. Also it is assumed that the [illegible] right of way average about 1½ miles apart, and that electrical sections of this length, or longer, will be classed as a "small number" and sections shorter than this will be classed [illegible]

[illegible] "large number" of sections is as follows:

[illegible]

[illegible]	[illegible]
2 Less switches to maintain.	2 Greater section of track cut [illegible] tage, however, related to cross-overs.
[illegible]	3 Larger section breakers re-[illegible]
4 Less cost.	

[illegible]

to say, the work-train service, in either case, would be about the same, and the structures to be put up of a character which would require much the same general superintendence and engineering.

In the case of the long sections it would, of course, be necessary to splice the messenger cables, as they could hardly be manufactured on single reels greater than two miles in length, but the splicing process would not be a matter of great inconvenience, and would not detract from the value of the cables.

On the other hand, in the case of the shorter sections, a greater number of anchor bridges would be required for the supply of sectionalizing switches, but this form of structure would not increase, to any extent, the difficulties of erection, nor would the placing of apparatus upon them interfere with regular traffic.

The last six months of operation have offered the opportunity for a collection of valuable data, and the following observations and recommendations are offered in the hope that they may be of some value to other engineers interested in the electrification of steam roads:

1. In one, two, three or four-track railroads, the single-phase distribution should include, besides the trolley wires, by-passes or feeders.

2. Electrical sections should not average less than 1.5 miles in length; greater averages are entirely acceptable and individual lengths should be governed by local conditions.

3. Twenty-two feet is a safe general working distance of trolley from rail.

4. The de-insulating effect of steam locomotive stack discharges is a most important consideration to be kept in mind in the matter of properly insulating high-tension wires from ground.

5. High insulation factors should be used where high-tension construction, due to low bridges, is brought nearer the rails than the normal height of 22 feet. Strong mechanical shields should be used to deflect locomotive blasts from messenger insulators at low bridges. Care should be exercised in the installation of these shields, so that high-tension conductors and ground are at safe working distance. Wherever possible, insulators should be installed away from the direct line of the locomotive blast.

6. Auxiliary wires in connection with the electrification, if they cannot be carried over highway bridges as aerial conductors, should not be carried under, unless they are enclosed in lead-covered cables, with end bells properly enclosed in suitable housings at points where the conductors change from aerial to lead-covered cables.

7. All circuit-breakers connecting feed wires (or by-passes) to the trolley bus-bars should be equipped with time relays, so that any short-circuit will immediately open the trolley breakers, thus locating the trolley section grounded. Equipping the feeder breakers with time relays insures continuity of voltage on wires not affected by the short-circuit. Each trolley-breaker pilot switch should be provided with a light to indicate when it opens, and an announcer bell should ring in the signal tower at the same time, so that the operator is promptly notified.

8. On account of deleterious influences of weather and locomotive-stack discharges, together with general inconvenience of getting at bus-bars and switches when installed on anchor bridges, all section oil switches should be installed in switch houses, erected at the side of the tracks, with lead-covered cable connections between trolley and switches.

9. Signaling should be arranged so that the operator can prevent the engineer from spanning two sections by his locomotive shoes in the event of the advance section being grounded.

10. All signal towers should be interconnected with a reliable telephone service. Immunity from electromagnetic and electrostatic disturbance in the telephone system can be secured by using twisted-wire pairs, enclosed in lead-covered sheath, the sheath being grounded frequently. This suggestion is more particularly applicable to the interrupted or tower-to-tower telephone system. In this case the distance of exposures of the telephone wires is not great, and thus the summated effect of electromagnetic induction is negligible. In the case of the through telephone line, where the circuit is uninterrupted throughout the zone of electrification, again the lead sheath and twisted pair are respectively effective in removing all static charges and electromagnetically balancing the circuit; but on account of the cumulative action of the electromagnetic induction, either compensating transformers or a system of impedance coils installed across the telephone circuits at intervals of two miles (this distance may be less, depending on the electromagnetic density) with their central points grounded should be used. Either method will satisfactorily remove the impressed voltage due to electromagnetic induction. The importance of reliable telephone service between operating towers [illegible]

After finishing the reading of his printed paper Mr. Murray said: "The discussion of double or single-catenary construction on main-line electrification was intentionally omitted from the paper. A choice of the one or the other must be a compromise [illegible] consideration, the principal one being the number of tracks to be electrified and local conditions, but there is one fact that has been conclusively demonstrated to me—viz., either the trolley wire or the trolley shoe must be flexible, whether the construction be for main or branch lines. Of course, in the single-catenary construction a flexible-contact conductor is provided. In the triangular construction the contact conductor is rigid. This requires a flexible shoe, which, in a degree, is secured by the spring pantagraph arrangement. Experience, however, has forced upon me the conclusion that the pantagraph must be still further supplemented by a light but strong mechanism, which will insure flexible contact between the shoe and trolley wire, thus not offering a great deal of inertia in movement when the shoe meets the hard spots of the line, which exist at the catenary-hanger points.

"A form of construction we have adopted in our East Port Chester yard, in which the latitudinal catenaries are supported by cross-catenaries (in some cases spanning as many as 10 tracks) has about it a great many attractive features, and I am not too sure but that experience will not bring out the possibility of using the cross-catenary for main-line work. Such an arrangement, if more frequently reinforced with cross-bridge anchorages, such as now used in the New Haven electrification, will bring a lighter and cheaper construction and possibly afford a greater opportunity in insulating the overhead system from ground. I can see no reason why single-catenary spans need be made any less than those used in the double-catenary construction, as the cross rigidity that may be desired can be obtained by tying into adjacent latitudinal catenaries, all of which, of course, are subject to the pull-off construction at present employed. Of course, there are a great many pros and cons about this, and again we are forced to the conclusion that today is not the time for standardization, as it will pay not to accelerate our conclusions at a greater rate than the operating evidence upon which they should be based.

"Still another point that has not been touched upon in the paper is the great flexibility offered in the double-switch arrangement of supplying power to a trolley wire at the two extremities of its section. It is readily seen that if trouble exists in one of the circuit-breakers supplying a trolley wire in any given section, this switch can be immediately cut out and all the power supplied from the remaining switch at the other end. This flexibility, of course, is secured in virtue of the low loss due to high-tension transmission and the employment of by-passes or feeders, to which previous reference has been made."

Discussion (in Part).

L. B. Stillwell, New York: I think that the Institute is to be congratulated upon the attitude of the New Haven road and its engineers in frankly disclosing not only their successes but their difficulties. The paper is one of a class of which I think we might have more to advantage, namely, of a class describing actual work. I think that a criticism of the layout of feeders and supply circuits in general for these large distributing plants, and particularly for railway service, is beneficial. I say particularly in railway service, because in industrial power service the interruption of a feeder ordinarily involves a local difficulty, whereas in railway service if we stop trains on one part of the line we hold up the entire road.

W. B. Potter, Schenectady, N. Y.: Mr. Murray has given us an interesting paper on a most interesting subject. The ordinary 600-volt trolley has been little of a criterion for the 11,000-volt catenary under steam-railroad conditions. Considered as an example of good construction work, I have never seen the equal of the catenary line to which he has referred. As to the relative reliability of such an overhead high-voltage trolley as compared to a third rail under conditions necessitating joint operation with steam, I believe this to be a debatable question. The experience thus far appears to me rather in favor of the third rail.

As to the points noted by Mr. Murray: First—I agree with him as to the desirability of a through feeder in parallel with the different sections. I do not see the need, however, of two such feeders on the same phase as the trolley wires. For local power the combination of the single feeder with the trolley wires would seem sufficient reserve, while any accident involving all four of the trolley wires would probably include the feeder as well. In case it did not the feeder could supply power beyond the break.

Second—As to the length of the main line sections, I should favor three to five miles rather than less. This is a question affecting reliability of operation, and it would seem that a reduction in the number of switching appliances would be favorable in this respect. Five-mile sections have proved satisfactory in third-rail operation, and there would seem to be no reason for shorter sections with the high-voltage trolley unless by reason of greater liability to breakdown. It would seem desirable, however, that at track cross-overs there should be a short section controlling the main line and cross-over tracks to better insure cross-over movements in the event of interruption on the main line sections.

Third—[illegible] feet [illegible] to be a generally

recognized standard height for the trolley wire. It is unfortunate that this height cannot be maintained throughout, as it would then be possible to use a much lighter form of pantagraph. The presence of overhead bridges with their limited overhead clearance often necessitates a vertical movement of seven to eight feet, requiring a pantagraph structure more liable to derangement.

Fourth—Depreciation of the catenary insulation, due to smoke from the steam locomotive would naturally be expected. The measure of trouble from this cause would seem to have a bearing on the permissible trolley voltage. Conditions might well arise where copper or efficiency would have to be sacrificed for reliability.

Sixth—So far as it can be avoided, I do not think that overhead wires subject to lightning should be run through lead cables. As the auxiliary wires could be so located as to be less exposed to the locomotive exhaust and as there would generally be little need of supporting them on insulators underneath the bridge itself, it would seem to me to be better practice to omit the lead covering.

Seventh and eighth—The suggestion with regard to time relays and switch indication are in line with well-established practice. As to the method of operating the circuit-breakers, I understand they are at present controlled from the main power circuit. Should not some means be provided for operating these switches in the event of failure of power? As these circuit-breakers are in the vicinity of signal towers, where manual operation could be conveniently applied, would not this be the more reliable method? Lever connections would provide certainty of operation and would not interfere with the automatic tripping. The proposed change from the bridges to switch houses would simplify the mechanical connections.

Ninth—While there is no question as to the desirability of guarding against spanning two sections in the event of one of them being grounded if two pantagraphs or trolley poles are far enough apart to span the section insulator it is as sure to happen as that grounds will occur. The only safe guard seems to be a fuse between the two collectors.

O. S. Lyford, Jr., New York: Mr. Murray's paper has evidently been written from the point of view of operations of a multiple-track road. When viewed from the standpoint of single-track operation this subject has some rather different aspects. Mr. Murray says: "1. In one, two, three or four-track railroads the single-phase distribution should include, besides the trolley wires, bypasses or feeders." I would not take any exception to that statement relating to two, three or four-track roads, but in connection with single-track roads the circumstances are quite different. The objects of sectionalization are perhaps three: First, to minimize the interference with the operation of the road in case of line trouble; second, to locate the fault quickly, and third, to reach the fault with a work train. As to the first object, to minimize the interference of operation, I think it would be quite apparent that that cannot be accomplished with a parallel feeder in a single-track road. Mr. Murray speaks of a special track to test and locate faults quickly, and if that proves out, there is little argument left for sectionalizing single-track roads between important points. Considering the question of reaching the fault with a work train with such section as has been discussed here tonight, the work train could not get within three-quarters of a mile or so of the fault, and it would be impracticable for the men to have to go the rest of the way on foot to locate the fault. The logical conclusion, therefore, is that the work train should be operated by an independent unit, either a steam locomotive or a gasoline car, preferably the latter, because it is more easily put into service.

It may be said that the high-voltage trolley system ought to be put up so as to minimize the probability of the line getting out of order. That at first looks like quite a proposition, but as you get acquainted with it it does not really appear so. The solution seems to be the exclusive use of porcelain for insulation. At first it would look as if we could not subject the porcelain to the heavy strains of the catenary construction without shattering the porcelain, but we have found with the standard forms of spool insulators, when properly harnessed up, that they can be tested out with 14,000 pounds tension, or compression, as the harness works at 22,000 volts or more electrical strain at the same time. These strains in the catenary circuits thus far used are about 4,000 pounds per wire, and we could therefore get a factor of safety of three or four with a single wire, or half that if we use one insulator for both wires. The use of built-up insulators is not very promising, and the use of wood (although wood appears to be a good insulator) has the objection that if there is leakage across the wood and you burn the wood in two, down comes the catenary construction; but if the porcelain should break, the only result is the insulation is lost, but the line does not come down, because the porcelain is under compression and the broken parts will hold.

Mr. Murray: Mr. Potter spoke of pinning his flag to the third rail versus the overhead construction. In regard to [illegible] a very large proportion [illegible] to believe that [illegible] question of operation [illegible] be the paramount feature and will make the overhead construction and [illegible] to the [illegible].

In order to explain the necessity of two feeders, I think that can be done [illegible] in the event of trouble, unlocking of the feeding system as established [illegible] is such that if trouble occurs on one feeder, by by-passing around through switches and on the another feeder we are enabled [illegible] feeder section and make the repairs, thereby giving a strong and more reliable [illegible] service.

In connection with Mr. Potter's suggestion that the sections be longer, I thoroughly agree with him. I think three to five miles is going to become standard, but local conditions should govern.

Concerning Mr. Lyford's remarks, I agree with him about the single-track feeder arrangement, but would qualify that for a long distance. In its application to long distances, I think a feeder arrangement for single track is quite necessary. We should have such a track as he spoke of in the middle of the line; it is not uncommon railway practice to operate to that point on both sides. If the catenary construction was grounded itself it would be impossible to transmit, and we could by-pass on that feeder. I certainly agree with him in regard to porcelain insulation in the place of moulded material, if it is possible to get the tension and compression strains in porcelain that is obtained in using molded material.

Illumination Discussed at Pittsburg.

The Pittsburg Section of the American Institute of Electrical Engineers met on January 8th, in the Carnegie Institute Lecture Hall, for the purpose of discussing "Illumination." One of the principal papers of the evening was given by Arthur J. Sweet of the Westinghouse Lamp Company of Newark, N. J. Mr. Sweet first reviewed the theoretical factors of good illumination, grouping them as follows: Efficiency of illumination, intrinsic brilliancy of light source, color, intensity, steadiness and efficiency of light distribution, size of illuminating source and the temperature to which it is possible to raise the incandescent solid. All these subjects have to be studied by the illuminating engineer in order to produce the physiological process of good visual perception. Visual perception is the thing to be considered more than candlepowers. The visual perception of an object lighted with an illumination of two foot-candles is very different when the field of vision is surrounded by intense light from what it is when surrounded by a soft, weak light. In other words, very light reflecting walls should not be highly illuminated from a small intense light source, but from a larger light source of lower intensity. Three, four or five units at a light source give best results.

Different colored papers absorb different amounts of light, and that which is absorbed is lost. The amounts of light reflected by different colored papers are:

White paper	80 per cent.
Orange paper	50 " "
Yellow paper	40 " "
Light pink paper	35 " "
Light blue paper	25 " "
Emerald green paper	18 " "
Dark brown paper	10 " "

This should be considered in lighting rooms of different colors.

The following table compares the physical properties of the most common forms of electric lamps:

Kind of Lamp	Mean Spherical Candlepower	Watts per Candle	Amount of Light per Kilowatt-hour
Common 56-watt, carbon-filament incandescent lamp, rated at 3.5 watts per candle, 16 horizontal candlepower.	13.2	4.24	236 candlepower-hours
Common 50-watt, carbon-filament incandescent lamp, rated at 3.1 watts per candle, 16 horizontal candlepower..	13.2	3.78	264 candlepower-hours
Three-glower, 264-watt Nernst lamp	81.	3.26	307 candlepower-hours
High-efficiency Gem, 125 watts, graphitized carbon-filament lamp of 50 horizontal candlepower	40.7	3.07	326 candlepower-hours
44-watt tantalum lamp, 22 rated horizontal candlepower	16.	2.75	364 candlepower-hours
D. C. 5.1-ampere enclosed arc on 110-volt circuit, .5-inch carbons	213.	2.63	380 candlepower-hours
A. C. enclosed 5.7 ampere arc taking 388 watts on 110-volt circuit, .5-inch carbons	152.	2.55	392 candlepower-hours
60-watt, 110-volt tungsten filament lamp, burning at 1.25 watts per horizontal candle.	37.	1.62	617 candlepower-hours
Luminous 8-ampere arc. 440 watts, 2 in series on 110-volt circuit	1020.	.431	2320 candlepower-hours

Mr. Sweet also described how the filaments of tungsten lamps are now spring-anchored and can be burned in any position. Samples of tungsten lamps were shown, and the point brought out that a tungsten lamp can be burned at double voltage [illegible] into vogue for fear that the arc-lamp designer [illegible] ported in a vacuum, and there was joy in the camp of the carbon manufacturers once more. Arc [illegible] per candlepower.

The manufacture of carbons has been gradually perfected through a great many more difficulties than are generally known. Many different kinds of coke and mixtures of coke and lampblack were tried, analyzed and refinements made, even down to extracting small quantities of iron impurities which made the carbons magnetic and blew the arc to one side.

George Loring, engineer of the National Electric Lamp Association of Cleveland, Ohio, gave an impromptu talk on the latest development of the tungsten lamp, how carefully they were packed and how they could now be shipped without danger of breaking. He also called attention to the improvement in the quality of light delivered by a tungsten lamp over the ordinary carbon-filament lamp. The tungsten lamp gives a light closely resembling sunlight, while the carbon-filament lamp light corresponds with that given by the spectrum from the green down.

A variation in voltage above or below the rated voltage does not make such a variation in the light emitted from the tantalum as that emitted from the carbon-filament lamp. The 32-candlepower, 40-watt, 110-volt tantalum lamp is now a commercial article, and appears to be the best suited for general needs.

Mr. Loring considered that the central-station man was mistaken about the use of the tantalum lamp when he thought that his receipts would be cut. "It is the present poor light you get from carbon-filament lamps that has made a great many people burn Welsbach light when they would prefer the electric light." Then the cheapening of anything makes its use much more general, and the customer would not be watching to turn off his lights as soon as possible, and more lights would be used for advertising.

Mr. Skinner called attention to tests made by the Allegheny County Light Company, who found that some of its customers were using old lamps that were originally tested at 16 candlepower, but had deteriorated so that some of them did not give more than six candlepower.

A letter was read from Mr. A. J. Wurts, suggesting that all lamps should have two ratings—a photometer rating and an illuminating power rating. The latter should be based on the well-known 16-candlepower lamp as a unit.

Mr. Martin of the Allegheny County Light Company read a short discussion on lighting, prepared by Mr. Muller. The principal points brought out were that the central-station man was now deriving quite an income from electric heating, small motors, etc., and that the electric lighting was not the whole thing any more. He gave a table comparing the renewal cost with the consumption of all the different styles of incandescent lamps on the market.

Use of Electric Light and Power in Chicago.

In an advertisement of January 13, 1908, the Commonwealth Edison Company of Chicago says that electric light equivalent to 2,140,000 16-candlepower lamps is supplied to over 60,000 homes and business houses in Chicago. The increase over last year is 34 per cent. Such progress is significant of two interesting facts. In the first place, standards of living have improved. There is a demand for comfortable, hygienic homes everywhere. In the second place, electric light has become so inexpensive that everyone can afford it. The number of electric signs in Chicago is placed at 4,000.

The company also announces the fact that it is now supplying 6,000 customers with electric power, delivering 104,000 horsepower to various plants. Some of these are the largest in Chicago, consuming as high as 3,000 horsepower in a single instance. In addition to this, 60,000 horsepower is supplied to the elevated railways and surface traction companies of the city.

The committee on state legislation of the Chicago Council is considering a resolution directing the drafting of a bill which would create a public-service commission for Chicago. The commission would be similar to the one in New York and would have power to regulate and control common carriers, gas and electric companies and other public-service companies.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

LI.—Electric Motor Drive.

Absence of Shafting.

There are many reasons why the motor drive is superior to any other, even when steam power is readily accessible. One of the most important of these is the absence of shafting and the very large reduction in the amount of belting used. Where shafting is present it represents a constant friction load which absorbs a certain amount of power, whether all or none of the machines connected to it are being used. The use of shafting also limits the location of the machinery practically to a line corresponding to the shafting, and therefore prevents, as a rule, the floor space being utilized to its fullest advantage. Shafting also interferes with the use of overhead cranes and travelers, which are almost a necessity in transferring heavy work from one machine to another.

The motor drive lends itself most readily to the extension of a plant, as all that is necessary is to carry the wires to whatever point may be necessary, and in a new plant it may easily permit of considerable reduction in the cost of buildings, as it allows the machinery to be located much more compactly, and therefore requires less floor space than any form of mechanical drive.

Economy.

Under the head of economy the motor drive will often prove its value when overtime work is to be done. If the individual-motor drive for each machine is adopted only the particular machine required for the overtime work need be run; or, if the group drive is adopted, only a comparatively small group of machines need be run, while in the case of a plant operated from the single steam engine, with belts and shafting, it would often be necessary to run practically the whole shop, even if only one machine were required for use.

Increasing Manufacturing Output.

The advantages so far mentioned as pertaining to the motor drive relate principally to convenience, flexibility and economy in power consumption, and while these factors are always important in any manufacturing concern, they are not always the governing considerations. A factory may be located, for example, where, on account of water-power, very cheap coal, or natural gas, the cost of power is so small that the saving in power alone would not justify the expense of changing from mechanical to motor driving, and as the motor drive has been adopted with advantage even where the cost of power has been comparatively unimportant, we must look for some further advantages inherent in the electric motor which justifies its adoption under conditions which are most favorable to mechanical driving.

It has been proved in a large number of industries that the use of the electric motor increases the amount of finished product which may be turned out; that is, with a given equipment of machinery a greater output will be produced when it is motor driven than when it is mechanically driven. This condition is particularly true of machine tools which require to be operated at various speeds, but it is also the case in many operations which are performed at constant speed. It is this consideration more than any other which appeals to almost every class of manufacturers, as the ability to turn out an increased product without any increase of machinery obviously leads to a considerable increase in profits.

In several cases where this question has been carefully tested the increase in production following the adoption of motor driving has amounted to from 25 to 30 per cent. The increase in production in the case of variable-speed motors is easily accounted for in many kinds of machine tools.

Take, for example, a lathe which is turning up work having a number of different diameters. In order to operate such a lathe at its maximum output a number of different speeds will be required, [illegible] and material of the work, and these different speeds, if the lathe is mechanically driven, will be obtained by shifting the belt [illegible] the back gear in and out. Either of these operations requires more or [illegible] part of the operator, and the result is almost invariable that considerable

[illegible]

of the work is done at considerably below its maximum speed.

If, on the other hand, the lathe is driven by a variable-speed motor the operator has his controller handle mounted on the tool carriage and he can adjust his lathe for either its maximum or minimum speed, or at any intermediate speed by the simple movement of a handle, with hardly any physical effort, without moving from his position at the tool carriage and without stopping the work for a moment.

Under these conditions it is not only possible but is extremely easy to perform every operation at the maximum allowable speed, and as no time whatever is lost by the operator obtaining these speeds, the machine produces its maximum output.

There are also many cases where increased production can be traced to the use of constant-speed motors. In the case of printing presses, for example, an increase of approximately 10 per cent. in the output of a press has been effected, even when the mechanical and the electrical drive which substituted it were supposed to run the press at exactly the same speed. The difference in product, however, was undoubtedly due to the almost absolutely constant speed of the electric drive, and the imperceptible losses in speed due to belt slip in case of the mechanical drive.

The driving of paper-making machinery is another operation which requires a practically absolutely uniform driving speed, to which the electric motor has been applied with remarkable success. There is no other method of driving which can compare with the electric motor in absolute constancy of speed, and the effect of changes in speed in paper-making machinery, which are liable to tear the paper, may be judged from the statement of a large paper manufacturer that he would rather burn out any motor in his plant than to interrupt a run of high-grade paper.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Self-help for Electricians.

H. S., Chicago: How can a common electrician, with some practical experience, advance himself in electrical lines? I want to be a better electrician than I am. How can I succeed?

Answer.

This is a broad question and an old question. The answer to it depends mainly on the man himself in each case—on his aptitude, energy and determination. The successful man hews his own way to the goal by the driving power that is within him. But every man who seeks to improve himself is entitled to all the outside help he can get, although he must fully realize that it is upon his own efforts that his main reliance must be placed. Chief among the helps is the technical press, which has, for one of its aims, the dissemination of practical information among its readers. The technical journal is planned to meet the varying requirements of many; but in its pages (and this remark has reference both to advertising and "reading" pages) the practical man will find during the year suggestions and the records of the work of others which will repay his subscription price many times over. Then there are the correspondence schools, often a great help, and some of these organize clubs among their students in certain neighborhoods. Evening courses in practical electrical work are of decided value. In Chicago these courses, with laboratory demonstrations, are given at the Armour Institute of Technology and Lewis Institute. In each case the required fee is small. At Lewis Institute, for instance, 400 practical men are attending the evening electrical classes. An elementary evening course is given at the Young Men's Christian Association. The Chicago Electrical Show, now in session, is a distinct educational force. By attending it one may gain a good idea of the newer electrical applications, particularly in the household arts; and with this advancement in domestic electricity the practical electrician should assuredly be familiar. Then, too, popular but nevertheless very instructive lectures are given at the exhibition.

These are a few of the ways in which the practical man can help himself to grasp a higher rung on the ladder. Of course, he can do a good deal by procuring books and simply studying at home by himself. But working under the stimulus of teacher and fellow-students, and with the help of laboratory apparatus, is manifestly much better. In any case downright earnestness, with grit and patience, are needed.

Operation of Single-phase Alternator.

B. F. T., Champaign, Ill.: While operating a single-phase alternator, with field separately excited, the driving force was suddenly removed, but the ammeter in the armature circuit showed full load current until the machine came nearly to standstill. Why did this current remain nearly constant until the machine had almost stopped?

Answer.

The details of normal operation and of the particular occurrence are incomplete. If the machine was running in parallel with others the machine may have been motorized at the instant that its electromotive force began to fall when the driving power failed and therefore taken current from the bus-bars until the circuit-breaker opened, the ammeter needle remaining at its limit point till this happened. If the machine was running alone, the ammeter needle may have stuck at the limit point until the current dropped to a low value. If there were any storage batteries connected through rotary converters on the line these may have momentarily pumped current into the machine to cause the ammeter needle to be driven to the limit till the reverse-current circuit-breakers opened. If the conditions were made more clear, other causes may also probably be found.

Telephoning on Horseback.

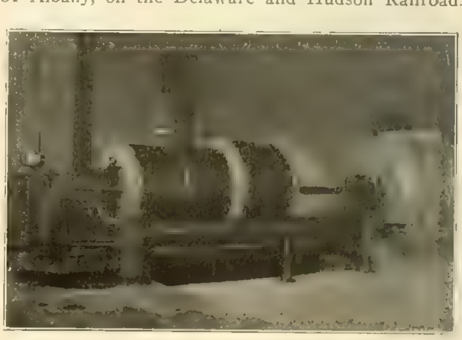
R. B., Milwaukee: Recent newspaper accounts are to the effect that Captain Knowles of Fort Leavenworth, Kan., has perfected a means of carrying on telephone conversations while proceeding on horseback. Kindly inform me how this is done.

Answer.

Captain A. O. Knowles, who is captain in the Thirtieth Infantry, U. S. A., and instructor in the Army Signal School, in a recent letter says: "I find myself unable on account of many duties to furnish the data desired. The inaccuracy of accounts in the daily papers on technical matters is forcibly illustrated in many clippings I have received, the majority of which border on the absurd. In brief, my experiments have demonstrated beyond question that telegraphic and telephonic communication with moving vehicles and moving mounted operators is possible. From a military point of view this will serve greatly to facilitate the movements and operations of an army in the field."

Steam-turbine Unit in Portland Cement Plant.

The Helderburg Portland Cement Company, whose offices are at Albany, N. Y., operates a cement mill of 1,400 barrels capacity daily at Howe's Cave, a small hamlet some 30 miles south of Albany, on the Delaware and Hudson Railroad.



STEAM-TURBINE UNIT IN PORTLAND CEMENT PLANT.

Following insistent demands for greater output, additional power was provided for in the installation of a 1,500-kilowatt steam turbo-generator unit.

The old plant was driven by two 20 and 38 by 42-inch cross-compound engines, which are retained for emergency use.

The turbine shown in the accompanying photograph, as it is installed, conforms to the well-known Allis-Chalmers standard design for both turbine and alternator, the latter being wound for 440 volts, 60 cycles, three-phase, and the former driving it at a speed of 1,800 revolutions per minute under a steam pressure of 150 pounds at 28-inch vacuum. A Tomlinson jet condenser with auxiliary air pump and accessories have also been installed, the complete plant being built by Allis-Chalmers Company.

Street Lighting by Tungsten Lamps.

The city of Grosse Point, Mich., has recently installed a series tungsten incandescent street lighting system where the advantages of this kind of lighting are well exemplified. The station equipment includes two 8.8-kilowatt, [illegible]-ampere constant-current transformers. One of these is held in reserve, while the other supplies current to 77 60-candlepower General Electric tungsten series incandescent lamps, suspended from artistic iron poles. All wiring is laid in conduit to the pole and wires pass up the center of the pole to the lamps. The form of poles used not only gives a very substantial line construction, but makes a much more artistic appearance than the usual wooden pole. These poles and lamps are shown in Figs. 1 and 2.

Fig. 1.

Fig. 2.

STREET LIGHTING BY TUNGSTEN LAMPS.

Fig. 3. Bracket Lamp with Radial Reflector.

One of the interesting features of this system is the radial reflector with which the lamps are equipped. This form of reflector is so constructed that the light is spread and projected very evenly over a considerable area instead of being nearly all concentrated in a circle around the lamp. Fig. 4 shows the candlepower distribution of a 40-candlepower series tungsten lamp equipped with a radial reflector. Fig. 3 illustrates one of these reflectors on a lamp. It may be seen from the diagram of the candlepower distribution that at about 30 degrees below horizontal the effective illumination is 50 candlepower, making the efficiency at this point about one watt per candlepower.

The series sockets with which these lamps are provided are so constructed that when a lamp is removed from the socket two contact plates of large area close together before the lamp is quite drawn out of the socket, leaving no danger of an open circuit at any time.

Tungsten series lamps are made in 32, 40 and 60-candlepower sizes, with current ratings of 4, 5.5, 6.6 and 7.5 amperes, and are exceedingly hardy on account of the heavy, short filament. It is said that they will burn for nearly 1,000 hours at efficiency of from $1\frac{1}{4}$ to $1\frac{1}{2}$ watts per candlepower.

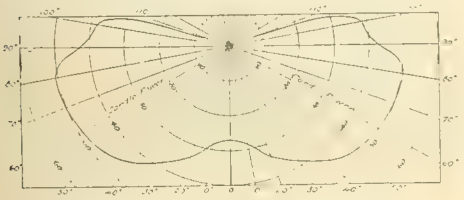


FIG. 4. CANDLEPOWER DISTRIBUTION OF A 40-CANDLEPOWER SERIES TUNGSTEN LAMP EQUIPPED WITH RADIAL REFLECTOR.

Another installation of series tungsten lamps for street lighting has recently been made in Grand Rapids, Mich. The lamps are of 60 candlepower and were placed on one of the principal streets of the city. Judging from the complimentary remarks of the press and the City Council, the test installation has proved highly satisfactory.

The tungsten lamp with its high efficiency should greatly increase the use of series incandescent lights in suburban and residential districts, where the thick foliage makes it necessary to have the units distributed at short intervals to produce satisfactory illumination.

The city of Fort William in New Ontario, Canada, has decided to own its municipal street-railway system, and application has been made to the Ontario Legislature for permission to issue debentures to provide funds to construct such a system early in the spring.

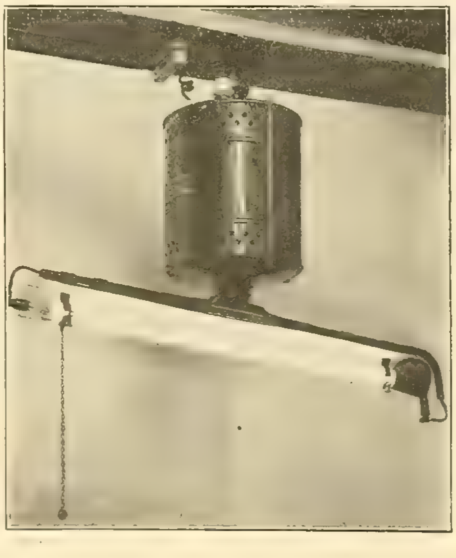
Shelton Electric Hair Dryer.

[illegible] ments for women. The Shelton dryer, illustrated herewith, is one that gives a breeze of either hot or cold air. It is essentially an extremely light [illegible] and combined with a tiny rotary blower. It is finely finished in black enamel, and, as it consists largely of aluminum parts, it is very light, weighing only $2\frac{1}{2}$ pounds complete. The Shelton hair dryer consumes very little current and can be used on both alternating-current and direct-current circuits of 110 volts. It is understood that with an ordinary hair dryer about one hour is required to dry a woman's head of hair. The value of this electric hair dryer will be appreciated, as it performs its work in about six minutes. The simple turn of a switch is all that is necessary to heat the air by cutting in the heating coils.

SHELTON ELECTRIC HAIR DRYER.

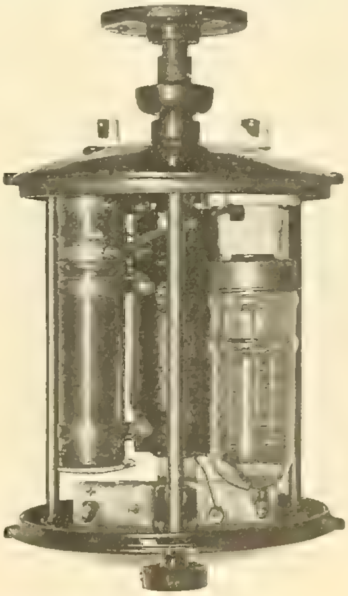
Improved Mercury-vapor Lamps.

The 1908 model of the Cooper Hewitt mercury-vapor lamp has a number of improvements. The general form of the tubes of the several types of lamps remains the same. The changes, for the [illegible] to handle each lamp outfit as a unit, and has greatly simplified the hanging of the lamp. The new casing of the auxiliary resembles the housing of an arc, being cylindrical in form and about eight inches in diameter and 10 inches high, with the supply lines entering binding posts at the top. The auxiliary is clearly shown in the pictures. The cover is hinged and may be thrown back, [illegible] iliary. The lamp rod, which supports the tube, is attached directly to the auxiliary by a pivot screw. [illegible] is extremely simple. A ceiling plate, a short threaded pipe nipple, and an insulating joint are furnished with each lamp outfit. These are fastened to the ceiling, and the auxiliary screwed to the insulating joint. Where it is necessary to hang the lamp at some distance from the ceiling, a pipe or conduit of the proper length can be used between the plate and the auxiliary. Where lamps are hung from outlet boxes the ceiling plate can be dispensed with. When desired, the lamp may be hung from a wire rope by screwing a hook to the insulating joint and properly guying the lamp so that it will not swing.



IMPROVED MERCURY-VAPOR LAMP.

The performance of the lamp depends directly on the auxiliary. In the new auxiliary the number of parts has been reduced, and the design and manufacture improved. Different parts may be removed or replaced with ease. The ballast or adjuster is made with a standard plug base, and screwed into an Edison socket. The inductance coils are thoroughly insulated, and the resistance is entirely embedded in an enamel-coated spool, which protects the wire against the deterioration effects of gases and dampness. The resistance spool has two binding posts, so that the lamp may be adjusted to the actual voltage of the supply. All standard lamps are made for either 110 or 220 volts; the resistance spool, just described, furnishes what little adjustment is necessary in the particular group for which the lamp is intended.



AUXILIARY (CASING REMOVED) FOR MERCURY-VAPOR LAMP.

Close regulation of the supply voltage is not necessary to the successful performance of the lamp, as the ballast and the inductance coil compensate for ordinary fluctuations. Standard series lamps are operating satisfactorily on power circuits of 500 to 600 volts. The lamp is manufactured by the Cooper Hewitt Electric Company of 220 West Twenty-ninth Street, New York.

The New "Standard" Storage Battery.

The two most serious objections to the ordinary lead storage battery are its great weight and deterioration when subjected to hard service. A novel construction has been embodied in the new "Standard" accumulator which is said to overcome, largely, both these drawbacks. This new cell is a perfected form of the Clare battery and is a radical departure from the regular lead storage-battery construction. Instead of using a heavy lead grid to hold the active material and conduct the current to it, the grid in this cell is in the form of a light and highly porous earthenware retainer, Fig. 1, provided with pockets for holding the active material against the conducting plate and at the same time forming the separator between plates. The conducting plates are thin lead sheets, on either side of which is a retainer plate, the set forming a thin, tightly boxed unit. The outer sides of the earthenware retainer plates are vertically ribbed, as shown in Fig. 2, to furnish ducts for the circulation of the liquid. These plates are so porous and their webs so thin as to permit unobstructed action of the electrolyte through them to the active material in the pockets. At the same time these plates serve to positively prevent the loosening and disintegration of the active material and the buckling of the plates as a whole.

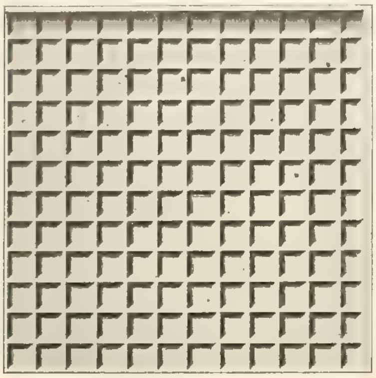


FIG. 1. INSIDE OF RETAINER PLATE OF "STANDARD" ACCUMULATOR.

In making up various sizes of the "Standard" accumulator, the unit system is used. The retainer-plate units are 2½ inches square, and as many as desired can be assembled on each side of the conducting plate to give any final plate dimensions desired. As many boxed plates as needed to give the desired capacity are assembled in a containing cell in the usual manner. The cells are made up into the customary sizes and are mounted in sealed rubber jars, glass jars or lead-lined wooden tanks as the service requires.

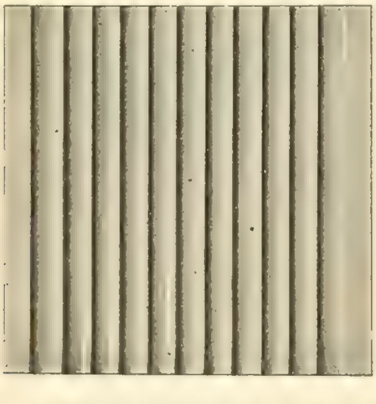


FIG. 2. OUTSIDE OF RETAINER PLATE OF "STANDARD" ACCUMULATOR.

The performance of "Standard" accumulators that have been in continuous service for five years is said to be practically as good as when they were installed. The cells show no signs of buckling or deterioration and are capable of many more years of work. They are free from local action and give good efficiencies. They stand up well under hard usage, and even short-circuiting them does not make [illegible] ampere-hour cell complete with electrolyte making less than 20 pounds. The Standard Electric Ac-[illegible] city, is the manufacturer of the new cells.

St. Louis to Have an Electrical Show.

[illegible] trical Show this week by Mr. G. Stuart Hill, representing the Trades Exposition Association, that [illegible] First Regiment Armory, St. Louis, Grand and [illegible] clusive. It is said that the electrical manufacturers, supply dealers and central-station men of St. Louis are backing the project. The St. Louis office of the Trades Exposition Association is at 618 Mermod-Jaccard Building.

Applications of Recording Instruments to Light and Power Systems.

By H. P. Dennis.

The ultimate economy of a power plant depends upon a great many factors, but the most potent of these will be found in the boiler room. Prime movers and generators have now been brought to such a high degree of efficiency that losses in them are small in comparison with those in the boiler-room. With mechanical stokers, economizers, feed-water heaters, superheaters, etc., a thermal efficiency at the bus-bars of 10.3 per cent. has been attained in probably the most efficient plant in existence.

A fruitful subject for thought is how to approach this efficiency in the average plant. In this model station 22.7 per cent. of the thermal energy in the coal was lost to stack. The feed-water heaters and economizers effected a saving of 9.9 per cent. These figures represent the best practice. It is evident that the operating engineer has a greater opportunity to check losses and institute positive savings in the boiler-room than anywhere else in the plant.

It is not sufficient that a boiler plant be equipped with good furnaces, boilers, economizers, etc. This apparatus will not give good results of itself. The plant so equipped is only potentially efficient. Actual economy depends upon scientific methods of operation. In how many plants is it known where the losses occur or even that there are losses that might be checked? Frequent boiler tests may lead to the correction of some defects, but they are expensive and do not insure the best year-in and year-out operation. Even in the model plant before referred to, where the most elaborate tests covering long periods of time were made by experts, it was only by aid of an automatic recording instrument that it was possible to reduce the loss to stack one-half.

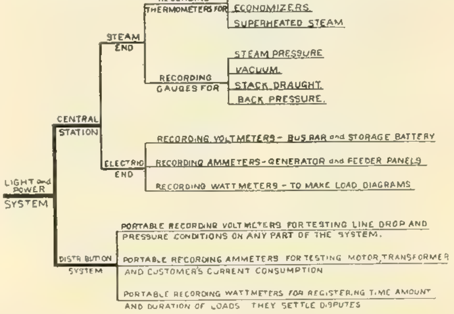


DIAGRAM SHOWING APPLICATIONS OF RECORDING INSTRUMENTS.

An equipment of automatic recording instruments produces results similar to an uninterrupted boiler test, if such a thing were possible. These instruments may be assembled under the eye of the operator, showing instantaneously the slightest deviation from best running conditions of any part of the equipment. They furthermore make permanent records of changes that might occur between consecutive readings of indicating instruments.

The diagram shown herewith illustrates some of the useful applications of automatic recorders to the different branches of a light or power system.

Recording thermometers for the control of flue or stack temperatures, superheaters, inlet and outlet to economizers and condensers, feed-water heaters and hot wells may all be assembled together with recording steam-pressure, vacuum and draft gauges at some central point for simultaneous observation. The sensitive bulbs of these ingenious recording thermometers and pyrometers are connected to the recording parts with flexible copper tubes, so that the continuous temperature records of flue-gas, feed-water, superheat, etc., are always before the engineer or fireman. If there is any tendency toward dereliction of duty, recording instruments are an absolute check.

Those responsible for the performance of plants will find the daily charts of temperature, pressure, vacuum or draft a fascinating study, particularly when observed in relation to those of previous days, months or years. The continuous log so furnished shows graphically not only the cycles occurring from hour to hour, but the general trend from month to month with the resulting influence on efficiency. Operating companies do not hesitate to spend vast sums to secure the best boiler-room equipment, but how often does it happen that a large part of this apparatus fails partly or entirely to perform the work for which it was intended? [illegible] of the largest plants under the very eye of experts, how much more is it likely to occur in smaller stations? Even the smaller plants may, however, be operated in a scientific and economic manner without expensive experts by the use of automatic recording instruments, all located near the seat of control.

Passing to the switchboard side of the central station we find the recording voltmeters to check the regulation on the storage battery if this latter forms a part of the equipment.

Recording ammeters and wattmeters have been employed considerably on generator and feeder panels where they supplement the use of indicating instruments by furnishing a record of the amount and duration of load on a generator or station; or the current or wattage output on a particular feeder circuit. A very useful application is on arc-light circuits to show outage, current regulation, grounds, etc.

On the distributing system, portable recording voltmeters make it easy to obtain diagrams of line-drop from any part of the system day or night. The value of such information as affecting the determination of feeder capacity is evident.

Portable recording ammeters and wattmeters are used effectively for a great variety of testing work in connection with customers' light or power circuits. A few ammeter records will generally show a "went to bed at 9 o'clock and burnt no lights all night" type of customer that he is eligible for the Annanias Club.

In fact the portable recorder as a means of settling disputes and proving the quality of service rendered forms a valuable piece of equipment.

Unsolicited But Appreciated.

"We congratulate you upon the success of your New Years number."—W. George Lane, sales manager of Economy Electric Company, Warren, O.

"We wish to congratulate you on the excellent appearance and makeup of your New Years number."—R. C. Lanphier, secretary of Sangamo Electric Company, Springfield, Ill.

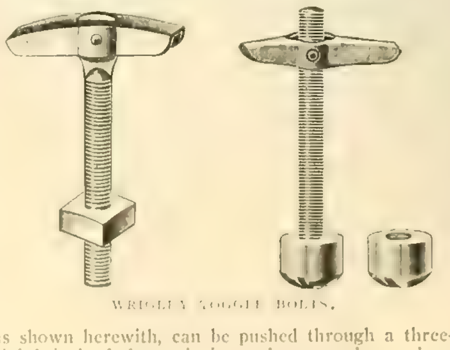
"The New Years number of the Western Electrician is just to hand, and I desire to offer to you my hearty congratulations upon the very creditable appearance of the same."—Leland Hume, general manager of Cumberland Telephone and Telegraph Company, Nashville, Tenn.

"The Western Electrician issues a notably handsome number in way of its annual review of the year's developments in the magical industry. It estimates the value of electrical and auxiliary manufactures in the United States in 1907 to be nearly $316,000,000. The total output of manufactures shows a decrease under that of 1906 of 10 per cent."—Chicago Commerce, the organ of the Chicago Association of Commerce.

"May we add our congratulations to you on the fine New Years number as issued last week? It certainly speaks well for you, as for the industry in general, and what makes it more particularly impressive is that, barring the colored cover, the unusual attractiveness of the number is not due to any departure from your usual course. Your average issue covers pretty much the same range, although it may require a special display number like the last one to impress your readers with the variety and quality of matter that you are regularly offering."—Albert Scheible, president of Ajax Line Material Company, Chicago.

Wrigley Toggle Bolts.

Two types of toggle bolts made by Thomas Wrigley & Co., 300 Dearborn Street, Chicago, are illustrated. The patent steel toggle bolt has hood riveted on and is provided with double-flanged sides and rigid back. It is used for securing brackets and fixtures to hollow tiling, marble slabs, steel ceilings or plastered walls where screws or nails fail to hold. The three-sixteenth-inch size,



WRIGLEY TOGGLE BOLTS.

as shown herewith, can be pushed through a three-eighth-inch hole and instantly securely anchors itself. By turning it half way around it will come out, or by pushing it up it will drop out. The second cut (on the right) shows a trunnion nut toggle bolt, the construction of which will be readily understood.

Mr. Edison's Cement House.

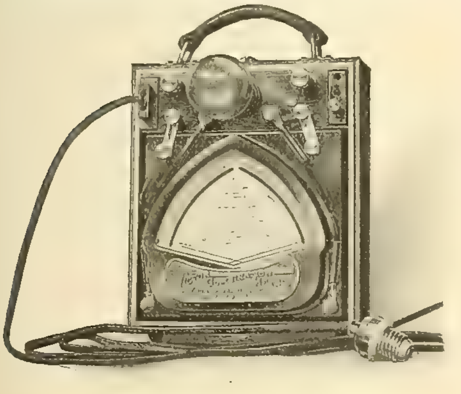
Referring to his invention of a process of making cement houses, Thomas A. Edison is reported to have said: "This winter I shall construct the iron molds and devise machinery whereby a full-sized house can be cast in 12 hours, after the molds are in position. At the end of six days the iron molds are removed and the house will be complete, including stairs, partitions, mantels, bath, etc., and after drying six days will probably be ready for occupancy. To build this house for $1,000, it is essential that it be erected on sandy soils, as the material excavated for the cellar is all that is required to build the house, except, of course, the cement. The cost of the iron molds will be about $25,000, the cost of the other machinery about $15,000. From this outfit an unlimited number of houses can be erected. I have not gone into this with the idea of making money from it, and will be glad to license reputable persons to make molds and erect houses, without any payments on account of patents. The only restriction is that the designs of the houses be satisfactory to me and that they shall use good material."

Ontario Municipalities Adopt Electric Power Regulations.

A number of Canadian cities recently voted on the new by-law which is to be the basis for the supply of electric power from Niagara Falls, to be furnished the municipalities by the Hydro-electric Power Commission. In no instance was the by-law carried by a majority of less than 60 per cent. In Ingersoll, where the conditions attached to the by-law required that, in the event of its passage, a power plant should be erected, the majority in opposition was 31 per cent. The towns and cities where the by-law was successful were Toronto, Hamilton, London, St. Thomas, Brantford, Stratford, Guelph, Woodstock, Galt, Waterloo, St. Marys, Hespeler and New Hamburg. In these municipalities the next step will be to ascertain what amount of power they will require and then submit the figures to the Hydro-electric Commission to be used as a basis upon which contract may be drawn for the supply of power to the various municipalities. Until the provincial government is informed of the amount of power required no further steps can be taken in the matter.

Victor Lamp-testing Meter.

A new type of direct-current meter has just been placed on the market by the H. W. Johns-Manville Company, 100 William Street, New York, for the use of the inspector, lamp salesman, lamp manufacturer, etc. The movements are built on the familiar d'Arsonval pattern and are so placed with reference to each other and the scale as to render the energy consumption directly readable at the



VICTOR LAMP-TESTING METER.

intersection of the volt and ampere indicator needles. The special feature is the design, which enables the operator to read at one glance the pressure, current and wattage on any lamp which may be inserted in a socket immediately above the meter.

The instrument is equipped with three self-contained shunts, one of 15 amperes capacity, having conveniently arranged binding posts, and a 1.5 and 0.75-ampere shunt, which is so connected within the base of the meter as to be readily thrown in circuit at will.

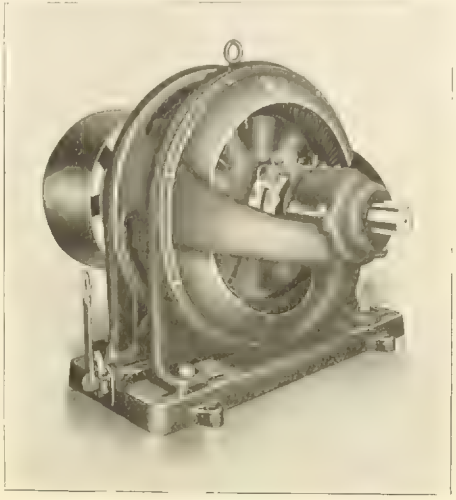
In order to test a lamp it is only necessary to connect the attachment plug and cord to any lamp circuit, insert the lamp and read volts, amperes and watts without computation. The different shunts may easily be placed in circuit by the adjustment of a small screw-plug at the top and right of the instrument.

The voltmeter may have either 150 or 300-volt scale, or both. The most valuable feature of this instrument is the fact that accurate wattage measurement may be taken on a fluctuating load, and it is required to observe but a single point for such readings. The instrument is entirely self-contained and weighs less than 15 pounds complete.

A New Polyphase Revolving-field Belted Alternator.

[illegible] to appeal to every manager of a small alternating-current station who has the day-load problem to solve or who is in need of additional generator capacity. The machine is illustrated herewith.

The alternator frame is of cast-iron, in two parts, accurately machined and bolted together through the laminations of the armature core. The laminations are in sections and of special shape, having inwardly projecting teeth and pro-



A NEW POLYPHASE REVOLVING-FIELD BELTED ALTERNATOR.

jections extending out from the usual symmetrical outside circumference. In these projections are punched the holes through which the bolts pass, clamping the core and the two halves of the field frame firmly together. Air spaces are provided at the ends of the core and between laminations at regular intervals to take advantage of forced ventilation produced by the fanning effect of the revolving field when the machine is in operation.

The revolving field of the Form B alternator is made up of a number of poles fitted into a central laminated spider with a dovetailed joint and taper keys to hold them firmly in position. After the poles are inserted in the spider special end plates are bolted to each end of the core, closing up the joints. The field coils, except in the 50 and 75-kilowatt sizes, are of strip copper, wound edgewise on a special winding machine, and then carefully insulated between layers and mounted on the insulated pole before the pole is assembled on the spider. The 50 and 75-kilowatt sizes have wire-wound coils, using double cotton-covered wire, as this has been found more suitable for these sizes. The flange on the pole-piece holds the coil firmly after the pole is in its position on the spider. The field coils are intended for 125 volts excitation.

The machines are made with either two-phase or three-phase windings for the following voltages: 2,300, 1,150, 600, 480 and 240 volts. The 2,300-volt rating is in more general demand, however, and the company is prepared to make more prompt shipment on alternators wound for this voltage.

On two-phase or three-phase load, the maximum rise in temperature will not exceed 40° C. after continuous operation with full current output at normal voltage and at any power factor between 80 and 100 per cent. The manufacturer also says that these machines will operate for three hours with 25 per cent. overload in current at any power factor between 80 and 100 per cent. with a rise in temperature not to exceed 50° C. above the surrounding air.

Belted exciters are furnished with all Form B alternators. These exciters are known as type ML and are belted to a small pulley mounted on an extension of the alternator shaft on the collector end.

Independent rheostats may be used for both alternator and exciter fields, if desired, but a special combination alternator-exciter field rheostat is frequently furnished with Fort Wayne alternators and has given satisfactory service. This rheostat serves the double purpose of regulating both the alternator and exciter fields with one resistance. With the use of such a rheostat, control of both fields is possible from a single point, which is an advantage, in addition to the reduced cost of rheostat, using one instead of two, and consequently reducing also the cost of switchboard panel.

In cases where the station is now using single-phase alternators and the generating capacity is insufficient to care for the rapidly increasing load, the three-phase alternators offer opportunity to prepare for the change to a day circuit and a [illegible] their three-phase output within the standard heating [illegible] increase the capacity of his plant and prepare to change it by installing three-phase, revolving-field machines without making any change in the single-phase distribution system, and making only inci- [illegible]

Electrical Testing.[1]

By [illegible]

[illegible] to a small saving of first cost, who places higher value upon the judgment of his engineers than upon the cost-cutting efforts of his purchasing agent, is our best customer. He secures not only the best goods, but a selection from the best. He knows that the payment must be in standard money; quality and quantity of money must be agreed upon and it must pass the test at the banks. Are both the quality and the quantity of the goods received up to so high a standard? Are they inspected and tested by so competent experts? Is it wise to accept without inspection machinery, apparatus and supplies and dispute over apparent or real discrepancies through the mails? The time to reject goods is before shipment, not after delivery. Disputes are avoided by rejection at the manufacturer's shop; you court controversy by rejection after delivery.

A good illustration of the value of our inspection is the following: A light and power company on the Pacific Coast had some second-hand railway motors offered at a low price by a concern in New York. The offer was attractive, but the manager did not propose to buy a "pig in a poke," so he ordered the motors subject to our inspection and test, knowing that by such a careful method of purchasing none but acceptable goods would be shipped.

The experience of the Washington Power Company of Spokane, as stated in a letter to us dated May 8, 1907, shows that inspection and test at the manufacturer's shop, before shipment, is good insurance. Since the fall of 1903 it has lost but one insulator from puncture on its 200 miles of 60,000-volt line. Mr. Huntington testifies that the careful and intelligent inspections and tests of the Elecrical Testing Laboratories "are in a very large degree responsible for protecting us from this very serious form of interruption."

In all, we have inspected and tested about 70,000 high-tension insulators for 14 different customers, at three different factories. Of these about 30,000 have been for the Washington Water Power Company. We have on hand at present time orders covering about 25,000 high-tension insulators for four customers, including two new ones. It is interesting to note in this connection that the percentage of rejections is very seldom less than 10 per cent., and occasionally runs as high as 25 or 30 per cent.

The Grand Rapids-Muskegon Water Power Electric Company has been our best single customer for the inspection and testing of large transformers, dynamos, rotaries, etc. Some of this apparatus required more power to drive than was available at the factory, and was therefore tested by us after installation. For the same company we tested and adjusted much of its switchboard and meter outfit. We also took care of the electrical end of a complete test on one of its plants.

We have also handled a considerable amount of machinery for two other power companies—one in Alabama and one in California. The advantages of making use of the laboratories for this work are of course greater in case of those companies which are situated so far from the shops of the principal manufacturers.

The importance of testing wire and cable at the factory is beginning to be recognized, and during the last year we have inspected and tested for several large buyers about 63,000 feet of lead-covered cable and about 125,000 feet of rubber-covered wire. It is rather surprising that many operating companies who will go into the question of lamp and meter testing so thoroughly will neglect the inspection of wire and cable, although they represent an enormous investment.

A noteworthy test was made by us for the New York and Queens Electric Light and Power Company. A 2,200-volt, 2,000-kilowatt, three-phase alternator, directly connected to a steam turbine, was shipped without the specified temperature test at the factory. We were asked to make the tests after installation. It was necessary to make two temporary water rheostats to absorb a 25 per cent overload at full voltage; i. e., 2,500 kilowatts at 2,200 volts. The advantage of making this test was knowledge gained as to just what could be expected of the machine in the way of load capacity, and the satisfaction of knowing that the machine was all that was being paid for.

1. A portion of a paper entitled "The Work of the Electrical Testing Laboratories," presented at the annual meeting of the Association of Edison Illuminating Companies at Hot Springs, Va., September 10-12, 1907.

For two prominent member companies and for one large gas company we have made electrolysis surveys of their underground structures to determine if damage were being done by stray currents, to trace the source and suggest remedies. This class of work must be done by our most skillful assistants under the personal direction of Dr. Sharp, and the reports must be free from all sensational or alarmist features so prominent in some of the literature on this subject.

For two member companies we have made tests to determine the candlepower of street lamps, both gas and electric, and the total illumination produced on the street by each. In one case the test was instrumental in demonstrating the superiority of electric lighting over gas lighting; in the other it provided the electric-lighting company with definite information concerning the value of its competitor's system.

The instruments which were used in the acceptance tests of the generators of the Niagara Falls Power Company were sent to the Electrical Testing Laboratories for standardization, as was also the standardizing outfit for the Georgia Railway and Electric Company.

We have tested several new types of storage cells, both for inventors and prospective investors.

From the beginning of our work in Jay Street we have been of considerable service to manufacturers. They have relied upon us for tests, not only of their standard product, but of very many samples of goods in the experimental or development stages. It has been most interesting to see the improvement of the product from time to time, as a result of information gained from our tests. It costs the manufacturer less to experiment intelligently than to work in the dark, and the purchaser is saved the loss and annoyance which comes from under-developed devices. Some manufacturers imagine it to be economy to save all testing costs, preferring to "try it on the dog," thereby [illegible] and the reputation [illegible] only upon demand of their customers, and judge us to be unfair because the percentage of rejection is high. A few manufacturers, having confidence in their output, heartily welcome our inspections and tests [illegible] their [illegible] From which manufacturer would you prefer to buy? Would [illegible] you toward the former?

Automatic Telephony.

By Franklin J. Truby.

Part II.

In Fig. 5 is represented in more detail a common-battery connector in combination with its electrical circuits. The two lines from the telephone are designated "vertical" (V L) and "rotary" (R L). The switch is operated by ground impulses imparted at the telephone of the subscriber and directed to the two relay electromagnets (V R) and (RR), called, respectively, vertical and rotary relays, which are bridged across the line at the exchange. These relays operate two springs (S_1) and (S_2), which take up the ground impulses and direct them to different parts of the switch.

The only mechanism which undergoes translation and rotation is the shaft (A) situated in front of the switch. The middle of this shaft contains a hub (H), the upper half of which is milled to form 10 horizontal circular teeth, and the lower half 10 longitudinal teeth. These are engaged, respectively, by the pawls (P_1) and (P_2) on the vertical and rotary armatures (V A) and (R A), when these are acted upon by the vertical and rotary magnets (V) and (R), enabling the shaft to be raised and rotated. Each impulse energizing the vertical magnet raises the shaft one step, each step corresponding to a certain level or row of bank contacts. Each impulse through the rotary magnets rotates the shaft one step, each step corresponding to one of the 10 contacts in a bank row. After each vertical impulse, the shaft is retained in position by the upper tooth (T_1) of the double dog (D D), the lower tooth of which (T_2) performs the same office for the shaft after rotation. This rotation may occur at any one of the 10 vertical positions, the shaft being supported by the fixed dog (F D). The lower part of the shaft holds the line and private wipers, the top, or private wiper (P W), operating on the private banks, forming the release trunk, while the lower, or line wipers (V W) and (R W), connect the vertical and rotary line with the corresponding contacts on the line banks. These wipers, rigidly attached to the shaft, form the jaws of a knife switch which readily engage the bank contacts.

The impulses operated by the vertical and rotary relays are directed to various parts of the switch by the action of a side switch. The side switch in this case consists of four knife switches (a), [illegible] insulated from one another and mounted upon a shaft rigidly attached to one end of the spider arm (S A), which is pivoted at (B) and operated by a spring (C). The action of the spider arm is controlled by a finger (F) engaged by two escapement springs (E S) fastened to an arm of the private armature (P A). In the normal position of the switch this finger is in the position here shown. An impulse through the private magnet (P M) pulls down the private armature and allows (F) to fall against the upper tooth of (E S). Upon cessation of the impulse the armature assumes the normal position and (F) passes into the second space of the lower escapement spring, the spider arm carrying the side switch into the second of the three positions (1), (2) and (3).

Upon the next impulse through the private magnet, (F) is carried out against the stop (X), and the side switch takes the third position. Battery is thrown upon the vertical line (V L) through

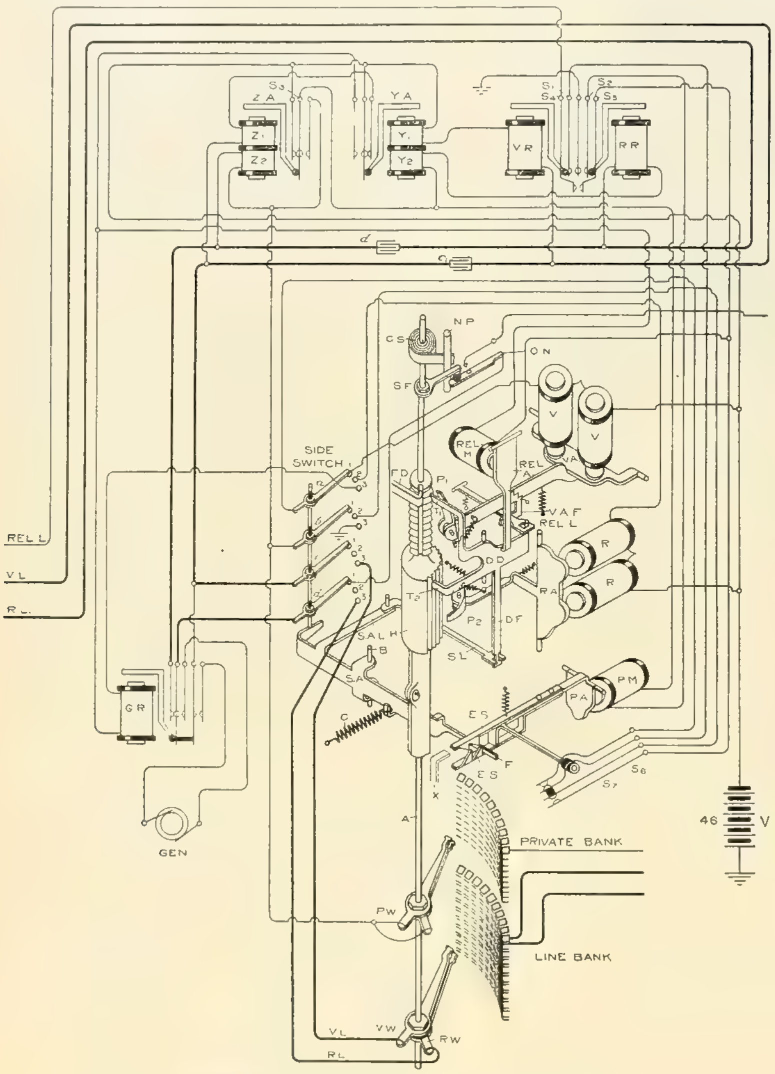


FIG. 5 COMMON-BATTERY CONNECTOR WITH ITS CIRCUITS.

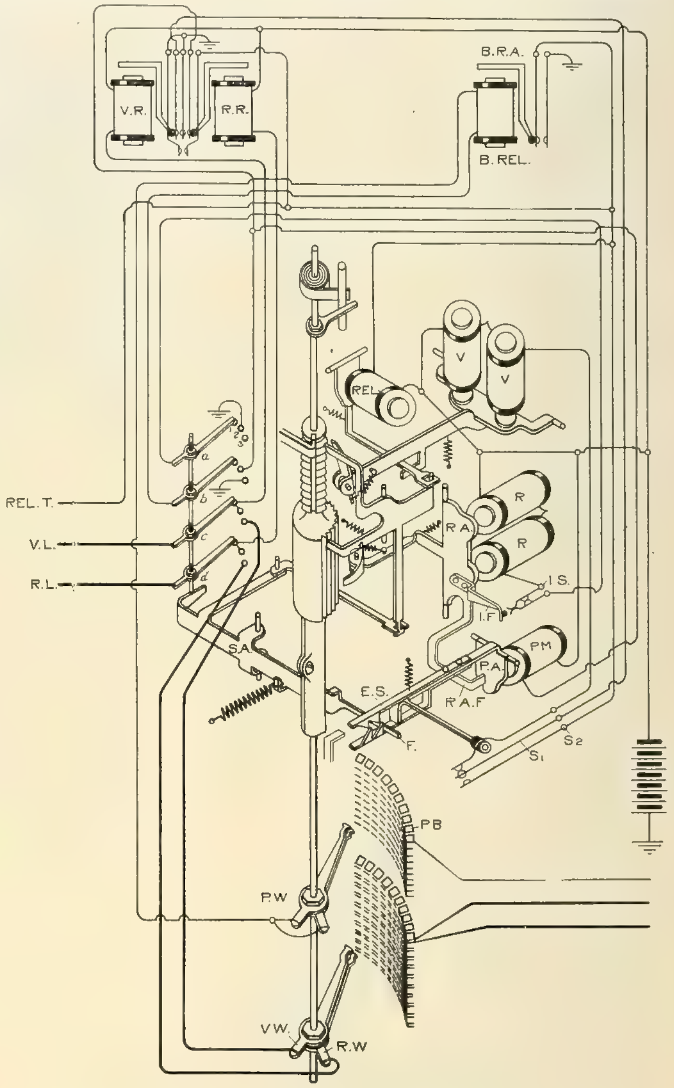


FIG. 6. THE PARTS OF A FIRST SELECTOR, WITH CIRCUITS.

the vertical relay (V R) in series with an additional coil (Y_1). Similarly, the rotary line (R L) receives battery current through the relay (R R) in series with the coil (Y_2). The two coils (Y_1 Y_2), one above the other, are wound so that in response to an impulse over both lines their magnetic forces act in the same direction.

The two relay armatures when attracted by the relay magnets (V R) and (R R), throw ground, respectively, on springs (S_1) and (S_2). The first of these, when closed, forms a part of a circuit passing through the spring contact of the private relay arm (P A), the side switch (a) and the coils of the vertical magnet (V) to battery. Spring (S_2) closes the circuit through the private magnet (P M) and the spring (S_3) to battery.

By the construction of the telephone every series of impulses over the vertical line is followed by one impulse over the rotary line, without a special act of the subscriber. A series of impulses over the vertical line is transformed into an equal number of vertical steps imparted to the shaft by the attraction of the vertical armature (V A) to the vertical magnet (V). The succeeding impulse over the rotary line allows the side switch (a) to pass into position (2).

The next series of impulses over the vertical line will be transformed into an equal number of steps imparted to the rotary shaft by the action of the rotary armature (R A). Again the impulse over the rotary line, operating the private magnet, allows the side switch (a) to occupy position (3).

It will now be seen that the vertical and rotary lines are connected through the side switches (c) and (d) to the wipers (V W) and (R W), and that the private wiper (P W) is connected to ground through side switch (b). An impulse over the vertical line will now throw ground through position (3) of side switch (a) upon the ringer relay (G R), which, acting upon a pair of springs, throws through them an alternating current from the generator upon the called line.

When the called subscriber takes his receiver from the hook a circuit is closed through the transmitter over the vertical line to main battery through coil (Z_1), and to ground over the rotary line through coil (Z_2), thus supplying current for talking to the called line. Coils (Z_1) and (Z_2) mounted in like manner as (Y_1) and (Y_2), with their magnetic forces acting in the same direction, attract armature (Z A), thereby throwing the rotary line of the calling subscriber by the action of spring (S_3) from battery to ground. Since the receiver of the calling subscriber is removed from the hook, a circuit is now completed from ground at side switch (b) through coils (Y_2) and (R R), over the calling line, back through the coils (V R) and (Y_1), to main battery, thus supplying current to the other half of the line. Coils (Y_1) and (Y_2), now in series, have their magnetic forces opposed so that armature (Y A) is not affected. Connection between the calling and the called line is made through condensers (C_1) and (D_1) of two microfarads capacity each.

The current over the calling line, passing through the vertical and rotary relays, may or may not cause their armatures to act, but this is immaterial, since there is now no battery on the impulse or front release springs.

After completing the conversation the switch is released and restored to normal upon hanging up the receiver, an action which grounds the vertical and rotary lines simultaneously. The grounding of the rotary line shunts out coil (Y_2), whereupon (Y_1), attracting its armature, deprives the called line of battery, which is transferred to one side of the release magnet. Coils (Z_1) and (Z_2), no longer energized, release the armature (Z A), and the rotary side of the calling line is thereby transferred from ground to battery. The vertical and rotary relays immediately re-energizing, close the front release springs (S_4) and (S_5). Spring (S_4) is grounded through a half-ohm coil of a selector over the release trunk, and (S_5) is now joined to main battery through the release magnet (Rel M). This magnet, attracting its armature, causes the double dog to release its clutch on the shaft. A release link (Rel L) dropping over a finger of (D D) retains it until the switch is again used. The shaft upon being released by (D D) is rotated back by the tension of a coiled spring (C S) until it is stopped by the finger (S F) striking the normal post (N P), when it drops to its original position. The same motion which withdraws the double dog also restores the arm (S A), by means of the finger (D F) acting through a link (S L) upon the lever (S A L). When the switch is next used, the first vertical impulse raises the release link by means of the finger (V A F) on the vertical armature, allowing the double dog to be acted upon by a spring, which returns it to the shaft. The switch can thus be released from any position.

Connection with a busy line is prevented by an automatic release of the connector. The private wiper of an operated connector throws ground on the private contact corresponding to the line contacts of the called subscriber from side switch (b) in position (3). The last impulse over the vertical line of a subscriber who is calling in on a busy line causes the private wiper of his connector to engage a multiple of the private bank [illegible] occupied by the private wiper of another connector, while his side switch is in position (2). Consequently, the wiper (P W) receives ground through the private bank, from the side switch of the connector occupying the line. The impulse over the rotary line which follows every series of vertical impulses, as noted before, energizes the private magnet (P M), which, in attracting armature (P A), closes springs (S_6) and (S_7), throwing main battery on the grounded private wiper through the release magnet, thus effecting the "busy" release. The subscriber, not yet knowing that his connector has been released, grounds the vertical line in order to ring. The connector responds by raising the vertical shaft. The off-normal springs (O N), which are held open by the finger (S F) when the switch is at normal, now close, connecting the rotary side of the line with the generator, which, by an inductive effect, produces the common "busy" signal.

Fig. 2 (see Western Electrician of last week) shows diagrammatically how this release is effected. No. 01 is here represented as having called No. 05, whose normal leads are connected with the fifth contact of the tenth bank level. No. 02 attempts to call No. 05 and engages a multiple at (Z) of the contact still occupied by No. 01 with his last impulse over the vertical line, while his side switch (b) is in the second position. The succeeding impulse over the rotary line causes the private armature to close two springs, which complete the circuit through the release magnet to battery. If, instead of No. 05, No. 02 attempts to call No. 01, the release is similarly accomplished. The normals of switch No. 01 are connected to the first contact of the tenth bank level, and the shaft being off-normal, the off-normal springs are closed, throwing ground over the private normal upon this contact. No. 02, upon engaging a multiple of the same contact, has his connector released as before.

In Fig. 6 are graphically represented the parts of a first selector with circuits. The purpose of a selector being to select a trunk line only, it is more simple than the connector, and coils (Y_1), (Y_2), (Z_1), (Z_2) and (G R) do not appear. An additional coil (B Rel), called the back release relay, on the interrupter springs (I S), constitutes the chief mechanical addition.

The step-by-step rotary movement of the first selector is automatic and not operated by the subscriber. After the first series of impulses over the vertical line has raised the wipers to the desired level, the following impulse over the rotary line operates, as before, the private magnet (P M). This magnet, attracting the private armature (P A), allows the finger of (S A) to pass directly from position (1) to position (3) in the following manner:

When (F), together with the side switch, passes into position (2), a circuit from ground at side switch (a) passes through springs (I S) and the rotary magnets (R) to battery. The rotary armature (R A) on pulling up breaks the circuit through (R) by interposing a finger (I F), which separates the two interrupter springs. At the same time, the rotary armature finger (R A F) presses down mechanically the private armature, allowing (F) to fall against the upper tooth of the escapement spring (E S). The circuit being broken, the rotary armature is pulled back by the action of a spring, and, the private armature rising, allows (F) to pass to position (3).

The wipers are thus left by the one rotary impulse upon the first bank contact of the row to which they were carried by the vertical impulses. The two lines (V L) and (R L) are thereby connected directly with the first connector of the [illegible] of this selector now throws ground upon the private bank contact through the half-ohm coil (B Rel) [illegible] front release spring (S_4) of the connector over the release trunk (Rel T).

The selector of another subscriber now calling into the same group will avoid this busy trunk and select one leading to another connector. At the first impulse over the rotary line the side switch (b) will pass into position (2) and the private wiper will engage the multiple of the contact previously grounded. The interrupter finger (I F), breaking the circuit through rotary magnets, allows the rotary armature to fall back. The private armature, however, remains held down, due to the ground received by the private magnet through the wiper (P W). The interrupter springs again closing the circuit, the shaft is rotated another step. The private wiper now resting on a contact not grounded, the private armature is released and the finger (F) passing into position (3) leaves the lines connected with connector (2). As long as the private wiper continues to engage a grounded contact, it will rotate automatically, the side switch being unable to pass out of position (2) until the private armature is released.

Owing to the fact that the first selector is eliminated after the side swich reaches position (3), its release is effected by the connector over the release trunk (Rel T). This, as shown in Fig. 5, is connected with one of the 100 contacts of the first selector private banks (P B), and from there with ground through the back release coil (B Rel), when the private wiper engages the contact. When the front release springs of the connector are closed during the release, the coil (B Rel) is energized, attracts its armature and throws ground on the release magnet, thereby releasing the first selector.

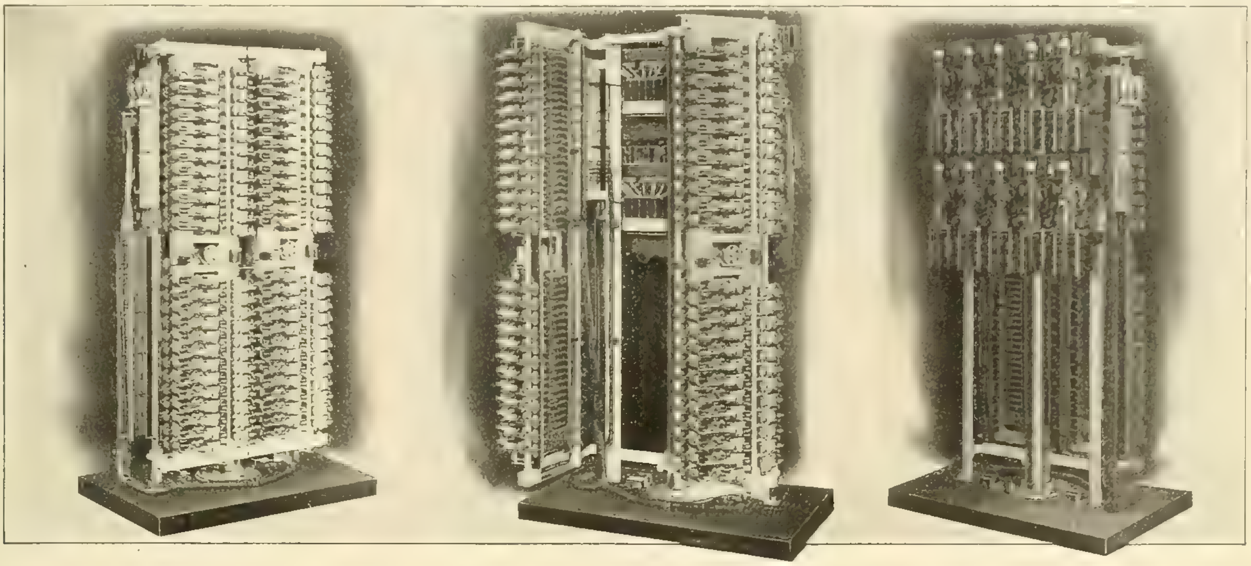


FIG. 7. DIFFERENT VIEWS OF A GROUP OF 100 LINE SWITCHES.

Should the subscriber for any reason wish to release his first selector before obtaining his connector, he accomplishes this by grounding both the vertical and rotary lines. The rotary line energizing the private magnet causes spring (S_2), connected with the release magnet (Rel 1), to make contact with (S_1), now receiving ground from (S), which is grounded by the impulse over the vertical line through coil (V B).

Fig. 7 shows a group of 100 line switches mounted on two rectangular panels, supported by hinges attached to the framework of an upright central post. Directly back of these, on the opposite side, and facing the opposite direction, are mounted 10 connectors in the usual manner. The 100 line switches with the 10 per cent. of connectors thus mounted constitute what is termed a "line switchboard unit." Each panel holds 50 line switches, separated into two groups, one above the other, by the master switch, which occupies a central position. Each group of 25 line switches consists of two parallel vertical contingent rows containing 12 and 13 switches, respectively.

[To be concluded.]

A Temporary Reduction in Voltage.

Writing from San Francisco on January 8th, the Pacific Slope correspondent of the Western Electrician notes briefly a rather unusual incident in power transmission: "The Northern California Power Company, operating on the western side of the Sacramento Valley in California, has reduced the voltage on its lines from 40,000 to 20,000, owing to the number of accidents which have occurred since the wet weather set in. The high voltage will be restored at the end of the wet season."

Independent Telephone Convention Next Week.

The annual convention of the International Independent Telephone Association will be held in the Coliseum Annex, Chicago, January 21st to 23d. Delegates are expected from all the state associations throughout the United States and from Canada. In view of the great strides made by the Independent telephone interests, pains have been taken to have an unusually complete and interesting program. The list of papers is the largest ever attempted for any telephone convention, and, in addition, present problems and their solution are to be discussed by prominent telephone men from all parts of the country.

Special interest attaches to the convention this year, as it is to be held in connection with the third annual Electrical Show. The entire annex of the Coliseum has been set apart for the convention sessions and for Independent telephone exhibits. The entertainment committee is arranging special social and entertainment features for delegates and visitors.

On Monday, January 20th, a meeting of the executive committee will be held at 1:30 p. m., and the advisory board will meet at 2:30. The committee in charge of details will meet at 10:30 a. m. on Tuesday. Convention headquarters will be maintained and committees will meet at the New Southern Hotel, a block and a half from the Coliseum.

The convention proper will be called to order on Tuesday, January 21st, at 2 p. m. in the Coliseum Annex. Following is the preliminary programme:

TUESDAY, 2 P. M.

Invocation.
Address of Welcome, by Hon. F. A. Busse, mayor of Chicago.
Response, by M. L. Clawson, Indianapolis.
President's annual address, by Theodore Gary, Macon, Mo.
Officers' reports; appointment of committees; written reports of state, territorial and provincial associations.
Papers and addresses as selected.
General discussion of practical subjects.
Question box.

WEDNESDAY, 10:30 A. M.

Report of Entertainment Committee.
Report of Committee on Resolutions.
Papers and addresses as selected.
Question box.

WEDNESDAY, 8:30 P. M.

Complimentary smoker in convention hall.
Music, refreshments and special programme.

THURSDAY, 10:30 A. M.

Papers and addresses as selected.
Reports of miscellaneous committees.
Report of Nominating Committee.
Election and installation of officers.
Transaction of miscellaneous and new business.
"Our Future Policy"—Discussion regarding work to be taken up during the coming year.

The following is a partial list of papers and addresses which will be presented at the convention:

"How to Raise Rates," L. A. Herrick, Freeport, Ill.; "Business Methods in the Telephone Business," C. B. Cheadle, Joliet, Ill.; "The District, State and International Associations," A. C. Lindemuth, Richmond, Ind.; "Independent Requirements in Canada," L. Page Wilson, Toronto, Can.; "Depreciation of Telephone Properties as Compared with Other Public Utility Corporations," Geo. S. Shanklin, Lexington, Ky.; "Financing Methods to Meet Modern Requirements," L. W. Stanton, Cleveland, O.; "Equitable Charges for Telephone Service," W. H. Crumb, Chicago, Ill.; "Telephone Investments," Max Koehler, St. Louis, Mo.; "Combatting the Sub-license Company," Frank L. Beam, Columbus, O.; "The Bankers' Opinion of Securities," E. H. Moulton, Minneapolis, Minn.; "Toll Line Advertising," J. B. Earle, Waco, Tex.; "Aerial and Underground Construction," C. H. Judson, Seattle, Wash.; "Winning Home Support in New Fields," T. S. Lane, Butte, Mont.; "Telegraphing Over Telephone Wires," C. Y. McVey, Cleveland, O.; "Joint Occupancy of Pole Lines," C. E. Tarte, Grand Rapids, Mich.

The Independent Telephone Association has its general headquarters in the Monadnock Building, Chicago, where Mr. J. A. Harney, assistant secretary, is in charge. Mr. Theodore Gary of Macon, Mo., is president and Mr. Charles West of Allentown, Pa., is secretary.

GENERAL TELEPHONE NEWS

C. O. Graves and others will install a telephone system in Pollock, La.

The Kerrville (Tex.) Telephone Company has been incorporated with a capital stock of $30,000.

The Hondo Telephone Company of Picacho, N. M., has been incorporated with a capital stock of $[illegible] by A. M. Thomas and others.

The West Beadle County Farmers' Telephone Company has been incorporated at Washington, S. D., with a capital of $[illegible].

[illegible] 1907 the Chicago Telephone Company reports an increase in the number of its telephones in service of 31,849, raising the total at the [illegible] in the county and country towns.

There are strange rumors current in Manitoba [illegible] ernment whereby the province purchased the Bell [illegible]

CORRESPONDENCE.

Continental Europe.

Paris, January 3.—There is a project on foot in Norway for a second electric tramway to run between Christiania and the suburban locality of Majorsteuen. The latter is the starting point of an electric railroad known as the Holmenkollen line and it runs to a much-frequented site lying at an altitude of 1,500 feet. The new traction road will be operated as a high-speed line, and it is expected to cover the distance within 10 minutes. Some 1.5 miles of tunnel will be required in the city.

A new type of light accumulator locomotive has been brought out not long since in Switzerland. It is constructed by the Oerlikon Company of Switzerland in combination with the Oerlikon Accumulator Company. The present locomotive is designed to give a normal capacity of 30 horsepower, being of a size which is adapted for trains of light cars. The motor of the above capacity is of the series type and is made to drive the axles by means of reduction gearing. The storage battery consists of 144 cells and is designed to give 240 ampere-hours on a 48 ampere discharge, or 180 ampere-hours on a 90-ampere rate. The total weight of the storage battery when in working order is somewhat over seven tons, and the locomotive as a whole weighs 20 tons. Using a current of 290 volts and 20 amperes, it will travel at 10 miles an hour. The tractive effort at the standard load is stated to be near 3,500 pounds.

At Sofia, Bulgaria, the minister of commerce and agriculture has lately advertised for bids concerning an electric plant which the government intends to install at the Pernik coal mines. The estimated cost of the plant is $200,000.

The Orleans Railroad Company has now installed a moving staircase in its large passenger station at Paris, lying on the bank of the Seine. In the present building the tracks of the line are upon a lower level than the sidewalk, and accordingly the station has two stories. The staircase will be a great convenience in transporting passengers to the upper story. It is operated by an electric motor, using three horsepower when running empty and only six horsepower when fully loaded with 50 persons. It can carry 4,000 persons an hour.

Application has been made to the Italian government for the rights for a standard-gauge electric railroad which is to run between Montesilvano and Penne. It is also proposed to adopt the electric system upon a considerable section of the railroad line which runs between Turin and Brusasco, this being the Turin-Chivasso section. The transformation has been already authorized by royal decree.

The Varesina Electric Company has lately applied to the authorities of the Como district of Italy for the water rights upon Molinera Creek and propose to erect a hydraulic plant upon this stream in the near future.

At Budweis, Germany, a firm known as the International Electric Company intends to erect a light and power plant of some size and at a later period it expects to install an electric-railway line.

The operations which are being carried on by the Salzburg Railroad and Traction Company of Austria provide for changing over a large part of the lines of this company to electric traction, and this will be carried out very soon as far as the Bavarian frontier. A. DE C.

Great Britain.

London, January 4.—A proposal has been made that a national memorial to Lord Kelvin should be established in Ireland, his lordship's native country, and as a matter of local sentiment there is much in favor of the idea. On the other hand, however, the proposition has set in motion a recommendation that a much more widely supported memorial should be erected in London or Glasgow, preferably the former. Thus the proposition becomes a national matter and befitting Lord Kelvin's life work. At present, however, the mere suggestion has been made, but it is bound to be actively taken up.

The signalman implicated in the accident upon the Metropolitan electric railway in October, which resulted in the death of three passengers, has after a long magisterial inquiry been committed to the Central Criminal Court upon a charge of manslaughter. There enters into the case prominently the working of the electrically interlocked signaling system, which the signalman alleges broke down and showed "line clear" when it should have been "train on line," but which the telegraph officials declare as impossible, and that any failure must be on the side of safety, viz., to prevent the lowering of the signal.

Considerable progress has now been made with the construction of the experimental track upon the Griffiths-Bedell surface-contact system of electric traction in London, a good portion of the roadwork having been excavated and the studholders placed in position. A number of improvements have been introduced into the system as the result [illegible] at Lincoln. For instance, at points and crossings manganese steel rails are used to prevent danger from short-circuiting when the skate passes over the rails. Every car is also fitted with a device in the shape of a steel brush which indicates by a bell on the car whether the stud post passed over by the skate remained alive.

The total amount disposed of by Lord Kelvin's will has not yet been made public, but it contains a grant of $25,000 to Glasgow University, to be applied by the senate in promoting research and teaching physical science in connection with the chair of natural philosophy which his lordship occupied for so many years.

One of the consumer companies which acquired the main generating station of the South Wales Electrical Power Distribution Company has commenced an extension of the plant and has ordered from the British Westinghouse Company a 3,000-kilowatt turbo-generator.

A somewhat unhappy state of affairs was revealed last week at the meeting of the Sunderland and District Electric Tramways Company. This concern runs a tramway service outside the city of Sunderland in a purely mining district where the traffic may be described as a more or less week-end traffic. Despite this drawback, however, it is clear that the undertaking has been badly handicapped by errors on the engineering side. A large number of French cars were purchased, presumably because they were cheap, but which the present chairman declares he would scrap tomorrow if he had the capital, while in order to get the undertaking at work as early as possible a gas-generating plant was installed which proved so uneconomical that it had to be replaced by a steam plant. G.

New York.

New York, January 11.—The first tunnel to Brooklyn was opened up for traffic on January 9th, and it is estimated that over 140,000 passengers were carried under the East River on the opening day. This opening was made the occasion for a celebration in Borough Hall Square, the present terminus of the Brooklyn subway. Speakers referred to the event as the most important since the opening of the Brooklyn Bridge. The effect of the subway was quite noticeably felt on the bridge traffic, and the fearful crush at the bridge terminal during the rush hours was reduced from 20 to 30 per cent. While it is believed that the new tunnel will at first carry a considerable number of passengers who want to try the new route from curiosity, it is evident that it will continue a distinct source of relief to the almost inhuman crowding on the bridge trains. During the rush hours eight-car trains will be run in the tunnel at a headway of three minutes.

The Public Service Commission has decided to hold a public hearing to consider the advisability of recommending amendments to the Elsberg law which now limits the term of subway leases and throws other restrictions about the construction of extensions and new lines that it is believed will hamper the proper growth of the system to keep pace with the demands for continued improvements in the transportation systems of the metropolis.

Mayor McClellan admitted the other day that tentative negotiations had been started between the city authorities and the Belmont interests looking to the city's purchase of the Belmont or Steinway tunnel to Long Island City. Even if the city should become the owner of this tunnel, it will have to look to the Public Service Commission in regard to operating it, so that this body will doubtless have the last word in the matter any way it turns out. This tunnel is almost ready.

On January 6th Judge Lacombe, of the United States Circuit Court, appointed F. W. Whitridge receiver for the Third Avenue Railway system on petition of the bondholders of the company. The action was caused by the failure of the receivers of the New York City and Metropolitan Street Railways to pay the interest on Third Avenue bonds that became due on January 1st. The immediate effect of this procedure is to take the Third Avenue lines out of the Metropolitan system and thus to terminate the transfer arrangements between the two original systems. The whole move is but another tangle in the already muddled relations of the Interborough underlying companies.

The Metropolitan Electric Repair Protective Association has been formed at a meeting in Brooklyn. James F. Hughes, of Charles A. Borne Company, New York, was elected temporary chairman, while Leopold F. Luedecke, of the Thompson-Bonney Company, Brooklyn, was elected temporary secretary. Mr. Hughes stated the purpose of the new association, emphasizing the essential reasons why such an association should be called into existence. He touched upon the abuses and impositions the repair man has become more and more exposed to by irresponsible persons, and said that the time was ripe when the repair men should unite in self defense. This sentiment was enthusiastically received, and a general debate ensued in which the most salient points of the repair business were discussed. The chairman ap-

pointed a committee to prepare [illegible] constitution and by-laws, consisting of John P. [illegible], [illegible] man, Eugene E. [illegible], of the [illegible] Company, New York, and Leopold F. [illegible] W.

Ohio.

Toledo, January 11.—J. F. [illegible], superintendent of fire and police-alarm telegraph in Toledo, will open a fight against the telephone and telegraph companies to compel them to comply with the ordinances requiring all wires to be placed in underground conduits.

A large class of inside wiremen and electricians took the annual examination held in Toledo last night. This examination indicates to the city electrician the competency of the men who are wiring buildings and constructing electrical apparatus in the city. It is also a guide to the workers as to the requirements of the Safety Board.

Extensive additions are being made at the Columbus lighting plant by the installation of a large quantity of new machinery, which will provide a complete reserve generating outfit for use in case of emergency. The work will be completed within 60 days.

P. D. Milloy, acting for the Milloy Electric Company of Bucyrus, Ohio, of which he is president, has purchased the patents for the single-phase railway system with third rail invented by H. C. Reagan of Pittsburg, who was awarded the Edward Longstritt medal by the Franklin Institute of Philadelphia. The patents for Reagan's arc lamp and electric headlight were also included in the transfer.

The Fremont Board of Education has issued orders to teachers and to telephone operators that no calls are to be sent into the school buildings during school hours unless in case of sickness or death. The action was taken to prevent telephone "visiting," which was becoming a nuisance.

The Council of the village of Kaiida, Ohio, has granted to William J. Francis a contract to furnish a lighting system for the municipality. The lamps are to be installed within six months.

Peter Harrison, who recently fell upon several high-tension wires carrying a total voltage of 18,000, in the Lake Shore Electric power house at Fremont, Ohio, is slowly recovering from the extensive burns received.

The Ohio Electric Railway Company has begun the work of building a power house near Lewiston reservoir, for the Bellefontaine extension. A pleasure resort will also be equipped at Orchard Island by the company this coming summer. H. L. S.

Michigan.

Detroit, January 11.—The Washtenaw Light and Power Company has been granted a 30-year franchise by the township board of Monguagon, Wayne County, giving the right to run feed wires on any road. It is planned to extend lines to Trenton and Grosse Isle.

On account of an increase in rates by the Citizens' Telephone Company at Holland, subscribers have petitioned the Common Council to test the validity of the franchise under which the company is operating.

It is reported that the work on the line of the Calumet and Lac la Belle Traction and Power Company, between Calumet and Mohawk, will begin on January 15th and that poles have been ordered and will be delivered on that date. The route has been surveyed and includes Calumet, Red Jacket, North Tamarack, Centennial Heights, Wolverine, Kearsarge and Mohawk, besides a few other villages.

Arrangements are being made to begin work on the Marquette, Negaunee and Ishpeming Railway in the spring, the surveying having been completed. According to the terms of the franchise, work must be started by June 1st.

Hartford is considering the question of a municipal electric-lighting plant and it may be submitted to the voters at the next election.

The Northern Ice Company has installed a new engine in its ice house at Bear Lake and arrangements are being made to supply that village with electric light.

Birmingham has received proposals for lighting from three companies and the citizens express a desire for 24-hour service. D.

Indiana.

Indianapolis, January 11.—The Northern Indiana Railway Company, which is allied with the Southern Michigan Railway Company, has entered upon the construction of lines to connect South Bend, Niles and Kalamazoo.

The interurban line between Brazil and Greencastle has been completed with the exception of a few days' overhead work. The completion of this line will allow the Terre Haute, Indianapolis and Eastern Traction Company through service from Terre Haute to Indianapolis by way of Brazil and Greencastle.

Work on the new interurban line of the Winona company between Valparaiso and Fort Wayne was begun during the week. This line has been under consideration for nearly two years. The road will parallel the [illegible] the distance.

The annual report of the [illegible] [illegible] Company [illegible] [illegible] and [illegible] been filed with the city controller. It shows a considerable gain in the traction business over that of 1906. [illegible] 1907 was [illegible] [illegible] purchase the city [illegible] in 1906.

The Town Council of Roanoke has passed an ordinance granting the Fort Wayne and Wabash Valley Traction Company a franchise to do an electric-lighting business in Roanoke for a period of 99 years.

The street-lighting franchise of the United Gas and Electric Company in New Albany will expire on September 1st next. The council has appointed a committee to prepare a new franchise ordinance, with a provision to sell the franchise to the highest bidder.

The City Council of Rockport has awarded a 10-year franchise to the Rockport Waterworks and Electric Light Company, under which the streets will be lighted and the public served with electricity and water.

A valuation of $57,632 has been placed on the Crawfordsville electric-light plant, a municipal concern, on which an appraisement was ordered by the City Council. This appraisement was made with a view to the sale of the property to a New York corporation, which has made an offer of $46,000 for the plant. Public sentiment relative to the sale of the plant is about equally divided.

Normal conditions have been resumed in Muncie, the scene of the street-railway strike, and nearly all of the state troops have been withdrawn. S. S.

Northwestern States.

Minneapolis, January 11.—A committee of the citizens of Spring Valley, Minn., and vicinity reports the general sentiment favorable toward the proposed electric railway between Spring Valley and Cresco, Iowa, and Owatonna, Minn. The length of the line will be about 75 miles.

At a special meeting of the Livingston (Mont.) City Council the Livingston Water Power Company was granted a water franchise. At a special election to be held there on February 4th the voters will also decide on granting the same company a 30-year electric-light franchise. The corporation is reported to have spent in Livingston about a quarter of a million dollars, and to have one of the finest plants in the state, with three sources of power supply—its own ditch out of the Yellowstone, its Madison River plant and its Big Hole plant.

The Prescott (Wis.) lighting system is increasing its capacity with a dam on the Kinnickinnic River at Clifton.

The hearings this week before a special committee of the Minneapolis Council, which is investigating the electric-light company looking toward a new contract for cheaper rates, has brought out the declaration of Judge Robert Jamison, for the company, that the Minneapolis General Electric Company has but one rate for all customers. The Commercial Club advises the acceptance of the company's compromise schedule.

All obstacles to the completion of the electric street railway for Mankato, Minn., are said to have been overcome by the Mankato Gas and Electric Light Company, and the installation of the power plant is being rushed.

At a meeting of the Graceville (Minn.) Commercial Club it was decided to make an effort to improve the water and electric-light plant.

Oshkosh (Wis.) promoters are planning the organization of a company to build an electric interurban railway to Winneconne, which will pass the famous fishing and hunting grounds of Butte des Morts Lake.

A $40,000 contract has been awarded a St. Paul firm for equipping electrically the new Denver (Colo.) auditorium in which the national democratic convention is to be held. R.

Pacific Slope.

San Francisco, January 8.—The management of the Great Western Power Company announces that its plant, some distance above Oroville in the Feather River Canyon, will be furnishing electric power by next October. Over 600 men are now employed on the work. The initial capacity of the plant will be in the neighborhood of 60,000 horsepower, but it is intended to bring the capacity up to 100,000 horsepower as soon as possible. A. B. Bidwell, who is superintendent of the Meadow division of the company's property, is now obtaining rights-of-way for a pole line in his territory.

The retiring Board of Supervisors of San Francisco at its final session passed a resolution revoking the appropriation of $720,000 made by the preceding board for the acquisition of the Geary Street railway system and its conversion into an electrical municipal system.

At a meeting on January 5th, the mine owners and other employers at Goldfield, Nev., decided that after January 10th electricians would be paid [illegible] men are willing to accept the reduction in wages, [illegible]

[illegible] Street, San Francisco, has completed the electric [illegible] and Market streets, San Francisco, the reconstruction of which is now practically completed. Alto[illegible] were placed in the building. Half as much electric [illegible] switches were installed. The electric current is supplied from a steam-turbine plant in the new annex on Stevenson Street.

The New Mexico Light, Heat and Power Company is making a number of changes and enlargements in its plant at Silver City, N. M. A 100-kilowatt alternator having a capacity of 2,200 volts has been added. The building is to be enlarged so as to permit of all the machinery being under one roof. The overhead system will be reconstructed.

R. L. Masson of the Arizona Power Company, which was recently formed to develop hydro-electric power at Fossil Creek, 50 miles from Prescott, Ariz., has arrived at Prescott to inspect the work and begin operations. He says that the company has been financed to the extent of $1,500,000 by Bonright & Co. of New York.

Joseph H. Handlon has been appointed chief claim agent for the United Railroads of San Francisco in place of A. K. Stevens, resigned. A number of minor changes in the personnel of the company have been made. Manager Black of the company reports that more than 500 of the striking employes have applied to be taken back and that some 350 have been accepted.

The City Council of Pasadena, Cal., has adopted a resolution providing for a $100,000 bond election. Fifty thousand dollars' worth of the bond is to be for the completion of the municipal lighting plant. A.

PERSONAL.

On the day that Mr. Hibbard took up his duties as mayor of Boston, Wire Commissioner Patrick J. Kennedy tendered his resignation. The mayor asked Mr. Kennedy to remain in office a few days.

Dr. George R. Olshauser, recently of Cornell University, is now assistant professor of electrical engineering at the Worcester Polytechnic Institute. He will give courses on the theory of electricity.

Mr. Frank McMaster, well known and well liked among electrical men in Chicago, reports that he has entirely recovered from his recent tedious illness. During the electrical show he is at the exhibit of the Fort Wayne Electric Works.

Julian E. Smith, chief mechanical and consulting engineer of the Armour company, Chicago, died suddenly on January 7th at Magnolia Springs, Ala. He had been connected with the Armour interests for 15 years. He was born in Cincinnati, Ohio, in 1862.

Among early out-of-town visitors to the Chicago Electrical Show were Dr. Lee De Forest, F. H. Gale and A. H. Patterson of New York; George H. Stickney of Lynn, Mass.; K. E. Sternberg of Springfield, Mass.; George Loring and Paul E. Norris of Cleveland and B. B. Montgomery of Indianapolis.

Mr. W. R. Garton, formerly president and treasurer of the W. R. Garton Company of Chicago, has associated himself with the Lord Electric Company and has been appointed general manager of the manufacturing department. He will be located at the general offices, 213 West Fortieth Street, New York city.

At last week's meeting of the American Institute of Electrical Engineers in New York city the following-named associates were transferred to the grade of member: Bennet Carroll Shipman, San Francisco; Winfield A. Haller, New Orleans; William Thomas Taylor, Mexico; Greenleaf Whittier Pickard, Boston; Henry Floy, New York.

Mr. Hayden Eames, the new general manager of the Studebaker Automobile Company, is an enthusiast on the power wagon. Mr. Eames says that every time he sees a horse struggling with a heavy load, the thought immediately occurs to him: "If the owner of that animal only knew how much better and cheaper his work could be performed with a power wagon, he wouldn't hesitate another day in making the change."

Mr. Russell M. Howard, who for the last seven years has been manager of the Clinton Street Railway Company of Clinton, Iowa, has accepted the position of manager of the Green Bay Light and Traction Company of Green Bay, Wis., which company owns the lighting and power plant at Green Bay, interurban systems to Kaukauna and to DePere, Wis., and the local street-railway sys-

tem in Green Bay. In Clinton Mr. Howard has built up an excellent street-railway system and he holds the confidence and good will of officials and employes of the company and of the public.

Wilson Henry Fairbank died at his home in Warren, Mass., on January 5th. Mr. Fairbank was well known for his construction of telegraph lines. He had a hand in the construction of the Atlantic and Pacific, American Union, Mutual Union and Postal Telegraph lines. In June, 1885, he became general superintendent of construction for the American Bell Telephone Company. In 1891 he was compelled, because of ill health, to retire from active business.

Mr. H. M. Lauritzen of the engineering department of the Holophane Company is in the West, chiefly in the interests of his company, but partly also to recuperate from recent illness. Mr. Lauritzen will remain probably several months in Flagstaff, Ariz., returning to New York via Mexico City, where he will assist the Holophane Company's local representatives, Messrs. Victor M. Braschi & Co., in handling a number of important lighting installations.

Mr. George Weston has been appointed by the mayor and confirmed by the City Council of Chicago as the representative of the city on the Board of Supervising Engineers, Chicago Traction, to take the place of Mr. Charles V. Weston, who left the board to become president of the South Side Elevated Railroad Company. The two men are brothers. Mr. George Weston has been assistant chief engineer of the board since its organization and will continue to serve in that capacity, Mr. Bion J. Arnold being chief engineer. He was born in Kalamazoo, Mich., January 30, 1861, and, removing to Chicago in 1887, has had wide engineering experience, including the construction of steam and electric railways. With his practical knowledge, good judgment and extensive knowledge of local street-railway conditions, the new member of the Board of Supervising Engineers will no doubt play an important part in the street-railway rehabilitation of the city.

GEORGE WESTON.

ELECTRIC LIGHTING.

Martin Bros. of Cleveland, Ohio, have been granted an electric-light franchise in Springdale, Ark.

The Grangeville (Idaho) Electric Light and Power Company is planning to double its present output.

A. C. Graves will construct a waterworks and electric-light plant in Harlowton, Mont., at a cost of $20,000.

The Southern Light and Power Company of Sallisaw, Okla., has been incorporated with a capital of $20,000.

The electric-light plant at Elma, Iowa, has been destroyed by fire. The loss is $6,000, with insurance of $2,000.

Cashton, Wis., will vote on January 21st on a proposed bond issue of $15,000 to construct an electric-light plant.

The Town Council of Kenora, Ont., has decided to spend an additional $75,000 for the development of municipal power.

The ratepayers of Regina, Saskatchewan, have voted in favor of spending $60,000 for extension to the electric-lighting system.

The Sheffield (Iowa) Brick and Tile Company is about to install an electric-lighting plant for its own use, and also to furnish light to others.

The plant of the Texarkana (Ark.) Light and Storage Company has been destroyed by fire. The loss, $100,000, is said to be fully covered by insurance.

The property of the Wabaska Electric Company of Wymore, Neb., has been sold by the receiver to C. A. Snyder of Auburn, Neb., who is wrecking the plant and disposing of it.

A committee of the City Council of Dodgeville, Wis., is considering the advisability of purchasing the local electric-light plant or building a new plant and operating it.

The directors of the Boston Edison Company have declared the regular quarterly dividend of [illegible] holders of record January 15, 1908.

[illegible] special illumination of Felix Street in St. Joseph, [illegible] pay for installing the lamps and have signed the guaranty bond required by the city for the maintenance of the lights. The board of public works will advertise for bids on the contract to lay the conduits and cables.

The Board of Trade and several interested citizens of Sulphur Springs, Ark., are planning to organize a company and establish an electric-light plant, waterworks and ice plant in Sulphur Springs.

Experiments are being made in the lighting of the University of Illinois library with the new tungsten incandescent lamps. About 40 of these lamps have been installed, greatly improving the illumination without increase of current.

The order that has been before the Boston Common Council concerning municipal ownership of street lighting has been finally settled by the Council refusing, by a vote of 35 to 20, to reconsider its rejection of the order on December 19th.

In the merger of the Chicago Edison Company and the Commonwealth Electric Company each concern lost its corporate name. As these titles could be taken by other companies, and thereby cause confusion, both institutions were reincorporated on January 8th with a capital of $1,000 each.

The W. G. Smith Light and Power Company, which owns and operates the electric-light plant in Cottonwood Falls, Kan., will add to its facilities by putting in an ice plant. The plant is to cost about $10,000 and will have a capacity of 10 tons of ice a day.

ELECTRIC RAILWAYS.

It was announced a few days ago that 90 per cent. of the stocks and bonds of the Chicago Union Traction Company and its various underlying corporations have been deposited so as to take advantage of the trust agreements under which the lines are to be reorganized as the Chicago Railways Company and the new franchise accepted.

The Philadelphia Ledger prints a report from Butler, Pa., to the effect that the northern division of the Baltimore and Ohio Railroad between Butler and Kane, Pa., a distance of 114 miles, is to be converted to electric traction. The change is made, it is said, with the expectation of reducing maintenance and operating cost.

The Illinois Traction Company has accepted the franchise passed by the City Council of Streator, Ill. This, it is said, insures the construction of an interurban electric road between Ottawa and Streator, work upon which is to be begun by March 1st, and $100,000 is to be expended the first year. The project involves a new bridge at Ottawa toward the cost of which the city of Ottawa, the local street-railway company and the Bell and Home telephone companies will contribute.

POWER TRANSMISSION.

When the Harriman interests acquired control of the street-railway company in Salt Lake over a year ago it was announced that large electric power plants would be built in Utah and in some portions of Idaho. An official of the Utah Light and Railway Company is now quoted as saying that in accordance with these plans this company will soon begin the erection of a power plant at Devil's Gate which will have a generating capacity of 10,000 horsepower. The site selected is just above the bridge of the Union Pacific Railroad Company, upon property owned for some time by the Harriman interests.

The hydro-electric plant at Trinity River, Cal., is one of the power-transmission systems which have been constructed with an eye to the future rather than the present needs of the communities which they serve. It is located in the central part of Trinity County, Cal., two miles below the town of Junction City, where Canon Creek, from which the water used for power is obtained, flows into the Trinity River, having a drainage area of 52 square miles. The dam, which is small, serves merely for diverting the water. Alternating sections of ditch and open flumes, with a total length of 5,250 feet and a tunnel 1,821 feet long are comprised in the system. An effective head of 600 feet, or working pressure of 260 pounds per square inch, is obtained from two penstocks, each 1,165 feet long. This power house is equipped with Allis-Chalmers electrical machinery, consisting of two three-phase, 25-cycle generators, each 750 kilowatts, 500 revolutions per minute, 2,200 volts; seven step-up transformers, and auxiliary apparatus. A description of the entire plant, quite complete, is given in Allis-Chalmers bulletin No. 2027, and will be found of interest by engineers and students.

PUBLICATIONS.

The Beardslee Chandelier Manufacturing Company, 176-180 South Clinton Street, Chicago, has issued a handy catalogue, showing a varied assortment of moderate-priced fixtures which the company manufactures and carries in stock ready for [illegible] The company has larger catalogues showing complete lines of its goods. Any of its catalogues will be sent prepaid to dealers on request.

The Jeffrey centrifugal fan for mine ventilation is the subject of a recent illustrated circular from the Jeffrey Manufacturing Company of Columbus, Ohio.

The Samson Cordage Works of Boston, Mass., is distributing a neat desk calendar made unique by an attached mica-enclosed sample of its spot cord for arc-lamp suspension and trolley guidance.

The New York Insulated Wire Company has just issued a leaflet giving prices and a general description of its friction and rubber tapes. The company will be glad to mail a copy, together with samples, to anyone interested.

The Rust Boiler Company of Pittsburg, Pa., has just issued a report of tests on the Rust water-tube boiler made by William Kent, dean of the College of Applied Science, Syracuse University. The booklet contains some good illustrations and a list of "points of excellence in the Rust boiler," which will be of interest to power users.

Bulletins 91 to 94, inclusive, of the Crocker-Wheeler Company, Ampere, N. J., relate, respectively, to "Induction Motor Panels," "Combined Generator and Feeder Panels," "Small Engine-type Direct-current Generators" and "Alternating-current Switchboard Panels." All are clearly illustrated and are excellent specimens of technical trade literature.

The Electric Controller and Supply Company of Cleveland, Ohio, has just published an attractive catalogue on lifting magnets. Some excellent pictures are given of the different types of lifting magnets and of actual installations, showing the wide range of applications. This company has been making magnets since 1897, but since 1905 special attention has been given to magnets capable of handling pig-iron, steel and iron scrap, castings, rails and miscellaneous material.

Two new bulletins from the Fort Wayne Electric Works are of interest to managers of central stations and industrial establishments. Bulletin No. 1102 gives a list of plants operating direct-current direct-connected generators of the type MP and MLP. Bulletin No. 1103 goes into the details of this company's series alternating-current arc-lighting system. A new bulletin index has also been issued which will be found valuable to electrical men as a reference.

The Electrocraft Publishing Company of Detroit issues a list of approved electrical fittings bound up with the revised National Electrical Code. The October, 1907, edition makes a neatly printed and profusely illustrated book of nearly 400 pages. One interesting feature is the illustrating of the Code by photographs and drawings showing the applications of many of the rules. The publisher says that this work is the only complete, illustrated list of electrical fittings approved by the Underwriters' association. Certainly the book is useful for reference.

A recent publication of the underwriters of interest to electrical men is entitled "Rules and Requirements of the National Board of Fire Underwriters for the construction and protection of standard railway car storage and operating houses as recommended by the National Fire Protection Association and American Street and Interurban Railway Association." Another new booklet gives general information in relation to the underwriters' laboratories in Chicago. W. H. Merrill, 382 Ohio Street, Chicago, can give further information in relation to these publications.

The various types of meters manufactured by the Westinghouse Electric and Manufacturing Company are fully illustrated and described in circular No. 1137, now being distributed. This circular is especially well illustrated, having a total of 62 illustrations, of which a large number are devoted to diagrams showing the connections to be used for meters in all classes of service. The writers of this bulletin have departed from the usual method of conveying commercial information by entering into a complete description of the theory of induction meter design, method of compensation employed for securing the 90 degrees phase relation, method of compounding for different frequencies, etc. A detailed description is given of the double-jewel and rolling type of ball-bearing together with an explanation of its operation. This circular is a valuable contribution to meter literature, and the employment of a complete index greatly facilitates its use.

SOCIETIES AND SCHOOLS.

A calibration laboratory has recently been established at the University of Illinois under the direction of the department of electrical engineering. This laboratory is prepared to calibrate electrical instruments of all types at a small charge intended [illegible] the actual cost of calibration.

The Proceedings of the tenth annual meeting of the Kansas Gas, Water, Electric Light and

Street Railway Association at Topeka on October 9 and 10, 1907, have been issued in pamphlet form. James D. Nicholson of the Electric Light and Power Company at Newton, Kan., is the secretary.

MISCELLANEOUS.

The Cleveland Cliffs Iron Company is installing a complete electric haulage system in the Maas mine at Marquette, Mich. A complete electric generating plant is included.

The Ohio Legislature, according to a Cleveland dispatch, is to be asked by Mayor Tom L. Johnson to open the way to his realization of his municipal-ownership programme by raising the barriers on bond issues that he may obtain $60,000,000 with which to finance the electric lighting, gas-making and piping, and street-railway operations by the city that the mayor recently announced he would bring about.

The International Waterways Commission has just issued a report, based on further consideration of the navigable condition of the Great Lakes, in which it adheres to its recommendation that no more than 10,000 cubic feet of water per second should be diverted from Lake Michigan for the Chicago Drainage Canal. The commission says that the preservation of the levels of the Great Lakes is imperative. Furthermore, it concludes, that "the diversion of 10,000 cubic feet of water per second through the Chicago River, with proper treatment, will provide for all population which will ever be tributary to that river, and the amount named will therefore be sufficient for sanitary purposes for Chicago for all time to come."

TRADE NEWS.

Manufactures imported into the United States in 1907 aggregated in value about $650,000,000, against approximately $770,000,000 value of manufactures [illegible] reported the [illegible] of [illegible]. Prior to the fiscal year 1897 manufactures imported always [illegible].

Consul [illegible] that electrical industries in Germany continue to manifest an exceptional degree of activity, and there are no indications of a [illegible].

The Cregier Signal Company of Chicago has been incorporated with a capital of $50,000. The declared object is to manufacture and sell electrical devices. R. N. Stiles, N. B. Cregier and J. A. Brown are the incorporators.

The plan for reorganization of the finances of the Westinghouse Electric and Manufacturing Company has as its principal feature, it is reported, the creation of a first mortgage for about $45,000,000 and the issuance under it of bonds which will be exchanged dollar for dollar for the company's present obligations, and also the raising by President George Westinghouse and his friends of $7,000,000 cash, in return for which stock of the company will be transferred to them.

BUSINESS.

The Lord Electric Motor Company of New York, Boston and Chicago has recently made marked improvement in its manufacturing department, having greatly broadened the field and scope by acquiring some very valuable patents under which it will manufacture. This company has been actively engaged in manufacturing and supplying rail bonds, lightning arresters and kindred devices and appliances. The success attained through its efforts in bringing out and developing its line has encouraged the company to take on additional valuable specialties, all of which are covered by strong patents and which will appeal to the oper[illegible] dends.

[illegible] Ohio, manufacturer of dynamos and motors, ceil[illegible] Boulevard, Chicago, where it will carry a large [illegible] stantly increasing business in this territory has made these increased facilities necessary.

Allis-Chalmers Company, Milwaukee, Wis., is offering a new line of small electric hoists, which are made in five sizes for the single-drum and six sizes for the double-drum units. Two types, "K" for direct current and "ANY" for 25-cycle and 60-cycle alternating current, all series wound for hoisting service, are used exclusively. The 60-cycle motors, wound for 440 volts, are kept in stock, with suitable controllers and resistance boxes, and complete units for 15, 25, 35 and 50-horse-power single-drum type are ready for immediate shipment.

Julius Auerbach, president of the Electrical Accessaries Company, New York city, has returned from his European trip, where he spent six weeks in Budapest and Augsburg in behalf of the "Just" tungsten lamp, which his company is importing into the United States. Mr. Auerbach is enthusiastic over the progress and numerous improvements made in the quality of these lamps by the different factories. The Electrical Accessaries Company is now importing a full line of commercial tungsten lamps in 25, 40 and 100 candlepower for 100 to 120 volts, and 50-candlepower lamps for 200 to 250 volts. It is able to ship promptly any quantity from New York stock. Mr. Auerbach says that the 25-candlepower lamps will be a great step in advance, but perhaps still more important are the high-voltage lamps which he is bringing over.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 7, 1908.

875,698. Electric Time Alarm. Eduard Dubs, Oerlikon, Zurich, Switzerland. Application filed August 30, 1906.

Around the dial plate are two concentric sets of holes adapted to receive pins that form the terminals of different circuits. A contact lever, connected with a battery and moving with the clock hand, makes contact with the several pins.

875,715. Interchangeable Electric Display Apparatus. Deronda Levy, New York, N. Y., assignor to the Mason Monogram Company, New York, N. Y. Application filed April 5, 1905.

In an electric display carriage-call apparatus, employing a monogrammic field of electric lamps to be lighted in the outline of the numerals to be displayed thereon, the switch mechanism comprises three sets of numbered switch levers carrying contacts for the grouping of lamps that forms the corresponding numbers.

875,750. Carbon Brush for Commutators and the Method of Preparing Same. Edwin C. Van Nort, Jr., St. Louis, Mo. Application filed March 19, 1906.

This commutator brush is constructed of a block of carbon which is permeated throughout with paraffine, carrying finely-powdered graphite.

875,757. Magnetic Clutch. Thomas S. Watson, Milwaukee, Wis. Application filed April 1, 1907.

A magnet coil is clamped to and surrounds the shaft so it can attract a disk armature keyed to the driven member.

875,784. Apparatus for the Manufacture of Copper Electrotypes. Sherard O. Cowper-Coles, London, England. Application filed March 5, 1906.

In the vat are concentric cylindrical cathodes and anodes. The latter are perforated and mounted on a cylinder secured to a vertical revolving shaft. (See cut on next page.)

875,788. Pressure Device for Electric-current Collectors. Coloman de Kandó, Budapest, Austria-Hungary, assignor to the Westinghouse Machine Company. Application filed May 6, 1905.

The trolley of a locomotive driven by induction motors is pressed to the working conductor by pneumatic means and with a pressure that is small for low speeds and that increases with higher speeds. (See cut on next page.)

875,791. Controller Regulator. John P. Durkin, Philadelphia, Pa., assignor to the Durkin Controller Handle Company, Philadelphia, Pa. Application filed August 31, 1907.

The controller shaft has a cover fixed to it which has a depending part with a peripheral way therein. A flange overlaps this part and has a corresponding way therein. A ball revolves in the ways, which are of variable depth.

875,796. Lamp Base. Theodore W. Frech, Jr., Cleveland, Ohio. Application filed March 27, 1907.

This lamp base comprises a continuous metallic shell having a skirt which is coated with an adhesive insulating substance and a layer of absorbent pliable fibrous material.

875,801. Construction of Induction Electric Furnaces. Gustave Gin, Paris, France. Application filed May 3, 1906.

A hearth is provided with a number of open channels of greater depth at one end than the other. These are connected by laterally closed inclined conduits. Electromagnetic means are adapted to set up an induced electric current in metal contained in the channels and conduits.

875,810. Automatic Fire Alarm. Bruce C. Hall and Floyd W. Hall, Elmwood, Ill. Application filed January 12, 1907.

A pin connected with one of the circuit wires has a metal collar surrounding it which is connected with the other wire. A fusible member is mounted adjacent to the pin, so that as it melts it connects the collar and pin.

875,821. Device for Supporting Motors. Alfred Insinger, Philadelphia, Pa. Application filed July 13, 1905.

This support for an electric motor has a bracket with a step-like arm secured rigidly to it, a pillar for supporting the free end of the bracket, and a supporting ring for the motor secured to the bracket and transversely adjustable thereon.

875,822. Pressure Device for Electric-current Collectors. Coloman de Kandó, Budapest, Austria-Hungary, assignor to the Westinghouse Machine Company. Application filed November 27, 1903.

This is a modified form of No. 875,788.

875,830. Socket Key Clamp. Max Loewenthal, Newark, N. J. Application filed June 6, 1906.

An electric lamp socket has an adjustable clamp around the body thereof, a portion of the clamp being in the path of action of the key of the socket, to prevent fully turning the key.

875,833. Electric Arc Lamp. Joseph A. Meaher, Cleveland, Ohio. Application filed October 29, 1906.

The magnet is provided with a tubular core portion and a tubular armature with a depending bead block carrying an adjustably mounted head. This is provided with an inverted truncated cone-shaped cavity and a tubular carbon-clutch member provided with a similarly shaped head mounted in the cavity and having a depending carbon guide extending through the central opening. The last-mentioned head has radially extending openings carrying bearing balls adapted to bear against the inclined walls of the cavity.

875,843. Apparatus for Track-circuit Control. James A. Peabody, Evanston, Ill. Application filed July 25, 1907.

This apparatus for supplying alternately current to a railway track for track signal control consists of a battery, a pole changer for alternating the direction of flow of current from the battery to the track, and a second battery and vibrator operated thereby for actuating the pole changer.

875,855. Electric Hoist or Draft Apparatus. Patrick F. Shevlin, South Boston, Mass. Application filed December 21, 1906.

A hollow base has a column extending upwardly from it, a hollow drum surrounding the column and journaled thereon, a motor located in the base and operatively connected to the drum, an arm rotatably mounted on the column, a sheave wheel carried by the arm, and means for preventing rotation of the arm on the column.

875,882. Designation Plug for Telephone Switchboards. Arthur H. Adams, Antwerp, Belgium, assignor to the Western Electric Company, Chicago, Ill. Application filed May 31, 1907.

This designation plug for spring jacks comprises a cylindrical body portion having a slotted head upon one end, the body portion being cut away at its opposite end upon one side to form a flat surface, and having the opposite side beveled at the end of the plug.

875,893. Electrically Operated Baggage Truck. Tracy V. Buckwalter, Altoona, Pa. Application filed March 21, 1907.

The truck has a frame with four relatively fixed points of support, wheels having pivotal connections with the frame at the respective points of support, mechanism connecting the wheels so that they are moved together about their respective pivotal connections, and a lever at each end of the truck for operating the mechanism.

875,900. Reversing Switch. Arthur C. Eastwood, Cleveland, Ohio. Application filed April 19, 1906.

A rotatable shaft carries contact rings which cooperate with four groups of stationary contact fingers. The latter are carried by two plates of insulating material, parallel with each other and with the shaft.

875,901. System of Control for Electric Motors. Arthur C. Eastwood, Cleveland, Ohio. Application filed May 22, 1906.

A series-parallel controller consists of a power-operated switching means for connecting the motor windings in series, a second power-operated switching means for connecting them in parallel, and means for energizing the closing mechanism of the second switching means before de-energizing the closing mechanism of the first switching means.

875,902. Means for Insulating the Supports of Electric Conduits. Carl E. Egnér, Stockholm, Sweden. Application filed November 15, 1906.

An interponent for insulators is formed of a number of superimposed caps, the sides of which are provided with a series of folds to impart to the caps a relative amount of fullness. The caps are conical in form, so that when applied to the supports the skirted portions of the caps become massed to assist in the retention of the insulators upon their supports.

875,907. Sparking Device. Benjamin G. Gilbough, Chicago, Ill. Application filed December 26, 1906.

A tubular spark plug is mounted in the firing chamber. A vibratory electrode is adapted to enter the spark plug and contact with the stationary electrode therein.

875,910. Electric Chain-welding Machine. Hugo Helberger, Munich, Germany. Application filed February 15, 1904.

A pair of pivotally mounted pressing jaws serves to conduct the current. Means are provided for feeding the material to be welded to the jaws. A member having heads is arranged between the jaws and adapted to loosely embrace the material at the welding joint to limit the upsetting.

875,911. Safety Signal System for Railways. William F. Herting and Frank C. Chlan, Baltimore, Md. Application filed April 20, 1907.

In combination with the block stations are means for signaling the approach of a train therein, main and reserve torpedo-setting mechanisms disposed at intervals along the road, means for actuating these from their respective stations to place a torpedo and means for registering such actuation within the stations.

875,942. Acetylene Lamp and Lighting Device for Automobiles and Other Vehicles. Svend M. Meyer, New York, N. Y., assignor to George Clinton Batcheller, New York, N. Y. Application filed December 21, 1905.

The acetylene generator and several dry cells are mounted side by side. Conductors lead from the cells to the several lamps through an incandescing coil and separate switch, so that any selected lamp may be lighted.

875,951. Controlling Mechanism for Automatic Exchanges. John G. Roberts, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 10, 1906.

This automatic telephone switch consists of a number of actuating members that can be displaced to different degrees, variable at will, and that, on their automatic return, actuate the mechanism for operating the switch. (See cut.)

875,964. Outdoor Lamp Receptacle. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Application filed June 13, 1906.

A housing has a central cylindrical portion forming a lamp socket, and legs adjacent to the housing and forming a support therefor and for the circuit wires, the ducts or passages being wholly enclosed throughout their length.

875,978. Electric Switch. Frank G. Baum, San Francisco, Cal. Application filed October 24, 1905.

This high-tension switch consists of a frame with vertical and horizontal members carrying three rows of insulators, each row having two fixed insulators and an intermediate swivel insulator. Upon the latter are mounted arms with switch blades at their extremities that fit into clips adjoining the fixed insulators.

875,981 and 875,982. Motor-controlling Mechanism. Herbert W. Cheney, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Appli-

This telegraph transmitter has a toothed actuator movable into operative relation to a contact on its downstroke and out of operative relation to the contact on its upstroke, and a key lever arranged to raise the actuator to permit its free return.

876,088. Electric Pistol. Ernst O. Pfeil, New York, N. Y. Application filed January 28, 1907.

In this pistol an electric lamp is supported in the barrel and a chamber contains a battery arranged between the hammer and the barrel. When the trigger is pulled an explosive cartridge makes a noise and at the same time the lamp circuit is closed and caused to flash a light.

876,165. Wireless-telegraph Transmitting System. Lee de Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. Application filed May 11, 1904.

In combination with a transmitting loop antenna, constituting a closed oscillating circuit is a closed oscillating energizing circuit associated therewith and attuned thereto. (See cut.)

876,169. Receptacle for Incandescent Lamps. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed June 14, 1907.

A sign receptacle has a pair of diametrically opposite lugs at the front and a like pair at the back, but out of line with those at the front, and ribs connecting the front with the back lugs.

876,187. Junction Box. Harry H. Hornsby, New York, N. Y. Application filed May 12, 1906.

The box is provided with integral outwardly turned ears at its upper edge and with brackets adjustably screwed to the sides and fitted into the ears.

expansible rod, so as to cut off the current when a predetermined degree of heat is reached.

876,273. Fuse Device. Frank B. Hall, Wheeling, W. Va. Application filed December 30, 1905.

The body is of insulating material with an opening therethrough. The fuse wire passes through this opening and has its terminals wrapped about the ends of the body in the form of metallic bands.

876,274. Electrically Controlled Releasing Device. Charles J. Kintner, New York, N. Y. Application filed April 20, 1906.

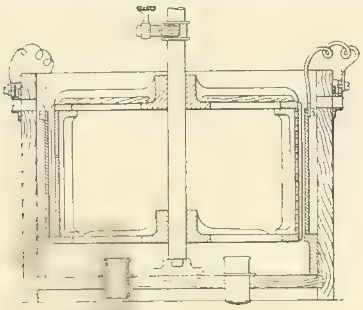
A railway signal adapted to be held in a definite position by a source of applied energy is provided with a control solenoid having its core so connected to the release device that, should the latter fail to operate when the coils of the solenoid are disconnected from a controlling source of electrical energy, the core will fall and by its weight impart to the release device a blow adapted to effect the operation thereof.

876,281. Combination Sending and Receiving Wireless-telegraph Apparatus. Albert L. New, Los Angeles, and William N. Hickman, Avalon, Cal.; said Hickman assignor of one-half of his right to said New. Application filed September 17, 1906.

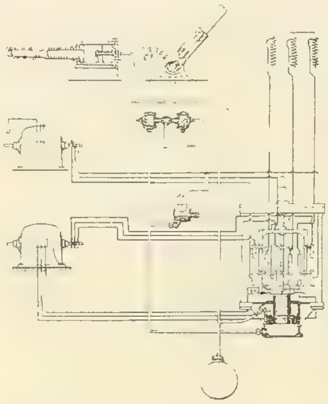
Two-aerial capacities are insulated from each other, one contains the transmitting and the other the receiving apparatus. The transmitter is arranged so that the strength of its impulses can be varied. The receiver is provided with a local battery circuit and means for regulating its power. Ground connections are arranged to be connected to either circuit.

876,293. Electric Time Switch. Frank W. Brock, Chatham, Ill. Application filed March 11, 1907.

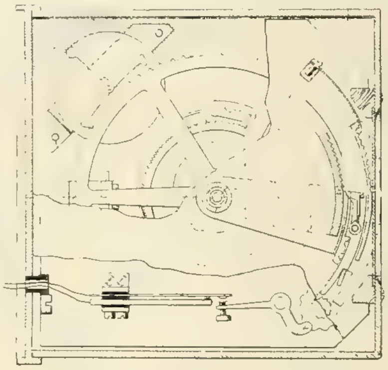
Two levers are provided, one for closing, the other for opening, the switch. Two alarm clocks are set so



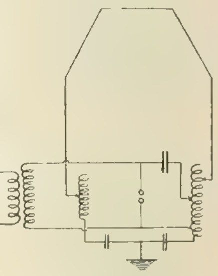
No. 875,784.—ELECTROTYPING APPARATUS.



No. 875,788. PRESSURE DEVICE FOR CURRENT COLLECTORS.



No. 875,951.—AUTOMATIC TELEPHONE APPARATUS.



No. 876,165.—WIRELESS TRANSMITTING SYSTEM.

cations filed J[illegible] 8, 1906, and March 30, 1907, respectively.

In a starter for an induction motor are provided a starting resistance connected to the rotor slip-rings, means for cutting this starting resistance out of circuit, and means for connecting the slip-rings internally when the starting resistance has been fully cut out.

876,004. Fire Escape. Emery Liberty, New York, N. Y. Application filed April 26, 1906.

A flexible fire-escape ladder is wound on a reel at the top of the building. The reel is connected with a number of alarm circuits which are normally open and become closed when the ladder is unwound.

876,006. Phonograph and Other Sound-producing Machine. Herbert S. Mills, Chicago, Ill. Application filed January 17, 1907.

A phonograph is driven by an electric motor which is connected to it through power-transmitting and motion-regulating means.

876,019. Bucket Elevator. John Ross, Tiburon, Cal. Application filed February 20, 1907.

An electric motor is mounted above the upper set of sheaves on the swinging frame. A trolley connection on the latter is adapted to connect the motor to the source [illegible] position of the swinging frame.

876,036. Electrically Controlled Releasing Device. Ralph P. Barnes, Schenectady, N. Y. Application filed April 1, 1907.

An electromagnet governs the action of a cam lever in [illegible] spring-actuated bolt.

876,039. Hand Mirror. Harold Burrell, Sheffield, England. Application filed July 8, 1907.

[illegible]

876,055. Switch. Carl H. Holley, Visalia, Cal., assignor [illegible] Geo. G. Hamilton, Visalia, Cal. [illegible] filed June 16, 1905.

[illegible]

876,064. Single-track Signaling and Train-controlling [illegible] F. Kinman, Plainfield, N. J. Application filed Octo-[illegible]

[illegible]

876,192. Signal Alarm System. Oliver B. Kaiser, Norwood, Ohio, assignor of one-fourth to Walter S. Ludlow and one-fourth to Walter S. Ludlow, Jr. Application filed April 30, 1906.

A fire extinguisher signal system comprises power-actuating devices, means whereby these are set into activity by a liquid flow of the extinguisher system, a signal transmitting device in positive driven connection with the power device and adapted to move idly for a predetermined time, and then to positively actuate the signal after the predetermined idle movement has elapsed, and means for restoring the actuated parts to their normal position after the activity of the liquid flow has ceased.

876,203. Ignition Circuit Connection. Edwin S. Lincoln, Brookline, Mass. Application filed May 13, 1907.

A generator, storage and primary batteries are connected to a double-pole, double-throw switch, so that in one position of the latter the primary battery is connected to the ignition system and the generator connected to charge the storage battery, and in the other position the two latter sources are connected to the ignition system in parallel.

876,207. Push-button Electric Switch. William G. Mann, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Application filed June 20, 1907.

The switch has contacts for connection with more than one circuit, and a push-button and circuit-closing means operated thereby for each circuit with a spring-actuated circuit-breaking blade, a latch to hold the latter and a push-button to release the blade to break the circuit.

876,233. Electric Lamp Receptacle. Herbert E. Plass, Newark, N. J., assignor to the Howard Miniature Lamp Company, Newark, N. J. Application filed August 1, 1907.

This receptacle comprises a cup part containing lamp terminals with rearwardly projecting prongs and screw and a cooperating cap with an insulated nut threaded on to the screw and adapted to be turned by hand to hold the cap in place.

876,241. Underground System of Laying Electrical Conductors. Wilhelm Schreiber, Munich, Germany. Application filed March 28, 1907.

[illegible] electrical conductors consists of [illegible] tubular [illegible] conducting lamellæ insulated from each other and ar-[illegible]

876,253. Electric Sad Iron. William J. Barr, Cleveland, Ohio. Application filed May 27, 1907.

[illegible]

that their alarm keys actuate latches that in each case release a weight and cord attached to the respective switch levers, one being thereby closed and the other subsequently opened.

876,312. Quadruplex or Multiplex Telegraphy. Lawrence Connell, Jr., Portland, Ore. Original application filed July 2, 1906. Divided and this application filed March 29, 1907.

The station apparatus comprises a polarized relay, a neutral relay having an armature and two main energizing coils, one composed of two differential high windings and the other of two differential low windings, one of the high windings and the low winding of similar direction being connected in series in the main line and one coil of the polarized relay.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 13, 1908:

444,416. Electric Motor. W. A. Anthony, Manchester, Conn.
444,424. Electric-light Support. A. Dawes, Chelsea, Mass.
444,452 and 444,453. Electrical Sporting Indicator. S. D. Mott, Passaic, N. J.
444,466. Electric-lamp Bracket. T. C. Smith, Philadelphia, Pa.
444,472 and 444,473. Electric Arc Lamp. B. B. Ward, New York, N. Y.
444,477. Conduit for Electric Wires. A. P. Wright, Boston, Mass.
444,479. Electric-car Controlling Device. E. M. Bentley, Brooklyn, N. Y.
444,480. Electric-railway Car. E. M. Bentley, New York, N. Y.
444,482. Electric Hand-setting Mechanism for Clocks. W. W. Bradley and W. N. Packer, Canton, Ohio.
444,486. Dynamo-electric Machinery. J. B. Entz, New York, N. Y.
444,512. Electric Locomotive. M. Waddell and J. B. Entz, New York, N. Y.
444,530. Leading-in Wire for Incandescent Electric Lamps. T. A. Edison, Llewellyn Park, N. J.
444,539. Electric-railway Car. L. A. McCarthy, Brooklyn, N. Y.
444,552. Electric Indicator. J. Hopkinson, Holmwood, Eng.
444,553. Method of Controlling Currents upon Electric Circuits. J. Hopkinson, Holmwood, Eng.
444,566. Current-collecting Device for Electric Railways. R. M. Hunter, Philadelphia, Pa.
444,587. Regulator for Dynamo-electric Machines. R. E. Ball, New York, N. Y.
444,640. Electric Elevator. N. P. Otis and R. C. Smith, Yonkers, N. Y.
444,678. Lightning Arrester. E. Thomson, Lynn, Mass.
444,700. Electric Gas Lighter. T. W. Lane, Boston, Mass.
444,707. Rheostatic Switch. J. H. Lehman, Philadelphia, Pa.
444,780. Telephone Annunciator or Indicator. G. R. Lawrence, Manteno, Ill.
444,804. Electrical Measuring Instrument. E. Weston, Newark, N. J.
[illegible] Electrical Measuring Instrument. E. Weston, Newark, N. J.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLII. CHICAGO, JANUARY 25, 1908 [illegible]

Some of the Striking Features of the Chicago Electrical Show.

No feature of the Chicago Electrical Show just closed attracted more general attention than the "House Electrical" of the Commonwealth Edison Company. Several illustrations of this handsomely furnished nine-room suite appeared in the Western Electrician of last week, and others are presented herewith. About everything that one could imagine in domestic electrical application, in the present tion in an up-to-date household and the desirability of pushing the service to materially increase their load.

An exhibit of unusual interest was made by W. S. Heger, Jr., of Milwaukee, Wis., in the "House Electrical." Mr. Heger, who is the son of W. S. Heger, assistant to President Whiteside of the Allis-Chalmers Company, Milwaukee, has developed an electrical fireless cooker which he calls the "autotherm." This appliance is the product of

A [illegible] corner of the [illegible] equipment [illegible] balcony. For purposes of support and insulation the antenna [illegible] wooden trapez-shaped bar [illegible] 200 feet. Telephonic communication was kept up between the two stations with considerable success, considering the large number of power and lighting wires, X-rays, and [illegible] transformer and induc-

Electrically Operated Vacuum Cleaner. Kitchen in "House Electrical." An Electric Refrigerator.
A Central-station Exhibit of Household Electrical Apparatus. Large Electric Sign Writer at South End of Coliseum. Bedroom in "House Electrical."
Wireless Telephone Exhibit. Entrance of Coliseum at Night. Electrical Production of Ozone.

SOME OF THE INTERESTING THINGS SHOWN AT THE CHICAGO ELECTRICAL SHOW.

state of the art, was to be found in this "house." The illumination of the house was referred to by Mr. Geo. H. Jones and others before the Chicago Section of the Illuminating Engineering Society, at the meeting reported on another page of this issue. In the way of heating utensils nearly everything devised in this line, except a glue pot and soldering iron, was shown, the varieties of electric radiators and cooking utensils in actual service demonstrating not only the utility of these devices, but that they are here to stay as active competitors for this service. The value of electric power in the home for running such a range of appliances as clocks, pianos, sewing and washing machines, refrigerating and cleaning outfits, fans, grinders, etc., was clearly shown. On the whole, the impression that the "house" created was most favorable from the viewpoint of the public and that of the central-station man. The former were shown that electric service is now well-nigh indispensable, since it provides not only electric light but almost every other modern convenience. The latter were shown the growing importance of electric heating and power applica-

considerable scientific investigation to find the most efficient heat insulator. The idea is to place electric cooking within the reach of a man of moderate means. With the autotherm operating in connection with an electric heater or stove, food may be cooked at a much less expenditure of electrical energy than under the ordinary conditions.

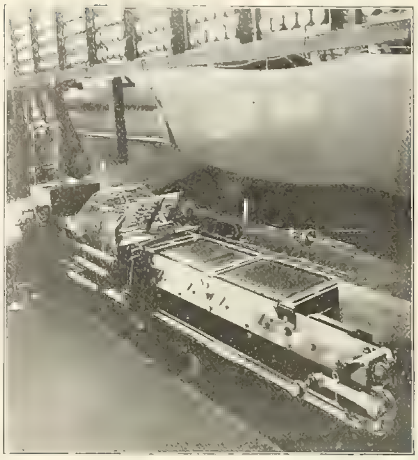
The North Shore Electric Company was another central-station company that made an interesting exhibit of electrical appliances used in the household. Here were to be seen a wide range of devices from elaborate art-glass lamps and an electrically operated piano to severely practical applications like the electric dishwasher and a vacuum cleaning system.

The De Forest wireless telephone system is new and attracted much attention. The main booth of the company was located near the northwest corner of the main floor. In it was installed a duplicate of the equipments furnished to the United States Navy for the battleships and destroyers of Admiral Evans' fleet. From this wires were run to near the roof of the building, forming an antenna.

tion coils, etc., in the building. On account of its less noisy location most of the transmission was from the balcony station, a phonograph there furnishing music to the microphone transmitter. When conversations were conducted the individuals stepped into telephone booths located at each station to shut out external noises. The apparatus consists of two distinct parts, the transmitting and the receiving portions. Each is connected through a transformer to the antenna circuit. In the transmitter the oscillations are set up by an arc burning in alcohol vapor, the arc being in series with a condenser and the primary of the transformer. The sound waves are impressed on the high-frequency circuit through a microphone transmitter connected between the transformer secondary and ground. At the receiving apparatus these oscillations are taken up by the "audion" receiver, which is an incandescent lamp into the bulb of which are sealed a grid and a plate of platinum as well as a tantalum filament. The conductivity of the heated and ionized gas in the bulb is effected by the oscillations, and this in turn actuates the tele-

phone receiver in shunt with it. The transmission of speech has now been perfected to a distance of 35 miles over sea by the apparatus exhibited, and Dr. De Forest, who had charge of the exhibit, expects to enlarge this sphere of action for marine work at first. On January 21st he gave a lecture before the Independent telephone convention on his system of wireless telephony.

One of the "drawing cards" of the show was the striking display of artificial lightning over the main entrance on the outside of the building by C. H. Thordarson. A large glass plate weighing 700 pounds was mounted on a strong wooden rack just outside of the center balcony windows. On each side of this plate were fastened metallic strips forming the terminals of a 200,000-volt circuit. When this was energized the flashing and crackling of the discharges over the plate could be heard for a long distance. The noise was so great that it scared the horses in the street and therefore could not be run continuously. The wires from the high-tension transformer were run through small holes in the middle of two of the window panes. A heavy static charge was frequently formed on these and from them communicated to the casing, producing considerable arcing about it. The energy for this display was obtained from a 25-cycle rotary converter on the main floor that changed 220 volts direct current to 160 volts alternating current, which was then stepped up to 200,000 volts by a high-tension transformer on the balcony. An impedance regulator was placed in the primary circuit to keep the energy of the set down to 40 kilowatts, its capacity without this being 75 kilowatts, which was found to produce too much of the arcing referred to. Unfortunately, it was found impracticable to show this artificial-lightning discharge in the exterior picture given on page 75. This view shows three automobile trucks with large electric signs, operated by storage batteries, which perambulated the streets at night to advertise the show.



OPERATING MECHANISM OF ELECTRIC SIGN WRITER

A feature of much technical interest was the production of ozone on a large scale by C. H. Thordarson. The apparatus was set up in the center of the west balcony and consisted of a large plate condenser, between the plates of which a current of air was forced by a blower driven by a three-horsepower motor. The condenser was built up of six rough glass plates three-eighths inch thick and 40 by 100 inches in dimensions. These were placed side by side on their long edges in a wooden framework. On each side of each plate was mounted a metal sheet, the sheets on opposite sides of the plates being connected to opposite terminals of a high-tension source of electricity. For this purpose the same transformer was used that supplied the display of artificial lightning outside the building, but the voltage was kept down to 18,000 or 20,000 volts. About 12 horsepower was used in charging the condenser and thus ozonizing the current of air blown through it. This air current was deflected toward the center of the building, where the ozone could be distinctly detected when the apparatus was in operation.

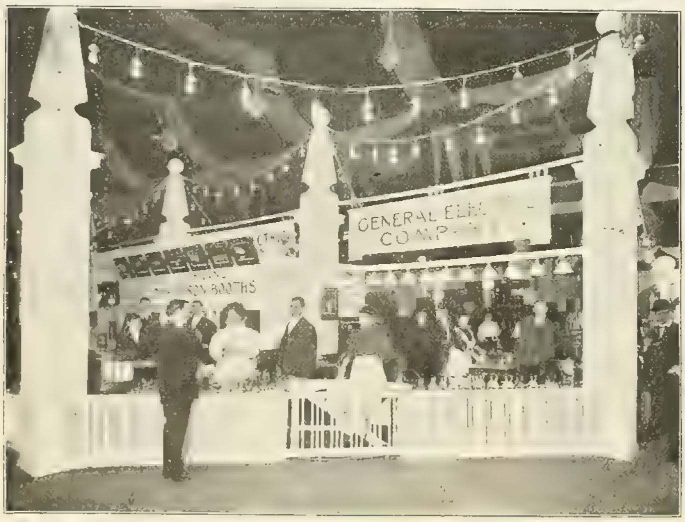
Another electric ozone-producing outfit formed one of the attractions on the main floor. It was exhibited by the Ozone Company of America and is illustrated on page 75. It is designed for purifying air or water and is ingenious and compact, being operated from an ordinary lamp socket.

A device for electric-light advertising which was very large and prominent was the electric sign writer exhibited by the Electric Sign Writer Company of Chicago. It is an apparatus by which letters, numbers, etc., can be instantly formed and controlled by the operating of a keyboard typewriter attachment. One of the signs written and flashed onto the frame in about one minute is shown on page 75. A picture of part of the mechanism is given on this page. While the sign flasher at the show was a very large one, it can be made still larger, the company planning to build the device as large as 250 feet in length. As shown, there are 60 boxes in three rows, each box having 25 four-candlepower lamps placed in white enameled cups. Each lamp is directly connected with the controller mechanism which selects the contacts. There are 120 contact blocks, 60 on each side of the middle division. Each of the contact blocks has a separate contact for each of the 25 lamps in the corresponding box. To make connection a brass plug is pushed down into a spring clip located at the bottom of the contact block. Each lamp connection has its movable contact plug, and the tops of these extend across the machine in a straight row in each contact block.

The selective device is mounted much like an Oliver typewriter and is provided with a keyboard which moves from left to right above the contact blocks, a block at a time, whenever a letter is struck on the keyboard. The selection of contacts is secured by making each key arm with protruding striking surfaces located so as to fall on top of only such contact plugs as are required to light the lamps that will produce the desired shape.

The corresponding portions of the machine are numbered with neat inlaid black and white celluloid. The double arrangement contact blocks permits the operator to prepare 60 letters on one side of the machine while the throw-over switch is showing what was previously written on the other 60 letters, in this way providing for a continual changing of the sign. It is equally easy to use four sections of 15 letters each, alternately, or six sections of 10 letters.

The patents are controlled by Mr. Leon J. Kahn and the machine was designed by Mr. A. W. King, mechanical engineer.



TWO VIEWS OF THE GENERAL ELECTRIC COMPANY'S EXHIBIT.

[illegible]

[illegible] Electric Works

[illegible]

THE CHICAGO ELECTRICAL SHOW OF 1908.

Maintaining the record of previous years, the third annual Electrical Show in Chicago of January 13-25, 1908, has been a complete success. Both visitors and exhibitors express satisfaction. The show was conducted by the Electrical Trades Exposition Company, of which Mr. Samuel Insull is president and Mr. Homer E. Niesz managing director.

Exhibits at the show covered many branches of the industry. In all lines exhibitors did their utmost to instruct and please visitors. The music was excellent, the decorations and illumination beautiful, and there was general good-fellowship.

The show was well patronized, and among the visitors are representatives of all parts of the United States. A few of the special attractions planned did not materialize, but there were enough special features to satisfy all. On Tuesday night of this week the management of the show entertained the exhibitors at a smoker and vaudeville in the Coliseum Annex, which was greatly enjoyed. Other features and meetings of electrical organizations are reported elsewhere.

In this issue will be found a detailed account of the show and numerous illustrations, in addition to those published last week.

Exhibit of Reclamation Service.

An interesting exhibit of the nature of the work done by the United States Reclamation Service in various irrigation projects in the arid West attracted considerable attention. About 25 large mounted photographs showed various stages of progress in many of the projects, and gave a good conception of the great extent and difficulties of the work. These comprised views of the sites before work was begun; dams, canals and tunnels during and after construction, and views showing the fertility of the land after being irrigated. A large map showed the location and size of the various projects. On the evening of January 20th Mr. Perkins, of the Reclamation Service, gave an illustrated lecture in the Coliseum Annex on this irrigation work, and told of the many cases wherein hydro-electric power was utilized in connection with the work while in progress and later for pumping and other power purposes. In a number of places electric pumping will be necessary to raise the water from low levels.

Supply of Current.

The electrical energy for lighting and exhibitors' use during the show was supplied almost entirely from the Commonwealth Edison Company's three-wire direct-current mains. A few circuits were supplied from the 110-volt direct-current plant in the building. The Edison 110-220-volt mains entered the building at the northeast corner from the underground system in the alley. From this point a set of feeders was run to the ceiling lights, and six sets of feeders north and south through the building for the lighting of booths and exhibitors' use. These feeders were all No. 0000, over 6,000 feet of this being used. A separate set of feeders was run to the Commonwealth Edison's booth in the north end of the building. The main feeders were suspended from the trusswork so as to run almost over the partitions between the booths along the main and adjacent long aisles. In each case one set of feeders supplied the north half of the building and terminated at the center, and another set ran intact through the north half and supplied the south half, one continuous neutral being used for both sets. Under the balconies and on the stage the two-wire system installed in the building was used, but it was disconnected from that plant, a neutral wire added, and each set connected to the Edison main. The number of sockets installed in the general lighting was approximately 5,000 in festoons, 3,000 in [illegible], 3,000 on posts and 900 in [illegible]. The 64 arc lamps in the eight [illegible] in the ceiling were left on the building circuit.

A motor generator set installed in the booth of the Western Electric Company supplied three-phase, 60-cycle, alternating current at 440 volts to exhibitors in the east half of the building. This set consisted of a 50-kilowatt, 125-volt, compound direct-current generator, operated as a shunt motor from the 110-volt plant in the building, two No. 000 feeders being specially run to it, and a 50-horse-power synchronous motor operated as a three-phase generator, the machines being direct connected and running at 1,200 revolutions per minute. The alternating-current feeders were three No. 6 wires, from which the current was either stepped down or up, as the exhibitors needed. The current supplied to exhibitors was almost entirely on the flat-rate basis, only about 18 meters being installed. The special wiring of the building was under the direction of its regular electrician, Mr. Forsberg, who had a force numbering 107 assistants for the 3½ days preceding the show.

FOUR VIEWS OF THE LARGE EXHIBIT OF THE WESTERN ELECTRIC COMPANY.

BRISTOL COMPANY'S EXHIBIT.

Automobiles.

The Woods Motor Vehicle Company showed a high-grade electric pleasure vehicle and exhibited a line of automobile supplies. A simple and convenient battery-charging outfit for use on alternating-current circuits was shown.

The Studebaker Automobile Company of South Bend, Ind., had an exhibit and did much toward furthering co-operation between central-station men and automobile manufacturers for mutual benefit and for the good of electric-vehicle owners. The company showed three handsome electric pleasure vehicles and demonstrated the use of the mercury rectifier outfit for charging batteries from alternating-current circuits. F. S. Chapman, J. D. Gordon and E. Q. Corner took care of visitors.

Conduit.

A display of various kinds of bituminized fiber conduit was made in the booth of the American Conduit Company of New York.

The McRoy Clay Works showed its line of vitrified clay conduit in an attractive exhibit in charge of C. C. Baird, sales representative.

The exhibit of the H. B. Camp Company, New York, attracted attention. A pyramid of clay conduit was set up with different colored rays of light thrown into the ducts from the back, making a very pretty and striking effect and drawing attention to the company's product.

B. S. Barnard & Co. made a display of their conduit, and aside from this there was a display of [illegible]

A new thing in conduit was the new sectional concrete conduit exhibited by the United States Conduit and Construction Company of St. Louis. This is a finished product requiring no cleaning tile or tubing in the construction. It is made in sections of concrete, the sections being so formed that they interlock both ways. Two or more sections when laid form a complete self-contained conduit with smooth continuous ducts. The exterior joints are laid up with mortar. With this product cables can be laid in as the conduit is placed, and for maintenance purposes the cables may be exposed at any point of fault by simply taking the joints apart. The conduit is made at the point of installation, requiring no shipping. C. D. Budd, president of the company, has made a long and thorough study of underground conduit construction. At the show he received much encouragement from practical men who inspected the new sectional conduit. A. W. Garrels was also present at the exhibit.

Educational.

The Sheldon School had a small section to enable it to explain its courses in salesmanship and business methods. A large number of electrical salesmen, who were graduates of the school and were representatives of many exhibitors at the show, proved themselves to be working exhibits of the success of the school's work. A. F. Sheldon, president, and Francis Raymond, secretary, represented the school directly.

The International Correspondence Schools, with headquarters at Scranton, Pa., had an attractive exhibit to show the scope and methods of its educational work. Two effective working models showed a sleeping workman not alive to his opportunities and a machine whose cogs were faithful employes making money for the man who knows how to take advantage of their services. Samples of students' work were shown, and a new feature in the form of a complete phonograph outfit for teaching foreign languages. A set of the 242 textbooks now published by the school was arranged for inspection. The total enrollment of the school's students in all parts of the world is now said to be over 1,037,000.

In the exhibit of the students' competition were shown a number of pieces of apparatus built by Chicago students of various schools. H. L. Transtrom showed a 22,000-volt transformer for wireless telegraphy and a high-frequency Tesla coil for electrotherapeutics. The primary circuits of the transformer contained a Thordarson regulator and the secondary was connected to a condenser and the primary of the Tesla coil in series. The set had been tuned and was in successful operation several times during the show. Mr. Transtrom was a student of the International Correspondence School. There were also exhibited a telegraph re-

lay made by Lynne Waynick of Lewis Institute, an alternating-current electrolytic rectifier by Byron De Forrest of the Alcott School and an induction coil by A. R. Perlow of Lewis Institute.

Electric Clocks.

The United Clock Company of Chicago showed an attractive line of electric chronometers of various kinds.

Represented by H. O. Jackson, president, and G. F. Randall, secretary, the American Clock Company of Chicago had an interesting exhibit of self-winding electric clocks, electric time systems, time stamps and time recorders. The combination of secondary clocks, time stamps and time recorders, all operated from the same master clock, is adapted for use in offices and factories.

Electrical Glassware.

The Phœnix Glass Company had an attractive exhibit of its well-known shades, reflectors, domes and handsome art glass for decorative lighting.

One of the most artistic exhibits at the show was that of the Colonial Art Glass Company of Chicago, which company manufactures art-glass shades and domes and bronze portables. Aside from artistic merit, the shades and domes are of exceptional strength on account of being glazed with copper instead of lead. The handsome designs are original, being brought out in the company's designing department by C. Eugene Parkhurst. Besides Mr. Parkhurst, those at the show were E. C. Gmelin, R. F. Warner and B. P. George.

Electrical Machinery.

Roth Bros. & Co. exhibited a line of their motors and dynamos and motor applications, including an interesting dish-washing machine. The machines, some with vertical shafts, have some new features and attachments. A two-horsepower equipment that attracted attention was the Economy electric tiering machine, a complete portable power elevator of 1,000 pounds capacity made by the Economy Engineering Company.

The Wagner Electric Manufacturing Company St. Louis, had a large exhibit, including a five-horsepower single-phase Wagner motor of the new type BA, in the new style frame, and a 10-horsepower three-phase induction motor with the new starter. The Wagner company has brought out a new type of induction-motor starter for polyphase motors, the switching device being in a separate case from the auto-transformer part of the starter, and so arranged that the running fuses are cut out for starting, or separate starting fuses may be provided. The company has changed its transformer line, building at the present time what is termed "high-effi- [illegible] type of transformers. Switchboard and portable indicating instruments were shown, including both direct-current and alternating-current instruments. F. N. Jewett, [illegible] represented the [illegible]

The Fort Wayne Electric Works had a very [illegible] Included was the company's line of type K wattmeters, forms SAA and SAB for single-phase circuits, form MAB for multiphase circuits; its prepayment wattmeter and its new type KM-1 calibrator for alternating current. The company also exhibited its standard type A transformers, its [illegible]

also a complete line of direct-current and alternating-current power motors, many of them connected to power circuits and shown in operation. In alternating current both single-phase and multiphase motors were shown.

The largest and most complete exhibit of electrical machinery and apparatus was that of the Western Electric Company of Chicago. This exhibit was especially attractive on account of the new alternating-current apparatus being placed on the market by this company and because of the

ROTH BROS. & CO.'S EXHIBIT.

large display of telephone apparatus exhibited for the first time for the inspection of all buyers. The exhibit was divided into two parts, the telephone exhibit and the apparatus and supply exhibit. A description of the former will be found among the telephone exhibits elsewhere in this issue. The power-apparatus exhibit was very interesting, affording visitors an opportunity to study the rapid strides taken by the Western Electric Company in the manufacture of alternating and direct-current apparatus. A specimen of the fine class of work turned out by the Western Electric Company at its Hawthorne works, covering an area of about 110 acres, was the 400-kilowatt, 60-cycle, three-phase, 2,300-volt alternator exhibited. While this engine-type alternator is very small, compared with the larger machines manufactured by the company, it was the largest one which could be exhibited, due to the danger of the floor giving way. High-class engineering and mechanical skill was apparent in the 15-kilowatt, 250-volt, direct-current, engine-type generator exhibited close to the 400-kilowatt alternator. This generator is one of the smallest manufactured for direct connection to an engine, and has a vertical divided frame. The frame is semi-steel and the pole-pieces laminated. It will be difficult to find a piece of apparatus to surpass this type in construction. The smallest generator exhibited in the booth was a 13½-volt, three-ampere ignition and battery-charging generator. A Western Electric motor-generator set supplied alternating current to its and other exhibitors' booths. It is described in the section on the wiring of the building. There were in operation also back-gear, continuous-service, phase-wound, vertical, alternating-current motors. Stators and rotors for squirrel-cage and phase-wound types of machines of various classes were seen under construction. The apparatus exhibited was so arranged that the observer could see various classes and types of apparatus under construction. For a number of years the Western Electric Company has manufactured a five-light testing regulator that can be used for testing series alternating-current lamps during the day, with a maximum voltage of 440, [illegible]

when using a larger regulator. This regulator can also be used for lighting from 440-volt power circuits, and for this class of services the company recommends operating five series alternating-current lamps in connection with the regulator. An equipment of this kind was on exhibition connected up so that the operation of the lamp and regulator could be demonstrated. The new Western Electric 440-volt, multiple alternating-current lamp was on exhibition, and sample 110-volt alternating-current and direct-current lamps were included in the list of display lamps. This company has recently formed a selling arrangement whereby it becomes a distributer of the Beck flaming arc lamp, and two of these lamps were on exhibition. An interesting feature of the Western Electric supply exhibition was the black enamel wire. Superiority is claimed for this class of insulation over silk and cotton, owing to the small amount of space required by the wire, the greater number of feet per pound and the high insulating quality. A line of supplies manufactured or handled by this company was also on exhibition, including American transformers, Vulcan heating apparatus, street-railway material, Electrose insulated material, Thomas high-tension insulators, Duncan wattmeters, D. & W. fuses and Deltabeston wire. The entire Western Electric exhibit was in charge of G. H. Lounsbery, assisted by the following gentlemen: J. H. Dutton, H. S. Kurtz, H. F. Boardman, R. C. Kearsley, O. O. Tucker, C. S. Boggs, H. M. Post and many others.

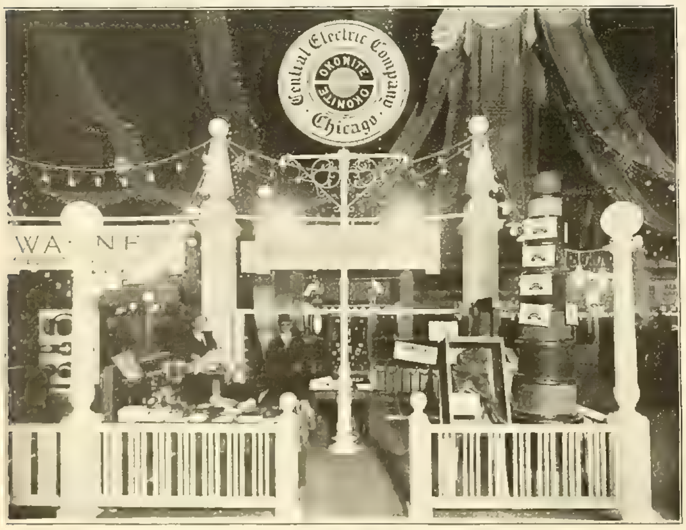
Heating and Cooking.

The exhibit of the General Electric Company was devoted largely to display and demonstration of electric-heating and cooking appliances and to electric illuminants, in the development of which this company has been very active. In a space prepared for the purpose skilled demonstrators showed the application of the large line of cooking and heating appliances produced by the company. At one end a dining room was fitted up, and here numerous parties were treated to full meals cooked in the booth entirely by electricity. Miss Potts, Mrs. Colby, Miss Lyons and Mrs. Abbott, accomplished in the art, prepared the food and did the cooking, besides giving demonstrations in the use of the electric range, electric stove, bake oven, griddles, fans, chafing dishes, coffee percolators, corn popper, flatirons and the many other electrical devices. A luminous electric grate, brought out by Mr. Jules Panigot of Grand Rapids, Mich., was one of the newest and most attractive devices.

The Simplex Electric Heating Company, Cambridge, Mass., had perhaps the largest display of electric-heating and cooking appliances at the show. It covered the complete line manufactured by this company and showed many new devices and new applications of electric heating in its application to domestic, factory and office use. About 50 styles, shapes and sizes of laundry and tailor's irons were shown; electric chafing dishes, coffee percolators and other dining-room accessories of new and attractive shapes; in fact, everything in electric-heating appliances from a little curling-iron heater for the dressing room to a 30-gallon kitchen boiler. A complete electric range was in operation and demonstrated for the benefit of visitors the ease and convenience of electric cooking. A number of complete meals were served in the booth and different kinds of eatables were served daily from the electric range, electric oven or some other device. Two demonstrators were present, besides H. R. Hixson, E. R. Jacobs, E. A. Strauss and W. R. [illegible]

Instruments.

While the International Electric Meter Company of Chicago had no special exhibit at the show, it



CENTRAL ELECTRIC COMPANY'S EXHIBIT

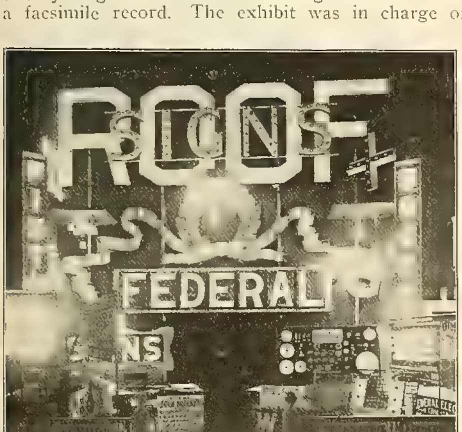
HEATING AND COOKING APPLIANCES OF SIMPLEX ELECTRIC HEATING COMPANY

had a number of its new instruments, both alternating and direct current, in one of the booths, and these attracted attention.

The Jewell Electrical Instrument Company of Chicago made its first exhibit at a show. Ammeters, voltmeters and switchboard instruments were exhibited. The company had an attractive line of six inch baby instruments and six inch direct current switchboard voltmeters. The instruments have excellent features which have met the approval of electricians. Edward W. Jewell, Ray Simpson and Oscar Adleman were in attendance.

There were 300 40-candlepower Tungsten Lamps in this Exhibit.
EXHIBIT OF ENGINEERING DEPARTMENT OF NATIONAL ELECTRIC LAMP ASSOCIATION.

The Bristol Company of Waterbury, Conn., with offices in Chicago, New York and London, had a very attractive exhibit of its well-known recording instruments of interest in every branch of electrical industry. The exhibit was arranged in groups to show the types of recorders as used in the steam, electric generating and transmission parts of light and power systems. These included recording gauges for steam, pressure and vacuum, recording thermometers for feed water, flue gases and superheated steam, switchboard recording voltmeters, ammeters and wattmeters and a full line of portable recording wattmeters and ammeters for the transmission system and general testing work. It was so arranged that visitors could be shown the interior design and construction in a very clear manner. A striking feature of the Bristol booth was a very large model of a recording voltmeter with a facsimile record. The exhibit was in charge of Western Manager H. P. Dennis, M. E., assisted by H. T. Carpenter, factory sales manager, and the Chicago office sales staff.



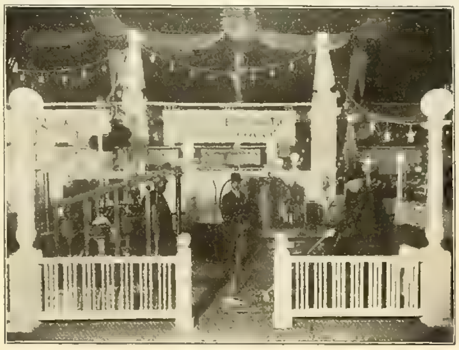
SIGNS SHOWN BY FEDERAL ELECTRIC COMPANY.

LAMPS, LIGHTING AND SIGNS.

Some very attractive canteen signs made to cover incandescent lamps for advertising purposes were shown by the Solar Electric Company of Chicago. A [illegible] lamps for [illegible] display was also shown.

The Federal Electric Company had as its principal exhibit a great variety of large and small electric signs of all kinds. Aside from these, the company exhibited some very pretty [illegible], Federal [illegible]. A new three stage, turn-down lamp of original design attracted attention.

A large line of its standard lamps was exhibited by the Moline Incandescent Lamp Company of Moline, Ill. The new Moline Jewel attracted attention, also the Meridian type, the Moline Jewel metallic-filament lamp and a line of regular Meridian types. There was also a line of imperial, candelabra and special lamps. F. T. Wright, manager Chicago branch, was in charge, assisted by Theodore Mueller, R. H. Mills and C. R. Wood of the home office.



A PORTION OF EXHIBIT OF CHICAGO PNEUMATIC TOOL COMPANY.

The booth of the General Electric Company was illuminated largely with tungsten lamps, and, as part of the decoration, a series of pictures was displayed giving night views of Niagara Falls as it appears under the powerful electric searchlights and illuminating device brought out by Mr. W. D'A. Ryan, illuminating engineer, with the General Electric Company. On one side there was a display of different colored silk cloth arranged so as to show the effect on the colors as produced by the various kinds of illuminants. The illuminants compared were the tantalum, Nernst, enclosed arc, tungsten, Gem and mercury arc lamps. The idea was to show which came nearest the daylight effect, and it was noticeable that all lamps did not have the same comparative effect on all colors. The Nernst and the enclosed arc seemed, however, to do the best as regards daylight effect, with apparently a little more of a yellowish hue in the former. Among representatives of the company seen at the booth were B. E. Sunny, F. N. Boyer, J. D. A. Cross, R. E. Keeler, F. H. Gale, E. L. Callahan, G. H. Stickney, James Lyman, F. W. Hilliard, D. Ulke, L. Friedman, H. Benson, W. H. Price, W. T. Dean, R. D. Fonger, W. H. Coleman, A. D. Page, S. F. Dibble and James Johnson.

[illegible] Three hundred [illegible] the great [illegible] Different [illegible] the effect of tungsten [illegible] appearance when [illegible]. The coloring, however, was greatly altered when exposed to the rays of the carbon filament. Disks containing the [illegible] and held stationary, first under the light furnished by the metal filament, then beneath that of the cellulose filament. The result with the tungsten lamp in service showed the disks, when revolving, to be practically white, and when stationary every color retained its true value. The carbon lamp caused the disks, when in motion, to become an orange-yellow, bordering upon pink. All the colors were darkened and changed in other respects, with the exception of the red, when the disks were quiet. Carbon, Gem, tantalum and tungsten lamps were shown side by side and data on their efficiency and economy compared. The high efficiency of the tungsten lamp, as well as its good color value, were strongly emphasized. P. E. Norris, A. W. Freund and George Loring were in charge of the exhibit. They were ably assisted by a corps of salesmen representing the various companies comprising the association.

MOTOR-DRIVEN TOOLS.

Four different styles of massage vibrators were shown by the Moon Vibrator Company. One style is for alternating current, one for direct current, one for either and a fourth is a battery outfit.

The Red Cross electric vibrator, a complete electric massage vibrator suitable for face, scalp and body massage, was exhibited by the Lindstrom-Smith Company, manufacturer of the device. A vibrating chair, producing the Swedish movement, was also exhibited.

GENERAL COMPRESSED AIR AND VACUUM MACHINERY COMPANY'S EXHIBIT.

The Shelton Electric Company presented a large display of the various vibratory massage devices for the physician and the home and demonstrated the different methods employed. A skilled lady demonstrator was kept busy by the ladies. The new electric hair-drying outfit attracted attention. G. Shelton and A. Grimes were present.

The James Clark, Jr., Electric Company of Louisville, Ky., showed a most interesting line of tools and machines, of which an electric motor forms a part. These consisted of two and three-spindle Willey drills, breast drills, semi-radial drills, screw-feed portable drills, hand drills, hacksaws, grinders for various uses, hand grinder and buffer, floor grinders, etc.

Those interested in pneumatic tools and electrically driven machinery derived much valuable information from the exhibit of the Chicago Pneumatic Tool Company. There were electric drills, grinders and blowers, alternating-current and direct-current air tools, rock drills, etc. The company showed a vacuum cleaner with a scrubbing attachment which attracted attention. The exhibit was in charge of C. B. Coats, assisted by E. Aplin.

The General Compressed Air and Vacuum Machinery Company of St. Louis exhibited in practical operation seven different outfits for cleaning by means of compressed air and the vacuum system. The largest was the type C outfit for house-to-house cleaning. A life-size model of a horse harnessed to this wagon outfit helped to attract attention. Among the other outfits was a two-wheel portable outfit for car cleaning and two other portable outfits and three for stationary installation. Thomas F. Clohesey, sales manager, and A. S. Foote were present to take care of visitors.

The Illinois Electric Renovator Sales Company of Chicago had an interesting exhibit of Invincible renovators, in charge of M. E. Poffinberger, presi-

dent, and W. F. Wall and P. E. Allison. The machines shown were for thorough house cleaning in every department and can be used on carpets, rugs, draperies, upholstered furniture, bedding, etc., without raising any dust. The renovator is operated by a one-half-horsepower motor with a speed of 3,500 revolutions per minute. A double turbine fan 14 inches in diameter is direct-connected to the motor shaft, and this fan produces a powerful suction that will remove all dust.

A line of individual motor-driven machines was exhibited by the McDowell-Stocker Company of Chicago. There were two lathes, one an 18-inch Hamilton Machine Tool Company lathe with all-geared head, and a 14-inch Ideal lathe of the Springfield Machine Tool Company. A Milwaukee shaper was driven by a Lincoln variable-speed motor. An interchangeable, open back, No. 3 Walsh power press was run by a 3½-horsepower Western Electric motor. Aluminum souvenirs were stamped out on a motor-driven punch press. An interesting machine was a Grant spring riveter driven by a one-half-horsepower vertical motor. With this machine rivet heads are turned instead of being hammered. W. J. McDowell was in charge of the exhibit.

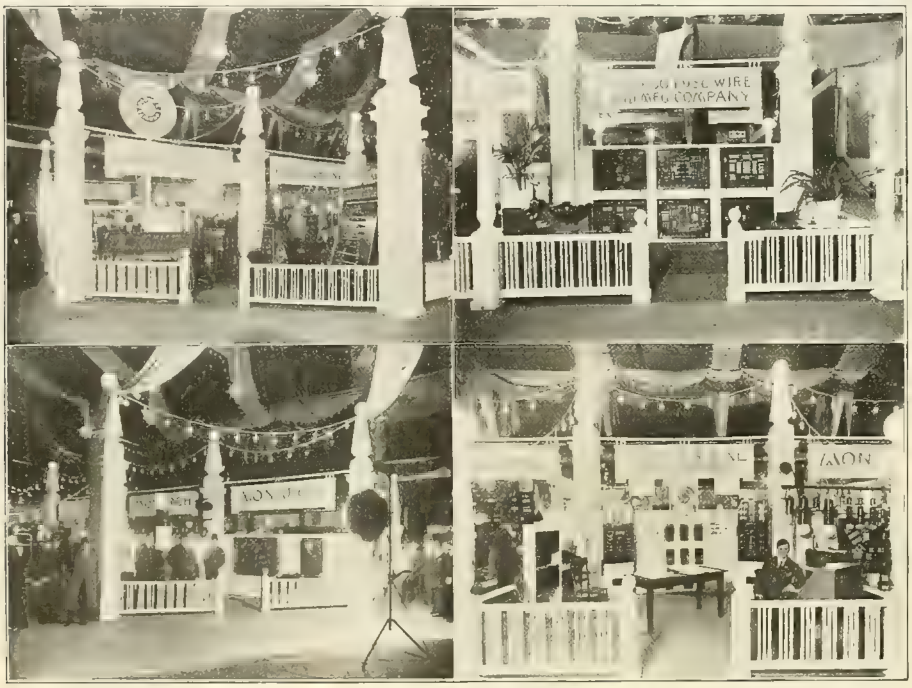
Erwin & Co., who are making a specialty of designing and building up-to-date types of electrically driven pumping machinery for all purposes, had a fine exhibit, consisting of modern methods of water supply in buildings and homes, operated and controlled automatically by electricity. Four types of electric pumps were shown in operation. A unique method shown was that of supplying water to buildings without the roof tank. This outfit is controlled by a special switch recently patented by the company. Another serviceable outfit is the electric seepage ejector. Other pumping outfits controlled by float switches were shown. The company also showed its method of mounting and belting a small triplex pump for use in residences to elevate cistern water. The pump is belted to a direct-current motor.

Considerable interest was shown by electrical men in the exhibit of A. Grothwell of San Francisco and New York. The Mogul brand of insulating paints, compounds, etc., was shown, together with Mogul armature varnish, and the like.

The Spalding-Bates Company of Chicago made a hit at the show with the Bates electric bulb cleaner and adjuster. With this device incandescent bulbs at any height can be reached from the floor and at any angle for removal, adjustment or cleaning, doing away with the inconvenience of a ladder. Manager F. W. Nind demonstrated the use of the handy device.

W. N. Matthews & Bro., St. Louis, exhibited, among other things, guy anchors, cable clamps, cable rollers, cable-splicing joints and sleeves, jack boxes and plugs, sleet cutters, lamp guards, etc. Many new money-saving attachments and devices were shown. Among the company's representatives present were W. N. Matthews, James R. Kearney, O. R. Johann and G. J. Geselschap.

The Electrical Manufacturing Company of Oshkosh, Wis., exhibited a high-potential cut-out which is very serviceable. It is simple and uses no current, being constructed so as to open automatically whenever a foreign current of higher voltage than that intended enters a building, thereby protecting life and preventing fire. W. F. Meter, W. L. Rideout and W. G. Maxcy were in attendance.



American Steel and Wire Company. Chicago Fuse Wire and Manufacturing Company.
Monarch Electric and Wire Company. Universal Manufacturing Company.

A GROUP OF EXHIBITS AT THE ELECTRICAL SHOW.

The Beckley-Ralston Company of Chicago showed a line of ignition apparatus and electrical and motor supplies. This company manufactures the Maximus timers and is the distributer of Pfanstiehl jump-spark coils and all standard lines of spark plugs, coils, timers, batteries, cable and accessories for jump-spark ignition. Batteries, battery connectors, cables, current indicators, etc., were also shown.

An attraction in the booth of the Joseph Dixon Crucible Company was the new graphite motor brush, which is meeting favor on account of perfect lubrication and freedom of wear on commutator. The company also showed a large line of graphite lubricants, crucibles, etc. Resistance rods were also shown, the company furnishing these in any size and resistance. F. R. Brandon and B. B. Worley entertained visitors.

Aside from a large display of electrical novelties the American Electrical Novelty and Manufacturing Company showed a large line of Ever Ready dry batteries and other supplies. A large electric clock, which is said to run one year without attention, was shown. Some novel flashlight applications were exhibited. Those in attendance were O. C. Igney, A. E. Barlow, E. R. Behrend, Paul Raniers, Edward Weed and R. E. Bain.

Dr. George W. Haverstick of St. Louis exhibited his "ocean breeze" fan by which the air in a room is washed, cooled and revitalized. An ordinary fan motor operates two fans, one at each end of a cylinder and connected by a small shaft. The cylinder is filled with a spray of water from a hydrant, and tubes in the cylinder are partly filled with water containing sea salt. Air is forced through the spray. Temperatures of 100 degrees in a room are said to have been reduced to 70 degrees with the fan.

The Monarch Electric and Wire Company had an attractive exhibit in its centrally located space. A striking novelty was the "Jupiter" photographic lamp, designed for flashlights as well as for time exposures. A reflector is lit up by incandescent lamps for focusing purposes. A double arc in the center is provided with highly actinic carbons. The "flash" is produced by short-circuiting the carbons for one-thirtieth second. The current consumption of this lamp is said to be only one-third that usually required for time-exposure lamps. This lamp was but one of a large collection of imported arc lamps, including not only Siemens and Nuremberg flaming arcs, but also the dwarf-like "Lilliput" and the "Radiant" arcs for indoor lighting. The latter is a very steady burning lamp producing an exceptionally white light. The company also showed a large line of wires and cables of its own manufacture, and an extensive line of electrical supplies, including among others a display of the National India Rubber Company's rubber-covered wires, cables and chords. The Monarch Company was represented by Messrs. L. Schwab, president, and H. Schwab, Max Austrich, E. W. Kearns, H. E. Mason, A. D. Gillespie and G. Morgan Hall.

BENJAMIN ELECTRIC MANUFACTURING COMPANY'S EXHIBIT.

Primary Batteries.

The Nungesser Electric Battery Company had as an attraction a very large model of the 1900 dry battery. A large line of these popular batteries, for telephone use, was shown, also the No. 6 special Rapid Fire battery for engine ignition. H. S. Greene and J. G. Gordon were in charge of the exhibit.

The Excelsior Supply Company of Chicago has added a line of electrical supplies to its automobile supply business. Among other things, this company exhibited the line of telephone batteries manufactured by the Stackpole Battery Company of St. Marys, Pa. Kingston spark coils of Kokomo Electric Company and the Komet magneto of the Dow Portable Electric Company of Braintree, Mass., were also shown. F. J. Alvin, E. W. Dolliver and L. L. Halle represented the company.

[illegible]

Storage Batteries.

The exhibit of the Vivax Storage Battery Company consisted principally of a line of storage batteries for electric vehicles.

In the large exhibit of storage-battery material shown by the Electric Storage Battery Company, Philadelphia, were a G-51 Chloride accumulator element in a tank of that size, having a capacity of 4,000 ampere-hours, the type of plate used for railway lighting and telephone work; an F-21 Chloride accumulator element in tank and an F-15 Chloride accumulator element in glass jar. These F types are used for small lighting and telephone plants. For railway work there was shown a two-compartment 11-ECS car-lighting tank, a 13-EP element and a smaller battery of the Exide type for signal service, also the special 10-volt battery made up for the Missouri Pacific, of a portable type, and the 7-S jar used as a special by the Harriman Lines. For electric-vehicle work there were exhibited Exide batteries, both for propulsion and sparking. The exhibit was in charge of Godfrey H. Atkin, manager of the Chicago office, assisted by J. M. S. Waring,

WESTERN ELECTRICIAN'S BOOTH.

district engineer, and Messrs. Bauer, Marshall and Rath.

Supplies.

The Geen Electric Supply Company of Chicago had a large exhibit of interesting electrical novelties. Besides it showed a line of "Superior" dry cells and quite a complete line of general electrical supplies.

A very complete line of electrical supplies and appliances was shown by the Electric Appliance Company. Sangamo alternating-current and direct-current meters of the house and switchboard type were exhibited; also a full line of Whitney instruments, including voltmeters, ammeters and wattmeters. There were telephone specialties and Faraday bells for all purposes, from the plain shell type to the waterproof type for mine use. The display also included Packard transformers, Paranite wires and cables, Packard, tungsten and other lamps, etc. P. R. Boole and F. J. Alderson were in charge of the exhibit.

Frank W. Pardee, general sales agent, had a large and varied exhibit, representing a number of well-known companies. The Rock Island Battery Company's dry cells for telephones, gas and gasoline engines and automobiles were shown. There was a display of wire made by the Wire and Telephone Company of America, Rome, N. Y., and a line of standard porcelains of all kinds and special pieces from the Peru Electric Manufacturing Company of Peru, Ind. Special high-tension insulators of the Electros Manufacturing Company, Brooklyn, N. Y., were shown in capacities up to 98,000 volts; also receiver shells and mouthpieces.

M. B. Austen & Co. had an attractive exhibit of supplies, including a line of Safety submarine and underground cable made by the Safety Insulated Wire and Cable Company; bare and insulated wire from the Benedict & Burnham Manufacturing Company; Stirling flexible steel conduit and armored conductors, made by the Stirling Conduit Company of Pittsburg; Thomas & Betts' line of conduit fittings; Gillette-Vibber specialties, and the tungsten lamps of the General Incandescent Lamp Company. Among those in attendance were A. H. Friend, J. P. Gillette, R. J. Thorne, A. Meineman and Harry C. Rice, the last-named vice-president of the General Incandescent Lamp Company.

The well-known Okonite sign of the Central Electric Company, Chicago, was to be seen from every part of the Coliseum. In attendance at the company's booth were F. R. Bryant, sales manager; Allen S. Pearl, J. M. Lorenz, D. M. Ayers, R. K. Fast, H. R. Miller and A. L. Hancock. The company's space was, for the most part, given over to the display of Okonite wires and cables, D. & W. enclosed fuses, Deltabeston magnet wire and Columbia incandescent lamps, for all of which the company acts as sales agent. The Okonite display included a pyramid of coils of different styles and sizes of Okonite wires, also the famous Okonite rubber [illegible] Para rubber compound [illegible] composed. The display of Okonite submarine cable was a notable feature, the [illegible] of cable that had been caught and twisted in the [illegible] propeller of a [illegible] without destroying its usefulness. The D. & W. fuse display included two sample boards of D. & W. fuses and boxes, also samples of Deltabeston magnet wire, the Deltabeston wire being heated red hot, with a like amount of cotton-covered magnet wire, to show that the asbestos insulation would withstand the heat, whereas the cotton insulation was destroyed. The Columbia incandescent-lamp exhibit included two cases of lamps, showing all the different types and also the process of manufacture. Considerable prominence was given to the display of tungsten and tantalum lamps. Flame arcs and other supplies were also shown.

Telephones and Telegraph.

Frank B. Cook exhibited an attractive line of his well-known protectors and telephone accessories.

The Monarch Telephone Manufacturing Company showed a line of telephones, switchboards and appliances.

The American Electric Telephone Company had a complete exhibit which was a center of interest for the Independent telephone men.

The well-known line of telephones and appliances of the Swedish American Telephone Company occupied a large space in the annex.

The Stromberg-Carlson Telephone Manufacturing Company had a large exhibit and a large force of attendants was on hand to take care of visitors.

The S. H. Couch Company, Boston, demonstrated its intercommunicating telephone systems. This company has installed intercommunicating systems with as many as 70 stations.

A receiver holder for attachment to a telephone transmitter was exhibited by the Staats Manufacturing Company. It holds the receiver to the ear, allowing the use of both hands.

In the large exhibit of the Dean Electric Company of Elyria, Ohio, was shown the company's large line of switchboards, telephones and appliances. Many new devices recently brought out were exhibited.

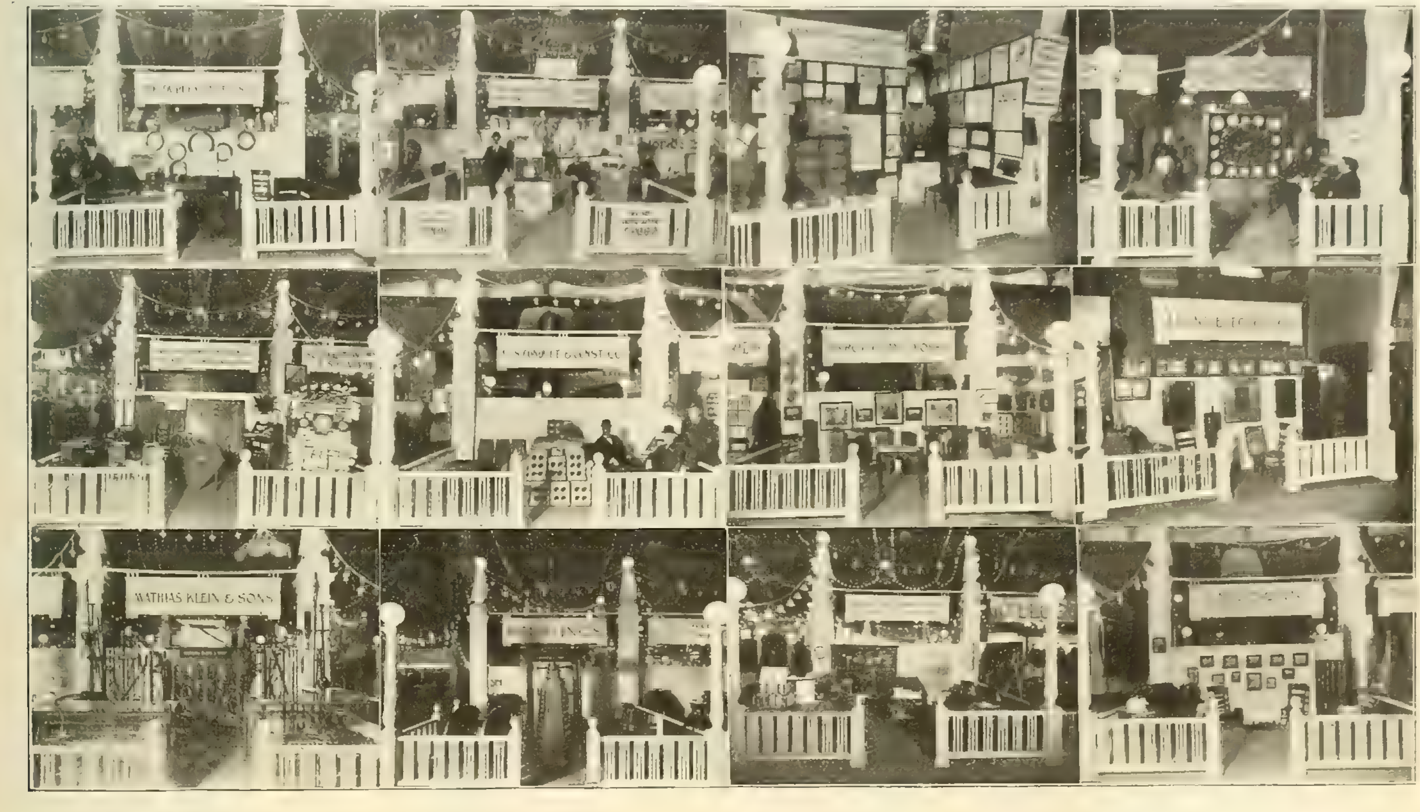
A complete multiple section of its ballast common-battery switchboard was shown in operation by the Vote-Berger Company of La Crosse, Wis., with ringing machines, power board, charging machines and storage batteries.

In the booth of the International Telephone Manufacturing Company the loud-speaking telephone was exhibited in operation, transmitting music through an International transmitter from [illegible] five blocks distant. Henry Shafer was in charge.

The American Automatic Telephone Company, Rochester, N. Y., exhibited a full-sized automatic [illegible] section of an automatic switchboard frame of [illegible].

The American Electric Fuse Company of Muskegon, Mich., made a specialty of small iron-frame distribution racks adaptable to small telephone-exchange work and toll stations; improved junction boxes, Merico soldering paste and the like. George W. Rodormer, Frank J. Jones and J. A. Kearny were present.

The Stolz Electrophone Company had on exhibition a line of its electrophones, which are miniature loud-speaking telephones, to be carried and used by those with defective hearing. There is a transmitter and ear piece. The transmitter carries the batteries, the whole weighing 12 ounces, and fits into the vest pocket. The transmitter is of globular carbon, and by varying the amount of globules in the electrode, "electrophones" of various tones result. The device reflects and transmits sounds on a compensating principle, intensifying the softer sounds and modulating the louder vibrations. It is for ordinary conversation or for church and theater use.



Duplex Metals Company. W. N. Matthews & Bro. International Correspondence Schools. Moline Incandescent Lamp Company.
Swedish Electric Vibrator Company. United States Conduit and Construction Company. McRoy Clay Works. J. Lang Electric Company.
M. Klein & Sons. John A. Roebling's Sons Company. Manhattan Electrical Supply Company. American Conduit Company.

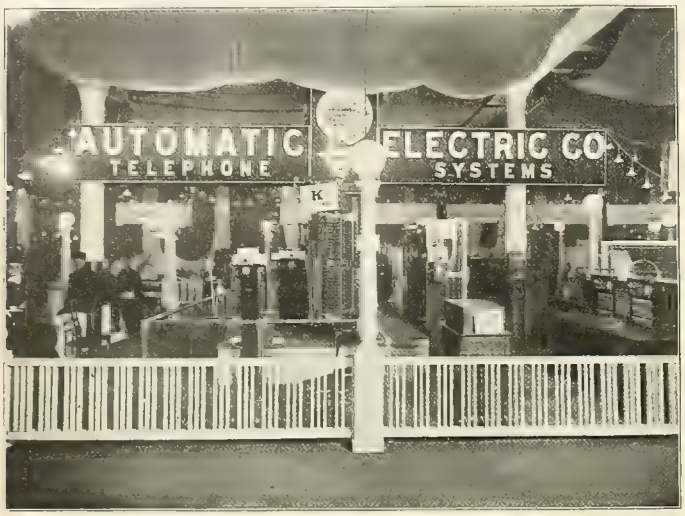
A GROUP OF EXHIBITS AT THE CHICAGO ELECTRICAL SHOW.

The exhibition of the Western Electric Company was divided into two parts, the telephone exhibit and the supply and apparatus exhibit, the latter described elsewhere. In the telephone exhibit was displayed a full line of magneto and common-battery switchboards as well as all kinds of telephones, including local and common-battery and intercommunicating sets. A self-restoring dropboard was connected up and in full operation. In addition a full line of standard construction material was shown, also a full line of cable terminals. Showcases were located in different parts of the exhibit filled with all parts which go to make up standard Western Electric Company switchboards and subscriber sets and which show the high grade of workmanship and material which is used in the apparatus. This exhibit was most complete and demonstrated the high art attained in telephone manufacture.

A printing telegraph was shown by F. D. Pearne, Chicago. It was arranged to operate simplex or duplex over a single line. The transmitting mechanism had a typewriter keyboard. A small motor running continuously was intermittently connected to a shaft by an electromagnetic clutch. By means of this each key transmitted over the line some combination of three distinct impulses that operated a rapid electric typewriter at the receiving end. Each station is provided with a transmitting and receiving printing machine. When operating simplex the latter makes a duplicate of the message. The printing machines at each station are operated

by a local storage battery, the control impulses only being sent over the line. A simple selective system was shown that enables the operator to control the stations to which he wishes the message sent and that also enables him to ascertain positively who sent any to him.

The Automatic Electric Company's exhibit was extensively visited and consisted of a "cross-section" of an automatic telephone system, the exhibit comprising a working section of two interconnecting common-battery automatic exchanges of the 100,000 system. The exchanges were designated "B" and "K," respectively. The "B" exchange section consisted of a standard 100-line unit and a board of trunking switches. The "K" exchange section was a regular party-line unit accommodating 100 party lines, or 400 telephones and trunking switches, as in exchange "B." Twelve telephones were connected to the exhibit and calls were made through the boards precisely the same as in the largest working exchange. A toll board, wire chief's desk and private-branch exchange were connected to exchange "B" and operated in conjunction with it. The harmonic converter in exchange "K" supplied the four-frequency currents for ringing the party-line telephones. One of the frequencies was also used for straight line ringing. In addition to ringing, the harmonic converter also furnishes the busy signal. In the party-line board four telephones are connected to one line and two to another. The two-position wire chief's desk exhibited is designed to be used in a 5,000-line exchange now being built.



AUTOMATIC ELECTRIC COMPANY'S EXHIBIT.

A VIEW IN THE TELEPHONE ANNEX.

Wires, Fuses and Wiring Devices.

A modern line of conduit outlet boxes and fittings, known as "wirelets," was exhibited by the Appleton Electric Company, Chicago. A line of universal "wirelets" was also shown.

In an attractive booth the Simplex Electrical Company exhibited a fine selection from its large line of insulated wires and cables. H. R. Hixson, J. G. Brobeck and J. N. Macalister were present to receive visitors.

The line of Monnot copper-clad products exhibited by the Duplex Metals Company attracted the attention of electrical men. This product, consisting of sheets and wire, has a mechanically welded surface of copper on steel. It is used for telegraph, telephone and transmission purposes.

The Chicago Fuse Wire and Manufacturing Company displayed Union enclosed fuses. Union enclosed fuse blocks, Union switch boxes, Union outlet conduit boxes and covers, and fuse wire and fuse links. Arthur S. Merrill and Clarence T. McDonald were in charge. W. W. Merrill made frequent visits.

[illegible] of Harter clusters, five kinds, [illegible] was displayed by the Harter [illegible]. The clusters are made of opal glass on copper contacts. A cluster with four 40-watt 50-candlepower tungsten lamps using an opal shade was shown. This type is said to be replacing arc lamps. G. A. Harter was present much [illegible]

[illegible] Wire Company [illegible] and railway appliances, lead-covered cables, bare and covered wire of all kinds, round and flat wire, [illegible] R. Sturdevant of Worcester, Mass., and B. H. Ryder, [illegible] were in attendance.

[illegible] Manufacturing Company of Boston attracted attention because of its [illegible]

time switch is proving a reliable device for automatic control of window, sign and street lighting. A large line of Aetna railway insulators was shown and also Anderson line material, including the Anderson third-rail bracket. Visitors were taken care of by William W. Hincher, manager Chicago office.

The exhibit of the Benjamin Electric Manufacturing Company contained up-to-date lighting specialties, including the new Benjamin wireless cluster for multiple interior service. This device consists of two principal parts, separably connected, making it possible to attach or remove the body portion, in other words, the finished part, without disturbing wiring connections. The new Benjamin attachment plug with rotating sleeve has advantages for use with portable lamps, flat irons, heaters, fans, etc. The rotating sleeve makes it possible to attach the plug without turning the device, and thus avoiding the twisting of the cord. Another new device was the Benjamin current tap, which has a rotating sleeve which makes it unnecessary to turn the device in order to attach to socket. It can be fixed in any position and the cord can be led out at any angle. Benjamin lamp guards, hand portables and cluster guards were also shown. A. N. Fox, manager of the publicity department, and G. Knott and H. Watson were in attendance at the exhibit.

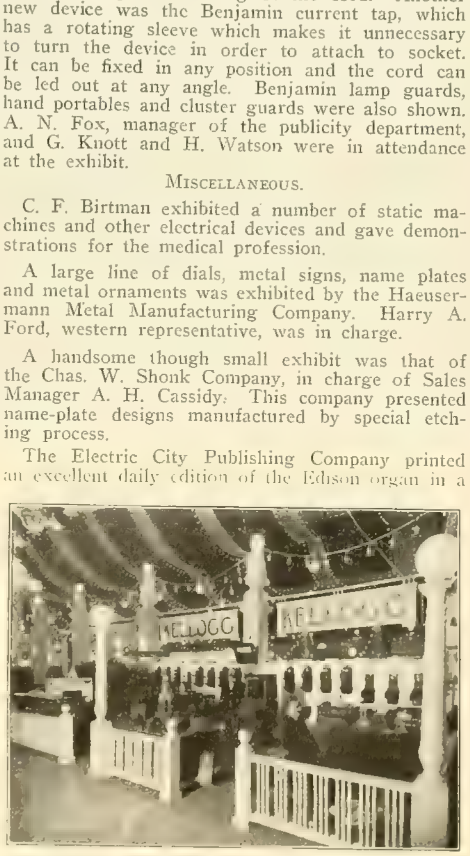
Miscellaneous.

C. F. Birtman exhibited a number of static machines and other electrical devices and gave demonstrations for the medical profession.

A large line of dials, metal signs, name plates and metal ornaments was exhibited by the Haeusermann Metal Manufacturing Company. Harry A. Ford, western representative, was in charge.

A handsome though small exhibit was that of the Chas. W. Shonk Company, in charge of Sales Manager A. H. Cassidy. This company presented name-plate designs manufactured by special etching process.

The Electric City Publishing Company printed an excellent daily edition of the Edison organ in a booth at the show. The cylinder press, paper cutter, folder, binder and other machinery were all operated by motors.



TELEPHONE APPARATUS OF KELLOGG SWITCHBOARD AND SUPPLY COMPANY.

The American Decorating Company, composed of Messrs. E. Kraemer and C. I. Wilson, had an exhibit at the show. This company made the papier-mâché electroliers used in the decorative lighting of the Coliseum for the show and furnished some plastic relief forms. It exhibited display forms and ornamental work.

In the booth of the Thordarson Electric Manufacturing Company was laboratory and lecture demonstration apparatus, which has become well known. A new feature was a line of ignition coils for gas and gasoline engines. These are entirely encased in metal, making a rugged construction, impervious to moisture and dirt. Being built on the transformer principle, they are said to be highly efficient. The coils shown were of the jump spark and also make-and-break types. They are built in single units and in sets for two, four or six-cylinder engines. Aside from these exhibits were the display of artificial lightning and the production of ozone; the apparatus for these working demonstrations was installed in the west balcony and is described in another column. All the exhibits were in direct charge of C. H. Thordarson.

The Crane Company showed a line of cast-steel valves and fittings for superheated steam having pure nickel seats and nickel-steel stems. Automatic emergency valves, steam traps, expansion joints and other power-plant accessories were shown. The electrical feature of the exhibit was a gate valve operated by a motor attached directly to the stem. The motor is stopped automatically when the opening or closing movement is completed, the switch requiring no attention after it is thrown into the open or closed position. The motor seats the valve tightly, making it unnecessary to use the hand wheel. The exhibit was in charge of J. A. Minwegen.

Out-of-town Visitors.

The following-named are among the visitors at the show from out of town, who registered at the booth of the Western Electrician up to January 22d:

Arkansas.—F. E. Leonard, superintendent Wynne Light and Water Works, Wynne.

Connecticut.—J. P. Gillette, Gillette-Vibber Company, New London.

Illinois.—R. C. Allan, Morris; A. J. Authenrieth, chief engineer Mattoon Heat, Light and Power Company and Central Illinois Traction Company, Mattoon; Frank Bacon, Chillicothe, Jacob Bunn, Sangamo Electric Company, Springfield; Wm. J. Catlin, superintendent Electric Light and Water Works, Glen Ellyn; P. E. Cowles, Lee County Lighting Company, Dixon; Edward Curry, Economy Light and Power Company, Joliet; Clarence Denman, electrician, Paxton; F. H. Earl, Plano; D. C. Fleming, International Harvester Company, Canton; Paul Hollister, West Chicago; John E. Haenig, Haenig Electric Company, Springfield; W. H. James, Harvey; G. F. Kaiser, Oregon; V. V. Kennedy, electrician, Earlville; R. C. Lanphier, Sangamo Electric Company, Springfield; Theo. Mueller, Moline; E. D. Smith, Galesburg; L. S. Snow, St. Charles; Joseph Steinen, Pekin Light, Heat and Power Company, Pekin; John D. Schwimmer, city electrician, Paxton; John H. Shull, city electrician, Galesburg; Hubert Sumpter, Farmers' Telephone Exchange, Colchester; N. M. Snyder, electrician, Kankakee; G. F. Schreiber, electricial engineer, Chicago Heights; L. B. Sigmart, Galesburg; Geo. S. Tinker, electrician, Highland Park; W. J. Zellar.

Indiana.—F. W. Bayer, Chicago Mica Company, Valparaiso; W. B. Brown, Bluffton; L. E. Bixenman, Lowell; Charles G. Burton, manager Peru Electric Manufacturing Company, Peru; Arthur E. Case, United Telephone Company, Hartford City; F. L. Dennis, Indian and Michigan Electric Company, South Bend; Frank E. C. Hawks, Hawks Electric Company, Goshen; F. E. Hannon, Indiana Harbor; E. H. Heilstedt, Chicago Mica Company, Valparaiso; Fred Leslie, superintendent Muncie Electric Light Company, Muncie; H. D. McVay, sales engineer, Sterling Electric Company, Lafayette; B. B. Montgomery, Western Electric Company, Indianapolis; G. C. Scott, superintendent Water and Light Department, Garrett; O. L. Shore, superintendent Municipal Electric Light and Water Plant, Hobart; William H. Sinks, Duncan Electric Manufacturing Company, Lafayette; C. M. Poor, superintendent Clinton Electric Light and Power Company, Clinton; Fred R. Parrett, manager Princeton Telephone Company, Princeton.

Iowa.—H. Askin, superintendent Barnes Electric Light and Power Company, Maquoketa; Geo. E. Bickley, superintendent Corn Belt Telephone Company, Waterloo; W. V. Caughlan, Acme Electrical Supply Company, Ottumwa; W. K. Caughlan, Acme Electrical Supply Company, Ottumwa; J. H. Denkhoff, Interstate Telephone Company, Dyersville; C. L. Emery, manager Mount Vernon Electric Light Company, Mount Vernon; F. L. Fisher, city electrician, Waterloo; A. T. Pentzel, Davenport.

Kentucky.—Walter S. Clark, James Clark, Jr., & Co., Louisville.

Massachusetts.—E. M. Beane, electrical department Waltham Gas Light Company, Waltham; C. B. Osgood, Thomson Electric Welding Company, Boston; Chauncey L. Hight, Boston; Kurt R. Sternberg, E. E., general manager Dickinson Manufacturing Company, Springfield; G. H. Stickney, General Electric Company, West Lynn.

Michigan.—John A. Cavanaugh, superintendent light department, Benton Harbor-St. Joe Railway and Light Company, Benton Harbor; L. O. Corell, Kalamazoo; H. E. [illegible], manager Battle Creek Electric Company, Battle Creek; A. H. Kling, Detroit; J. H. McPherson, Commercial Supply Company, Detroit; Geo. C. Milham, superintendent Municipal Lighting Plant, Kalamazoo; [illegible]

[illegible] & Pantsol Company, [illegible]; F. H. R[illegible], [illegible] ral Electric Company, [illegible]
Minnesota.—J. W. Barber, [illegible] superintendent City Light and Power Company [illegible].
Missouri.—[illegible] Dunlap, Monarch [illegible] Manufacturing Company, Springfield; [illegible] Miller, [illegible]; Thomas T. Richard, Wagner Electric Manufacturing Company, St. Louis; E. C. White, St. Louis.
Nebraska.—D. B. Huff, manager Greeley [illegible] Telephone Company, Greeley.
New York.—George W. Armstrong, [illegible] Arc Lamp Company, New York; Charles Blizard, Electric Storage Battery Company, New York; Frank W. [illegible], Stanley & Patterson, New York; [illegible] S. G. Edwards, president [illegible] Telephone Company, Johnstown; H. W. [illegible] Arc Lamp Company, New York; [illegible], Brooklyn Edison Company, Brooklyn; Geo. F. Parker, manager Electrical Show, New York; A. H. Patterson, vice-president Phœnix Glass Company, New York.
Ohio.—W. S. Berry, manager Western Electric Company, Cincinnati; J. Robert Crouse, Co-operative Electrical Development Association, Cleveland; Arthur W. Freund, National Electric Lamp Association, Cleveland; N. C. Cotabish, National Carbon Company, Cleveland; O. A. Foote, Foote-Howard Company, Cleveland; E. C. Fish, president National Electric Lamp Association, Shelby; Emil Grab, Toledo; Milton Hartman, Buckeye Electric Company, Cleveland; B. C. Kramer, Toledo Electric Company, Toledo; C. A. Kuehn, Kuehn Electric Company, Canton; George Loring, National Electric Lamp Association, Cleveland; Myer A. Loeb, general manager Rock Island Battery Company, Cincinnati; H. L. Meade, Urbana; C. H. Maher, general manager Toledo Electric Company, Toledo; J. Alex. Navarre, F. Bissell Company, Toledo; Paul E. Norris, National Electric Lamp Association, Cleveland; Adelbert V. Ward, National Carbon Company, Cleveland; C. W. Wilkens, National Carbon Company, Cleveland; C. E. Yost, Toledo Electric Company, Toledo.
Pennsylvania.—R. K. Mickey, president Novelty Incandescent Lamp Company, Emporium.
South Dakota.—H. F. Brown, Menno Rural Telephone Company, Menno.
Tennessee.—M. W. Younkin, superintendent City Water and Light Plant, Paris.
Utah.—W. E. Anderson, Telluride Power Company, Niagara Falls and Provo.
Wisconsin.—W. C. Davis, general manager Walworth Telephone Exchange Company, Walworth; C. I. Danielson, manager Electric and Water Company, Grand Rapids; Edward A. Golden, chief electrician, Menominee and Marinette Light and Traction Company, Marinette; Daniel W. Mead, consulting engineer, Madison; Roy Redding, Platteville; C. P. Sylvester, electrician, Boscobel; W. H. Smale, superintendent Marathon County Telephone Company, Wausau; Will Van Middlesworth, manager Citizens' Telephone Company, Racine.
Canada.—C. H. Abbott, James Stuart Electric Company, Winnipeg, Man.

A New Gasoline-electric Railroad Car.

The new gas-electric car of the General Electric Company was given an official test on January 15th, having on board a party of representative men from the Delaware and Hudson Railroad and the American Locomotive and General Electric companies. The car left Schenectady on the Delaware & Hudson Railroad at 11 o'clock, carrying the party to Delanson. From Delanson the test continued over the Susquehanna branch of the road to the Albany station, and then to Troy and home via Mechanicville. The test was satisfactory. At times a speed of 60 miles an hour was attained. This new type of gas-electric car is intended to take the place of steam engines and trains for short-line work. A powerful gas engine drives an electric generator. The current obtained in this way supplies power to the motors which drive the car.

Among the General Electric men present on the test trip were C. A. Coffin, president; E. W. Rice and J. R. Lovejoy, vice-presidents; W. B. Potter, traction engineer; A. H. Armstrong, assistant traction engineer, and H. L. Monroe, manager of railway department of the Chicago office. E. H. Scofield, chief engineer of the Twin City Rapid Transit Company of Minneapolis, was also a member of the party.

The car is of the combination type, and comprises one ordinary passenger compartment, a smoking room, baggage room, engine room, toilet and observation compartment. The car is single-ended, having the controlling apparatus situated in the engine room. The length over all is 50 feet and the length of engine room nine feet six inches. The seating capacity is 44, and the total weight of car and trucks fully equipped is 31 tons.

The shape of the ends is parabolic, in order to reduce the air resistance to a minimum when traveling at high speed. The general shape of the car will be seen by reference to the illustration. The framework of the roof and sides is made of T-irons bent to the required shape and braced diagonally. The exterior of the car is of steel plate, while the interior is finished with selected Mexican mahogany. The car body was built by the Wason Manufacturing Company, Springfield, Mass., in accordance with the designs of the General Electric Company.

A gasoline engine is direct-coupled to a 90-kilowatt, direct-current generator, which furnishes current at a variable potential. This current is fed to the motors through the medium of the control system by which the voltage of the generator may be governed according to the requirements. The two motors are each rated at 60 horsepower. The engine was designed and built by the General Electric Company with special reference to the requirements peculiar to gasoline-electric cars. Very special attention has been paid to the simplification of the engine; the number of parts and weight have been reduced to a minimum. When running at 550 revolutions per minute the engine develops 100 horsepower and has a greater capacity at increased speeds. There are eight cylinders, each of which is eight inches in diameter and has a stroke of seven inches. The cylinders are placed at 90 [illegible] with the [illegible]

[illegible] a separate [illegible] is provided for each cylinder [illegible] accumulator. [illegible] commutator. [illegible] difficulty has been experienced in starting gasoline engines of this size heretofore, but in the present [illegible] has been provided [illegible] a charge of [illegible] cylinders, and [illegible] overcoming this difficulty.

The gasoline [illegible]

[illegible]

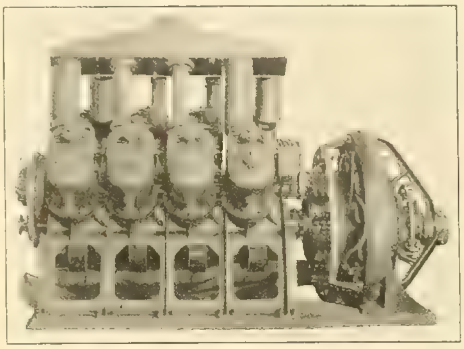
[illegible]

A NEW GASOLINE-ELECTRIC CAR.

steel tank having a capacity of 60 gallons, and is raised to a small auxiliary tank in the cab by means of a diaphragm pump. The gasoline is filtered in transit from the tank to the pump. The auxiliary tank is provided with a float to register the height of the gasoline, and a glass tube somewhat similar to a sight-feed lubricator is provided, so that the operator can see if the diaphragm pump is working. The gasoline is fed by gravity to the carburetor.

The generator is an eight-pole separately excited unit, which has been specially designed with a view to procuring the lightest possible machine for the necessary output, and at the same time keeping the temperature rise to within a reasonable figure. It is provided with commutating poles, which, in conjunction with the potential type of control, gives a great flexibility of current output. The advantage of this arrangement will be readily appreciated when it is pointed out that at starting the field excitation is weak, and that large currents are required to give the necessary starting torque. The normal pressure when running at 550 revolutions per minute is 250 volts, at which time the current will amount to 360 amperes, but at starting a current of 800 amperes can be secured at a corresponding decrease in voltage. It would be impossible to commutate so large a current in a machine with so great a kilowatt capacity per pound without the use of commutating poles.

The total weight of the generator, including exciter, is only 2,740 pounds, while a standard machine of this output weighs 8,800 pounds. As is only natural in a machine where the weight has been so materially reduced, the temperature rise is higher and the efficiency lower than in standard apparatus of the same output. The higher temperatures are fully provided for by the type of insulation employed. There is no paper or muslin used anywhere in the machine. The armature coils are insulated with mica, the interpolated pole coils with asbestos, and the field coils are wound with enameled wire. The armature leads to the



GASOLINE ENGINE AND GENERATOR UNIT ON RAILROAD CAR.

commutator are riveted as well as soldered, although the precaution has been taken to use pure tin for soldering, which has a melting point of over 200° Centigrade. Air ducts of ample dimensions are provided to insure a large volume of air being circulated through the core. The efficiency is 88 per cent., being only about three per cent. lower than a standard machine having a temperature rise of 35° Centigrade. A three-kilowatt, 70-volt exciter is mounted on the shaft of the generator.

The speed of the motors is governed by a potential control, the generator being separately excited stat. The function of the controller is [illegible] and out this rheostat as occasion demands.

A storage battery which floats on the exciter circuit is used for supplying the lighting circuits, and its charging and discharging is controlled by means of a reverse-current relay which permits the lights being supplied directly from the exciting circuit or from the storage battery, according to the voltage of the exciter circuit. A Tirrill regulator is employed for regulating the voltage on the lighting circuit. These arrangements enable the car lights being used when the engine is at rest.

The master controller, which has some unique features, is of type C-44, and gives seven steps with the two motors connected in series and eight steps with the two motors connected in parallel. It is provided with four handles, three of which are mounted one above the other on concentric shafts. The function of the top handle is to advance and retard the ignition of the engine, the second controls the throttle of the engine, while the third handle controls the generator field resistances and the contactors, which establish the circuit for the motors, besides transposing the motor connections from series to parallel. The fourth handle operates the reversing switch and controls the direction of rotation of the motors.

The car is heated by passing part of the exhaust gases through pipes suitably located in the car body.

The car is provided with a straight air-brake equipment and the air is supplied by means of a compressor, which is direct-connected to the engine. The working pressure is 60 pounds per square inch, and this is kept constant in the storage tank by a mechanical governor. Hand brakes are also provided.

The trucks were constructed by the American Locomotive Company. They are of the swing-bolster type, and have wheels 36 inches in diameter. One motor is mounted on each truck. The journals are of the MCB standard pattern.

Canadian Electric Railways.

The report of the comptroller of railway statistics, just presented to the Canadian Parliament, shows that the electric-railway interests of the Dominion made satisfactory progress during the year 1907. The paid-up capital was increased by $11,337,505, bringing the total amount up to $75,195,475. The mileage, however, remained almost stationary. The gross earnings were $12,630,430, showing a betterment of $1,663,559 over the preceding year. The operating expenses, which were larger than last year, left a favorable balance of $4,971,624. The proportion of operating expenses to gross earnings was 61.25. The total number of passengers carried was 273,999,404, a gain of over 36,000,000, as compared with the previous year. The killing of 71 persons and the injuring of 1,736 others reveal the sacrifice that would appear to be inseparable from the operation of electric railways. The danger is manifestly in proportion to the number of cars run and the population served thereby, since out of the 71 fatal accidents 22 took place in Montreal and 20 in Toronto. Singularly enough, however, not one passenger was killed in Montreal, while nine lost their lives in Toronto. Thus, while but one passenger in every 40,311,552 was killed in 1901, this proportion was reduced to one in 6,782,243 in 1905, and last year one in 10,188,126 passengers carried. The average for seven years is one in every 18,268,306 passengers carried. The gross total mileage of these roads in Canada is given as 814 miles. The mileage, however, has increased since 1902 by 46 per cent.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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DEPARTMENTS.

[illegible]

DATES AHEAD.

[illegible] Regiment Armory, March [illegible]

ONE FEATURE of the Chicago electrical show of marked educational value was the exhibit of the United States Reclamation Service, from which much valuable information was disseminated. The government is engaged in no more useful work than the various irrigation projects undertaken by the Reclamation Service. Primarily these projects are intended to utilize the waters of rivers and watercourses, by dams or diversion, to irrigate arid but fertile lands now practically worthless for lack of water and add them to the crop-bearing area of the nation. But incidentally many valuable waterpowers will be created which may be readily utilized by electrical transmission where there is a demand for the power, as there will be, to a considerable extent, when the irrigated land is cultivated. Pumping will at once suggest itself as the first demand for power, and as the population increases varied industries, as electric lighting, canning factories and other industrial establishments, will follow, all needing power. When it is stated that the government has now in hand no less than 23 of these irrigation projects, located in 16 states and territories, some of them very extensive, it will be seen that the power possibilities are of great magnitude.

A STATE MONOPOLY of electricity is the curious proposal that has been made in Germany. One would think that a suggestion to monopolize one of the causes of the phenomena of nature would not be taken seriously anywhere. But we are assured that the subject was gravely discussed at a meeting of the Berlin Boerse. However, not even the Germans, with their paternal government, are likely to accept such a fantastic proposal. As one writer in Berlin points out, a monopoly of electricity would involve the same disadvantages as every other monopoly, such as the removal of individual initiative, the limitation of economic freedom, an increase in the number of state officials and employes, which already is excessive in Germany. Such a monopoly would be especially injurious, because the era of the exploitation of electricity for industrial purposes is only just beginning, and it is impossible to predict to what extent electricity may one day influence the whole life of the nation. One thing is certain, that German bureaucracy does not possess the necessary qualities to develop the use of electricity for all possible purposes. If individual initiative is crushed to enable the bureaucracy to control electricity, disastrous results will ensue.

To which one may respond, Hear, hear! But we hope the amiable Mr. Tom Johnson of Cleveland won't get hold of the idea, for then there may be trouble in earnest.

YELLOW LIGHT is best for the eyes, according to Dr. H. H. Seabrook, who has been giving illuminating engineers in New York and Boston the benefit of his knowledge as an oculist. This means some comfort for the users of the carbon-filament lamp, although the doctor's purpose appears to relate principally to the color of glass shades to be employed with too intense light. The following is an essential paragraph in Dr. Seabrook's paper:

"Many substances absorb chemical rays and allow luminous rays to pass. For practical purposes there seems no need to consider any of them except glass as a protection for the eyes from the intrinsic brightness of too intense light. Neither does there seem any question that yellow is the color to choose to conserve or improve vision and protect the eyes from the chemical action of light. Globes may be used of pink, orange, red or green, as desired, when the light may be diminished in luminous qualities. It is best to choose for protective purposes that shade of yellow which appears in the best ray filters or is shown in the glass used for modifying the light of developing rooms for photographic plates. This amber yellow may be darkened by a brown admixture for weak or [illegible], or unusual light exposure. It is difficult to manufacture without imperfections, and the supply slowly follows the demand."

[illegible] not occur so abundantly in nature as some other colors, say green or blue, the doctor no doubt knows what he is talking about in referring to glass screens for light sources. Yellow paper has been recommended often for printed books, and many writers who prepare manuscripts find by experience that yellow paper is more grateful to the eyes than white for long-continued use. Nevertheless, few books are printed on yellow paper, and it is unlikely that the coloring of electrical glassware will be greatly affected by the recommendation of the medical men for some time to come. But the point is one to be borne in mind, especially in view of the consideration which Dr. Seabrook points out, that globes may be of other colors where it is permissible to reduce the luminous quality of the light rather than merely to protect the eyes from its intrinsic brightness.

THE NORTHWESTERN ELECTRICAL ASSOCIATION has accomplished useful work in the electrical field and has an honorable history. But it is indisputable that within the last few years interest in this once strong association has perceptibly slackened, while attendance at its conventions has decreased. At last week's convention in Milwaukee the attendance was considerably less than a hundred, while neither the president nor either of the vice-presidents graced the gathering with his attendance. This was discouraging, but one of the directors, Mr. W. P. Putnam of Red Wing, Minn., was prevailed upon to accept the chair, and a fairly good meeting resulted after all, several papers being presented which brought out a good discussion.

One characteristic of the Northwestern Association is that its members are scattered in half a dozen states, some of which have electrical associations of their own, organized since the Northwestern Electrical Association was formed. The bulk of the membership has always been found in Wisconsin, however, and by the by-laws the association is supposed to hold its regular annual convention in Milwaukee, although last year this rule was transgressed to bring the convention to the Chicago electrical show.

It is now proposed to make the organization frankly a Wisconsin state affair, consolidating perhaps with the youthful Wisconsin Electric and Interurban Railway Association. But there is opposition to this, and very naturally so, for some of the most valuable and faithful members come from other states. The whole subject was referred to a committee to confer with the Wisconsin state association, and will come up at the next annual convention. The non-Wisconsin members very magnanimously declare that the men from that state should decide the matter themselves and solely in view of the best interests of the association. But many of the Wisconsin members remember very distinctly the services of their colleagues living outside the state. An Illinois man was president at last year's meeting, while at the convention of last week it was a gentleman from Minnesota who stepped into the breach and filled the chair. Such elements of strength are not to be passed over lightly.

Perhaps the interstate idea can still be retained and the association rejuvenated. On the other hand, as the central-station industry has been developed in this country, there seems to be little place for an organization intermediate between the powerful national organization, with large resources, dealing with broad problems common to all, and the state association, whose members do business under the same laws and are strongly bound together by local interests.

Thus the Northwestern Electrical Association is between the horns of a dilemma. A class of honorary membership could be made for the non-Wisconsin members, but that would hardly meet the situation. It is evident, clearly enough, that something must be done if the association is to regain its old-time prestige. But in whatever form the association is preserved, its members will do well to remember that individual work and individual loyalty furnish the only keys to success in an organization of this character.

Northwestern Electrical Association.

There was a slim attendance at the sixteenth annual convention of the Northwestern Electrical Association, held at the Hotel Pfister, Milwaukee, on Wednesday and Thursday, January 15th and 16th. Nevertheless the papers and discussions were of considerable value. W. R. Putnam of Red Wing, Minn., acted as chairman in the absence of the president and vice-presidents.

Opening Business

The annual report of R. N. Kimball of Kenosha, secretary and treasurer of the association, was the first business presented. Practically all of the old bills of the association have been paid.

Invitations to visit the works of the Allis-Chalmers Company and the Public Service Building of the Milwaukee Electric Railway and Light Company were received.

Irving P. Lord of Waupaca, Wis., Ludwig Kemper of Albert Lea, Minn., and W. B. Jackson of Chicago were appointed as the nominating committee.

It was decided to appoint a programme committee of five, consisting of the president, the secretary and three men to be appointed by the incoming president. This committee shall prepare the programme for the next convention. It was also decided that a committee be appointed to draft new by-laws, to report at the next meeting.

A Strictly Wisconsin Association Proposed.

There was a discussion on the advisability of allowing the Northwestern Electrical Association to become simply a state association for Wisconsin. Illinois and Michigan central-station men have state associations, and there is talk of forming one in Minnesota. Messrs. Putnam and Kemper of Minnesota, Lord, Kimball and Korst of Wisconsin, Lukes of Illinois and Harding of Indiana participated in the discussion. Many seemed to think that the Northwestern association had outlived its usefulness as an inter-state organization and that it should be transformed into a Wisconsin association pure and simple. Mr. Smith, the secretary of the Wisconsin Electric and Interurban Railway Association, was in attendance and spoke briefly by request. He said that his association had about 25 companies as members, one-third of which are street railways purely without lighting, one-third combine street railways and lighting, and one-third are electric-lighting companies alone. If the Northwestern association should decide to confine itself to Wisconsin, the speaker thought an amalgamation, or at any rate co-operation, of the two associations could be effected.

The discussion was put over until the next day, when, upon motion, J. S. Allen of Lake Geneva, Wis., and Mr. Voth of Sheboygan, Wis., were appointed a committee to confer with a similar committee from the Wisconsin Electric and Interurban Railway Association upon the possibility of merging the two associations. A strong sentiment against legislating the non-Wisconsin members out of the association was developed at this session, however, and the outcome of the proposal was left in doubt.

Public-utility Problems in Wisconsin.

The question of the classification of accounts of electric-light companies was brought up by the proposed forms of the Railroad Commission of Wisconsin, which regulates public-utility companies in that state by a recent law. In a letter on this subject to Secretary Kimball of the Northwestern association, dated January 10th, Secretary J. M. Winterbotham, secretary of the Railroad Commission, said:

"We have, as you say, prepared a tentative schedule. This schedule is perhaps too detailed for small plants and perhaps not detailed enough for the larger ones. It was largely gotten up for the purpose of serving as a basis for discussion when the matter is taken up between us, and it may be of some use in this respect. We do not have in mind any radical change in your records, but may desire enough of a uniformity in the same throughout the state so that the reports of the various companies or classes of plants can be made out on about the same basis. To this end it may often be found advisable to classify plants according to size or capacity and to have a separate form of report for each class. These are matters that will have to be settled between us, and need not be discussed here. We are now using a short schedule for the smaller plants for such reports as we require in connection with complaints and applications to change rates."

Mr. Winterbotham enclosed copies of the tentative schedule of accounts and the one now in use, and said the commission would be glad to meet a committee from the association.

Secretary Smith of the Wisconsin Electric and Interurban Railway Association said he believed the state commission intended to be fair. He thought his association, the Northwestern association and the Wisconsin Gas Association should appoint a joint committee or co-operating committees to lay the case of the public-utility companies before the commission. B. L. Parker of Green Bay, president of the Wisconsin Street Railway Association, spoke to the [illegible] and he was asked to make arrangements for the joint committee. Later this committee, consisting of H. D. Smith of Appleton, B. G. Brood of Sheboygan and P. H. Korst of Janesville, was announced.

Indeterminate franchises or permits of public-utility companies are allowed in Wisconsin, and they aroused some discussion. Mr. Parker said it is a grave question whether they are a benefit to the company. They do not permit competition, but on the other hand perhaps the financial interests will not provide money for extensions under indeterminate permits.

Later in the day Neal Brown of Wausau, Wis., by invitation, gave his idea of the new indeterminate permits, as one who has given some study to the subject. Among other things, Mr. Brown said:

"I have been asked a number of times here what I thought about the wisdom of public-service corporations which are operating under a franchise passed prior to the passage of the public-utility bill, so-called, relinquishing that prior franchise and going under the public-utility bill, and getting what is called an indeterminate permit, and if they got it, what it meant.

"Well, I don't know as anybody knows. I think that the solution or interpretation of the meaning of the indeterminate permit is very deeply hidden in the womb of the future, and that you may have to apply to the courts finally to determine just what it is all about.

"I only know that they had a great battle, and, as little Peterkin said in the poem, quite a number of people were killed, but what it was all for he did not know, and I do not know. I do not know what some of the provisions mean.

"Now, I will say this, that if you are about ready to expire, at your last gasp, with your existing franchise, why then I think I would make a virtue of necessity, and I would drop gracefully under the public-utility law, and I notice some public-service corporations in this state have been doing that, and have done it so cheerfully, so genially, that I really believe they made themselves and the public think that is just what they have been waiting for all along, for a refuge of that kind to get into; and I guess it has been a sort of a city of refuge for some public-utility corporations. It solved a lot of questions and relieved them from a lot of embarrassment, and a lot of conflicts and all that.

"If you already have a franchise, while it may be like the roof over a Northern Wisconsin pioneer's cabin, somewhat leaky, so that the water drips in on him occasionally, yet, after all, I believe I would stick to it. You may have some question of what you ought to do, but I think I would hang on for a while to that old franchise until you are driven out from under it, or the roof gets so leaky that you cannot stand it any longer.

"I do not know that I know what this indeterminate franchise signifies. It is a sort of mumbo jumbo that seems to have an occult and mysterious power of some sort; but what its limitations are, how long it can last, I do not know that anybody knows.

"But I fancy, and I do not want this opinion to be brought up against me hereafter, and what I say here is in the strictest confidence, and I want you to consider it as privileged, that the main purpose of it is to give to cities in the proper cases the right of municipal ownership, because it provides in substance that the franchise shall be lost upon the exercise of this right of municipal ownership, or when terminated by law. Now, that is pretty indefinite, but I imagine the latter clause may mean proceedings for forfeiture, such as the state may in certain cases carry out to forfeit a franchise, for non-user, or for acts and offenses which make it forfeitable, and I should think that would be perhaps as far as that language would go.

"Of course, this bugbear of municipal ownership of some corporations is quite a serious one, but not really serious in its practical aspects and application. In the first place, as to railroads and as to power-lighting propositions that are interurban in their character, in the extension of lines, it is utterly impossible for any municipality to own a proposition of that kind, and the time has come when almost every street-railroad proposition is an interurban proposition, and in Northern Wisconsin I think a great many street-railway propositions also involve a lighting and power proposition, the power often being produced by water-power developed; so that if a municipality should attempt to cut in twain and parcel out a business of that kind, a lighting and power plant or a street railroad that was so extensive in its character, it would be simply a physical impossibility to do it. There are probably few plants in the state where that would apply, but now and then some plant coming under the indeterminate-franchise law would be open to that danger."

As the committee to take up the question of accounting with the Railroad Commission of Wisconsin, C. N. Duffy of Milwaukee, B. W. Lyon of Beloit and R. N. Kimball of Kenosha were appointed as representing the Northwestern Electrical Association.

[illegible]

At the afternoon session of Wednesday C. N. Duffy, [illegible] Railway and Light [illegible] De-preciation." W. B. Jackson, P. H. Korst of Janesville, J. H. Harding [illegible] Kimball of Kenosha, and others discussed this able paper.

E. J. Callahan [illegible] of the General Electric Company read a paper on the "Central-station Load that Pays." The load referred to is electric heating and cooking devices, of which Mr. Callahan makes a specialty. There was considerable discussion.

The next paper was on the subject of "The Public's Debt to the Public-service Corporation," by W. R. Putnam of Red Wing, Minn. Mr. Duffy, Mr. Lord, P. L. Utley of Watertown, Wis., Mr. Parker and others discussed the paper.

New Members.

On Thursday morning the following-named were admitted to membership, on recommendation of George H. Lukes of Chicago, chairman of the committee on membership: Albert Lea Light and Power Company, Albert Lea, Minn.; Frank Doyle, superintendent Water and Light Company, Fort Atkinson, Wis.; C. N. Duffy, comptroller Electric Railway and Light Company, Milwaukee; George W. Pierce, manager Brodhead Electric Company, Brodhead, Wis.; W. A. Russell, superintendent Kenosha Electric Railway Company, Kenosha, Wis.; Whitney E. Smith, Columbus, Wis.; E. F. Strong, Chaska, Minn.; C. L. Vogel, superintendent Fennimore Electric Light Company.

Other Papers

The paper on "Steam Notes on Small Turbine Plants," by J. L. Hecht of the North Shore Electric Company of Chicago, was read by the author. Mr. Lukes, Mr. Kimball, Mr. Putnam and others took part in the discussion.

The next paper on the programme was "Electrical Notes on Small Steam-turbine Plants," by C. W. Pen Dell, also of the North Shore Electric Company of Chicago. J. S. Allen of Lake Geneva, Wis., W. B. Jackson of Chicago and the author discussed this paper.

At the afternoon session of Thursday Irving P. Lord of Waupaca, Wis., former president of the association, read his paper on "Electric Lighting in Cities and Villages of Three Thousand People and Under." Mr. Wright, George E. Wheeler of Eau Claire, O. M. Rau of Milwaukee, Mr. Lukes and others discussed the paper.

F. L. Kaufman of Beloit followed with his paper entitled "Recent Developments in Single-phase Variable-speed Motors." Mr. Pen Dell, F. N. Jewett of the Chicago office of the Wagner Electric Manufacturing Company, Mr. Vaughn of Milwaukee, J. R. Dishington of Racine, Mr. Rau, Mr. Voth of Sheboygan, Mr. Allen and others took part in the discussion.

W. B. Jackson spoke of a large lifting magnet made in Milwaukee, which he said the visitors might like to inspect.

The Central Station and the Contractor.

Chairman Putnam, Red Wing, Minn.: We have a question here as to whether central stations should do construction work in competition with contractors. This question has been put up for answer, and we shall be pleased to hear from central-station men on the subject.

Secretary R. N. Kimball, Kenosha: I recently had a little experience along that line. We had always at Kenosha done contracting work. Our original reason for getting into it was because the local contractor charged so much that people did not have the work done. Last summer we had a strike, and we were unable to do anything. So the strikers got out and began doing contracting work for themselves; and we have found that we have got quite a number of solicitors that we are not paying, that are out for getting wiring work, and getting new business for us; and the position that I have taken since the strike is over is that we are not going back into the contract work, although we stand ready to do so if the prices are not satisfactory to our customers.

Mr. Putnam: In our town, some three years ago, after consulting with me, a couple of outside men came in and opened up a contracting office, and we have found that it has been very satisfactory to us, and we have had the same experience that Mr. Kimball has had. While we still keep a line of supplies, and do a certain amount of contract work under special conditions, nevertheless we aim to have this firm do a greater part of the work, and we find they are constantly out soliciting business for us. Once in a while we have to get after them on certain lines of business they have taken on, and have informed them that when they get off from our lines, or are taking on special work on our present lines, before they make any contract they must have our permission; but they have been of much benefit to us. During the time they have been there our output has increased 30 to 40 per cent. each year over the previous year, and we have spent practically no

money in soliciting new business for our electric plant.

Mr. Lukes: I think that is a mooted question, and I think that it has got to be decided by each manager according to local conditions. In some territories that we operate in there is not business enough to keep a contractor going, and we may be obliged to handle that work. I find that whether we are in it, or out of it, we have to stand a certain amount of blame. If we are in it we are blamed because our prices are too high by one set of people, and we are damned by the contractors because we are cutting into their business. So that there is bound to be trouble on both sides. But I think it depends entirely on local conditions.

J. S. Allen, Lake Geneva, Wis.: My experience has been limited to towns of from 5,000 to 15,000 inhabitants, but I have very decided views on the question of a company going into the contracting business. It took me a long time to learn it, but I firmly believe that a company ought to sell current, and not sockets and switches. I have thought that in larger places, such as perhaps 40,000 or 50,000 population, where they had only well-paid men to take charge of the wiring business, that the company could well afford, perhaps, to have a wiring department and supply department; but, so far as my experience has gone, in small towns, I do not believe we can afford to give any attention whatever to selling supplies. The company has absolute control over the wiring contractor in every instance. The latter knows that most of the business comes from the central station, and my experience has been very satisfactory with contractors. Even where your contractors are of very limited ability, they do get out and get business when the central station would not get it.

Mr. Lukes: Suppose you want to go into a campaign for increasing your business, and you wish to hire men to wire houses on the installment plan, or wire them at cost, or anything of that kind, what will you do? Various schemes have been used by new-business departments, and you might find it rather difficult under certain circumstances to get your work done.

Mr. Allen: Well, I have not gotten that far yet, but I have worked a great many different things through the contractor, making him our representative in every way, so far, for instance, as selling flatirons and disposing of heating apparatus and doing line work, and taking care of him, if he is short of business. In that case we turn over some business to him. He is a very valuable man to us, and we can afford to let him have some of the profits; and it has been very satisfactory to us to take care of him in that way.

Mr. Korst: In reply to Mr. Lukes' question, I will say that up to two years ago we did practically all of our wiring contracting business in Janesville, and as long as we were doing that work the contractor could not get any business; but we finally decided to give that work up, and our experience since then has been very satisfactory.

This season of the year, January, February and March, as you all know, is one when business is usually very quiet, as far as getting new business is concerned, and I called our contractors in and made this proposition to them: I said: "Now we want to keep you boys busy during this dull season, and we want to get some business ourselves. Now we want to advertise this proposition, that we will wire a house with five outlets, or five rooms, and in two of the rooms we will have a two-light fixture, and the other three will either have drop cords or brackets, as the customer may choose." Then I said to the contractor: "Now you must understand this is to tide you over your dull season. We want to make this a special offer, to get business, and you must get down on the ground floor with your prices." They did so, and we said, if you do it, we will take care of the account and we will pay your proportion, and we will carry the account on the monthly-installment plan. That proposition was accepted, and the plan has proved very successful. We sell the fixtures and they do the work, and when the work is finished we pay them, and carry the account. We have advertised the plan quite extensively too. The proposition is to wire a five-room house complete, ready for use, for $14, $2 down and $1 a month thereafter until it is paid up.

Mr. Lukes: I would like to ask Mr. Korst a question about the matter of customers' repairs. [illegible] business. That question is rather important, because we found out that our customers' repairs [illegible] custom is. We have always made those repairs for nothing. That is, replacing fuses, fixing lights [illegible] rial, etc.

[illegible]

We do that because contractors do not care to be troubled with it, and, moreover, our customers cannot get contractors to do that work promptly. The contractors will not leave a big job for a little repair job, and of course the customer cannot wait a minute.

Our experience has been similar to Mr. Lukes' about heating devices. It seems to me that on flatirons about two or three times in a season we have got to repair cords or terminals. About every flatiron is constantly in use, and consumers usually spoil a socket or two before they learn to stop turning them off at the key socket instead of at the iron; and that is one of the weak features of the flatiron at the present time, namely, the constant necessity for repairing it; and I hope that it will soon be improved so that it will be a little more reliable. The trouble seems to be more in the connecting cord than in the iron itself.

Mr. Harding: What is your practice in regard to replacing units? Do you charge for them? Does the company maintain the flatiron?

Mr. Korst: If the iron has just been out a short time, and the heating element gives out for no apparent cause, we replace it free of charge; but if it comes in showing evidence of having been dropped on the floor, or something like that, we charge for the repair, or if it has been used for quite a while we charge for it; but such items as repairing the broken portions of a terminal, or something like that, we generally do free of charge.

Engine Economy.

C. J. Davidson, chief engineer of the Milwaukee Electric Railway and Light Company, read a paper, illustrated by charts, to show the proper consumption of coal of a non-condensing Corliss engine of 500 horsepower or less, with variable load. Mr. Davidson gave interesting data on the subject, which was also discussed by Messrs. Kemper and Kimball.

Election of Officers and Closing Business.

On the recommendation of the nominating committee (except in the case of the secretary's position) these officers were elected:

President—P. H. Korst, Janesville, Wis.

First vice-president—John Wright, Antigo, Wis.

Second vice-president—John S. Allen, Lake Geneva, Wis.

Secretary-treasurer—Roger N. Kimball, Kenosha, Wis.

Directors—John H. Harding, Laporte, Ind.; P. E. Elevier, Superior, Wis.; L. L. Tessier, Depere, Wis.

There was no contest, except for the position of secretary, for which both Thomas R. Mercein of Milwaukee, former secretary, and Mr. Kimball, the present incumbent, were nominated. Mr. Kimball was elected.

Mr. Korst, the new president, was escorted to the chair and made a few remarks. He is secretary and manager of the Janesville Electric Company, which operates both waterpower and steam plants, and is an old member of the association. Messrs. Wright, Allen, Kimball and Putnam also spoke briefly, and soon after the sixteenth convention was finally adjourned.

The Chicago section of the Illuminating Engineering Society invited the members of the association to attend a meeting held in conjunction with the Chicago electrical show on the evening of Friday, January 17th. About 20 gentlemen accepted the invitation. A report of this meeting is given in another column.

Among those attending the Milwaukee convention whose names have not been mentioned already were H. P. Andrae, Milwaukee; N. C. Cotabish, National Carbon Company, Cleveland; H. L. Bacon, New London, Wis.; M. C. Ewing, Wausau, Wis.; J. B. Griffith, Nernst Lamp Company, Chicago; M. H. Juhl, Ashland, Wis.; B. J. Kacin, Central Electric Company, Chicago; M. W. Knapstein, New London, Wis.; W. D. McDonald, Westinghouse Electric and Manufacturing Company, Chicago; A. Meineman, M. B. Austin & Co., Chicago; W. G. Patterson, Menomonie, Wis.; George M. Pierce, Brodhead, Wis.; W. T. Pomeroy, Edgarton, Wis.; T. T. Richards, Wagner Electric Manufacturing Company, St. Louis; W. A. Russell, Kenosha, Wis.; W. E. Smith, Columbus, Wis.; H. C. Sterling, New London, Wis.; R. H. Strang, Richland Center, Wis.; Charles N. Thorpe, Franklin Electric Manufacturing Company, Chicago; John E. Tingley, Madison, Wis.; B. D. Viles, Chippewa Falls, Wis.; C. W. Wilkins, National Carbon Company, Cleveland; James Wolff, New York Insulated Wire Company, Chicago.

Sons of Jove Rejuvenation.

The Sons of Jove held a rejuvenation in the Coliseum on Monday night, January 20th, which was well attended, many out-of-town members being present on account of the electrical show. W. E. Robertson, Jupiter, of Buffalo, and C. B. Roulet, Mercury, of Dallas, Tex., heads of the organization, were present and assisted in the rejuvenation. J. Robert Crouse, Neptune, of Cleve- [illegible]

After initiating 28 new members into the mysteries of Jovianism the annual banquet was held. A. D. Blocker of Chicago, Jovian Statesman for Illinois, presided at the banquet, which proved an enjoyable affair.

The Illumination of Apartments and Small Houses.

On the evening of January 17th the Chicago Section, Illuminating Engineering Society, held its meeting in the convention hall of the Coliseum Annex, to which members of the Northwestern Electrical Association attending the electrical show had been invited. The general topic of the evening was the gas and electric illumination of apartments and small houses, and special reference was made to the Commonwealth Edison Company's "House Electrical" at the show.

George H. Jones of that company led the discussion. He said that many recent improvements are making the use of electricity in homes very common. The laying out of a house-wiring system now naturally divides itself into two sections—first, the planning of outlets for lighting, and second, the planning of outlets for other electrical appliances. In the first service, consideration must be given for every-day needs and for lighting on special occasions, such as the reception of guests, parties, etc. For the former an efficient illumination is most desirable; for special work the effects outweigh the economy. The present tendency is to place lamps near the ceiling to get them out of the range of vision and to give a better distribution of the light. For most rooms strong, concentrated lights are not desirable. Many outlets should be provided for convenience in attaching fans, heating and other appliances; for this purpose baseboard and wall receptacles are particularly desirable, as they do away with pendant cords. The lighting of closets should not be overlooked; automatic door switches are good for this purpose. Stair lights should have three-way switches. Porch lights should be provided and the driveways should be illuminated. Where the house stands apart, underground connections to the pole line will be found desirable.

Mr. Jones then described in detail the electrical equipment of the "House Electrical" at the Chicago electrical show. He pointed out in particular that double ceiling outlets were provided in the large rooms for moderate or more intense illumination, the use of turn-down lamps, the placing of wall brackets over and near tables, dressers, mirrors and other places where a concentrated light was desirable.

Albert Scheible stated that his impression was that this house was for exhibit and therefore more elaborate than the average home. How should the lighting be changed for an ordinary house? Mr. Jones said that more lights were provided than would usually be necessary because the outside lighting was so intense. The general scheme is the same he would recommend for any modern home.

E. W. Lloyd pointed out that the cost of these fixtures was high because they were specially designed and were built of solid metal and of the best workmanship throughout. They might be 25 per cent. less costly and produce practically the same results. As they stood they cost about $500. The fixtures were not designed for efficiency, primarily, but rather for artistic effects.

George C. Keech declared that the new feature to be emphasized was the large number of outlets provided. While these added to the initial cost, they were a source of economy in the end, since they enabled one to turn on lights just where they were most needed.

W. R. Bonham said he had hoped to see something new in lighting effects. The dining-room lighting he criticized as not up to the latest practice. A single 50-watt lamp with Holophane reflector and a dome shade would have produced as good if not better results.

J. R. Cravath, in discussing some of the details of the fixtures, found fault with the use of unshaded lamps, and the placing of bracket lights in the field of vision. All the ceiling lights should have been provided with reflectors to throw the light down.

G. H. Stickney, Lynn, Mass., pointed out that in house lighting there is always to be considered the relative importance of economy and beauty. The home should be as beautiful and attractive as possible, especially for the benefit of the ladies. He cited the example of a prominent illuminating engineer who designed a highly efficient lighting system for a New York lady of means that was not approved because she wanted certain artistic effects. The recent paper by Mr. Bassett Jones, Jr., showed that the æsthetic side must be considered in proportion to the wealth of the client.

In reply to the criticism that this house was no model for what should be done in a modest residence in towns and small cities, George H. Jones said that for this class of apartments the two-year installment plan of payment for wiring was found extremely popular by the Common-

wealth Edison Company and that nearly [illegible] light had been contracted for on this plan in the last few months. This service cost about [illegible] per light to install for a good ordinary round-stem fixture.

Mr. Scheible called attention to the fact that the old gas-lighting style of fixture had been entirely abandoned in the "House Electrical," while in most houses they are still largely in use. The combination fixture is not the best practice in modern houses, as separate outlets are preferable.

H. Von Holst declared that the architect must design to suit his client and cannot always follow his own tastes. This is particularly true of the color scheme. He does not neglect good illuminating principles, if there is any way of applying them. Architects want to be informed on all new kinds of lighting fixtures, shades, globes, etc., as it gives them a larger range to choose from.

Gas Engines in Railway Power House Put to Severe Test.

An interesting illustration of the apparent reliability of large gas-engine-driven electrical units under severe conditions of service was afforded during the recent heavy snow and windstorm in the Northwest. Interurban lines centering at Milwaukee as well as a large part of the street-railway system of that city were at a standstill for a period ranging from 24 to 36 hours, with the exception of the Milwaukee Northern Railway. This line, which has its power house at Port Washington, 20 miles north of Milwaukee, is supplied with current at present from one of two Allis-Chalmers alternating-current generators direct coupled to four-cycle double-acting twin-tandem gas engines of the same company's build, each unit being rated at 1,000-kilowatt capacity.

Most of the railway right-of-way is through a flat, open country, where there was full exposure to the storm. Accordingly, precautions had been taken against snow interfering with traffic by putting up snow fences along the worst places, but the storm very early in the day destroyed these fences and the tracks were soon covered with snow to the depth of several feet in places. At this time the Milwaukee Northern had running three large interurban cars, one large snow-plow, one large sweeper and four city cars. The interurban cars when going through the heavy snow would take as much as 550 horsepower, and the snow-plows, of course, considerably more than that. This, together with the city cars, gave the gas engine in operation at Port Washington a swinging load of from 280 to 2,400 horsepower. It is reported that the engine acted extremely well under these trying conditions, picking up the heavy load with apparent ease and running so quietly that if it had not been for the wattmeter it would have been hard to detect an overload by the action of the engine. The Milwaukee Northern, although it did not run on schedule time during the day, kept the cars going, and by nightfall was back to its regular schedule.

Berlin Wireless Convention Before United States Senate.

The Berlin international radio-telegraph convention of 1906 is up before the United States Senate for ratification. Great Britain gave its official adherence last year, after a determined fight against the convention by the Marconi company. It is evident that similar opposition is to be made in this country, for on January 15th John W. Griggs, counsel for the Marconi Wireless Telegraph Company, submitted to the committee on foreign relations of the Senate objections to the confirmation of the convention. The memorandum says in part: "The arrangement thus proposed represents an enforced partnership to which the Marconi companies contribute everything and the German manufacturers of wireless apparatus nothing, neither invention nor capital nor skillful enterprise. In short, the German company proposes to obtain artificially, through international legislation, the advantage of the position obtained by the Marconi companies in open competition and by private effort at private expense."

An Ambitious Electric-railway Project.

An ambitious project has been launched by the filing of articles of incorporation at Pierre, S. D., of the St. Paul, Minneapolis and Seattle Electric Railway Company, with authorized capital of $500,000,000. The company proposes an electric line from St. Paul and from Minneapolis, these not running from one city to the other, but to spur into the country by the shortest route, the lines to join at some distance for the purpose of saving time from the necessarily slow speed between the cities. The route is to go to the Dakotas and branches are to be run to Fargo, N. D., and Aberdeen, S. D.

ELEMENTS OF ELECTRICAL ENGINEERING.

[illegible]

LII.—Motor Driving.

[illegible]

Machine-tool driving [illegible] very light machines the group drive is still in [illegible] individual drive is now considered the best practice. By individual drive is meant the use of a single motor upon the driven machine, but in the case of some very large machines it is found more convenient as well as more economical to use a separate motor for each motion of the machine.

For almost all kinds of machine tools direct-current motors are still preferable, perhaps, chiefly on account of their inherent characteristics in regard to speed regulation; and the selection of a motor having suitable characteristics for the class of service in which it is to be used is frequently a matter requiring considerable engineering experience. In general it may be said that lathes, drill presses and other machines having a rotary motion should be equipped with shunt-wound motors, while planers, slotters and similar machines having a reciprocating motion should always be equipped with compound-wound motors. Cranes, hoists, bending rolls and similar machines should be equipped with series motors.

In nearly all machine-tool operations variable speeds are required for performing different kinds of work, and the variable-speed motor has been a very important factor in machine-shop practice. The introduction of the various high-speed steels a few years ago marked the beginning of the present practice in the line of rapid production, and today rapid production is recognized as the most important condition of successful manufacture. By rapid production is meant turning out the maximum amount of work of which the machine is capable in a given time, and in order to do this very wide variations of speed are often required.

If a lathe, for example, is being used to turn down a piece of metal at the maximum allowable cutting speed of the tool, and there is a change in the diameter of the work, it requires a corresponding change in the speed of the lathe to maintain the cutting speed of the tool at its maximum value. If it is necessary to shift the belt, or to throw back gearing in or out, this requires considerable physical effort on the part of the operator, and also involves considerable loss of time, so that the result under these conditions is generally that considerable of the work is done at much less than its maximum speed. The variable-speed motor, together with high-speed tool steels, have entirely overcome the loss of time incident to mechanical speed-changing devices and have therefore greatly increased the production wherever they have been adopted, as by the simple movement of a controller handle any speed within the range of the machine is at once available.

There are several different ways of obtaining variable speeds. These are by weakening the field, by the use of three-wire system, by the four-wire multi-voltage system, and by double-commutator motors. Of these systems the method of speed variation by field weakening only is now considered the best practice, as it requires only a single voltage, which greatly simplifies the method of wiring and also the system of control.

For variations in speed in the ratio of two to one the ordinary shunt-wound motors may be employed, but for wider variations, such as three to one, or four to one, a modification of the shunt-wound motor is required. This modification consists in the addition of auxiliary or inter-poles, a type of machine which will be described later.

The three-wire systems, whether of the balanced or unbalanced-voltage kind, have been used in many cases with success. These systems require the use of several wires, which, in turn, complicate the controllers to a considerable extent. They also add considerable complication to the generating system.

The four-wire multi-voltage system requires one more wire for its distribution than the three-wire system, and, on account of the complications it introduces, is not extensively used.

The auxiliary-pole motor, which is now largely [illegible]

The function of these auxiliary poles is merely to secure good commutation.

When the field is weakened to a considerable extent to secure a high speed in the motor, the armature current tends to produce a considerable distortion of the magnetic field, which shifts the point of commutation. The auxiliary poles, whose coils are in series with the armature, are located so that they just neutralize the field distortion produced by the armature current. As the strength of this auxiliary field is always proportional to the armature current, the field distortion is always exactly neutralized for any value of the armature current. This gives a fixed point of commutation, so that the current in the coils directly under the brushes has a zero value, and sparking at the commutator is therefore eliminated. This fixed point of commutation is very important when the motor is used for reversing operations.

Motors of this character are generally used on a 220-volt, single-voltage system, which makes the installation very simple, as only two wires need be carried from the generator to the motor.

The term "variable speed" in connection with motors of this type is somewhat a misnomer, as a variable-speed motor, strictly speaking, is one in which the speed varies with the load. The term "adjustable speed" defines these motors more accurately, as while the speed may be varied between wide limits, the motor has a constant speed for each position of the controller for any load within its capacity. This constant speed is a characteristic of the shunt-wound motor, and the auxiliary-pole motor is in reality a shunt-wound motor, as the series winding is so placed that its only effect is to secure good commutation.

The regulation of variable-speed motors is usually effected by means of drum-type controllers whose function is to insert more or less resistance in the shunt-field winding of the motor, and in some cases resistance is inserted in the armature circuit of the motor also, on the starting position of the controller. Armature resistance is not recommended, however, except for starting purposes, as its use is not only wasteful of power, but it tends to impair the speed regulation.

For motors of large capacity the drum-type controller becomes difficult to operate, on account of its size, and unit switches, operated by a master controller, similar to the unit-switch railway control, are used instead of the drum controller.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Six-cent Fares Proposed in Massachusetts.

The forthcoming report of the Massachusetts Railroad Commissioners on the electric railways of the state will show that more than one-half of them fail to meet their expenses. Of course such a system as the Boston Elevated pays handsomely, meeting its charges with ease, putting back some of the earnings into betterments and disbursing regular dividends. There are other systems in the state which disburse good dividends to their stockholders, but out of the 83 trolley lines in the commonwealth 47 fall behind.

In consequence there is a purpose on the part of some street-railway managements to raise fares from five cents a ride to six cents. Already the Blue Hill Street Railway Company, operating south of Boston, has raised its rates, and Stoughton residents have raised the issue that the new fare of six cents is excessive. The Railroad Commissioners are on record as follows: "The public, now so generally dependent upon interurban roads, should be ever mindful that while it is essential that service should always be adequate, the ideal conditions can only be obtained through a fair return upon money invested." What they will do with regard to the specific cases soon to come before them is an interesting question, but the railway directorates have been much encouraged by the statement quoted.

President George F. Parker announces that the second annual Electrical Show will open at Madison Square Garden, New York, October 3, 1908. It is said that a feature of the New York show will be the foreign exhibits.

Marseilles Electrical Exhibition.

[From the Paris correspondent of the Western Electrician.]

The electrical exposition which is to be held at Marseilles this year, from April 19th to October 31st, will be one of the largest displays of electrical machinery and apparatus which has been seen on the Continent. Its organization has been carried out on a large scale, and it is backed by the leading societies and electrical concerns of France. The French government will co-operate in the enterprise, which will have also the aid of the Paris Chamber of Commerce.

At the present time there is a great activity in the southern coast region of France in relation to electrical enterprises. Recently the city of Marseilles has been supplied with large electric-light and tramway stations, and it also receives current from a transmission line. The Marseilles tramway system is the most extensive in Europe for its population, which is 500,000 inhabitants. The southeastern or coast region is now the center of a large system of power plants erected in the mountain regions by large companies, which will have a capacity, counting the reserve steam plants, of 150,000 horsepower. Four hundred communes, scattered over eight departments, representing a population of over 3,000,000 inhabitants, are now supplied or will be in the near future by means of this network of pole lines and stations. This means that there is an enormous field opened up to the electrical industry. Owing to these conditions, the projected exposition is a timely one. Well arranged in a large space, it will serve to show the public the numerous applications which can be made of electrical apparatus.

The city of Marseilles placed at the disposal of the management of the exposition the Prado Park, where the Colonial Exposition was held in 1906. It has an area of 60 acres, and, with its convenient arrangements of all kinds, it is well adapted for the purpose. The Grand Palace covers a surface of 5,000 square meters. The Energy Palace, newly built, covers 5,000 square meters. At the middle part will be placed cascades and luminous fountains. The Traction and Mining Palace has an area of 4,000 square meters. The Agricultural Building, of 2,500 square meters area, has large experimental grounds for agricultural machines driven by electric motors. There will also be a modern dwelling which contains the applications of current for cooking, heating and the like. Besides a large theater, there is a fine arts pavilion and a music stand.

Exhibits are divided into 17 sections: 1. Power plants and lines. 2. Motor work for industries. 3. Applications of current for domestic industry. 4. Applications to household use. 5. Public and private lighting. 6. Heating and ventilation. 7. Cranes, etc. 8. Mines. 9. Traction. 10. Agriculture. 11. Military and maritime work. 12. Electrochemistry and electro-metallurgy. 13. Telegraphy and telephony. 14. Medical uses. 15. Instruments. 16. Raw material and products. 17. Instruction.

Current will not be generated on the spot, but will be supplied by lines coming from neighboring plants, as direct current, single-phase or three-phase current.

Some Characteristics of the 14,000-kilowatt Turbine.[1]

By W. L. R. Emmet.

The General Electric Company's present form of turbine, in its highest state of development, is a machine which is now rated at 14,000 kilowatts maximum, and is, I believe, the largest that has ever been built, of any kind; it is also the most efficient machine ever built by a very considerable margin. This machine in Chicago has delivered to the switchboard a kilowatt-hour at an expenditure of 12.8 pounds of steam, and that is the equivalent of something like 8¾ pounds per indicated horsepower. Its performance represents not only a very high efficiency of action, but very high range of action, the machine operating from 175 pounds down to a vacuum of 29 inches. Other turbines have given as large a percentage of the theoretical possibility, but no machine has ever given so large an output per pound of steam, and the reason is that this machine is both efficient and designed for a wide range of usefulness, whereas other machines, while efficient, are not suited for so wide a range.

One of the great problems in connection with [illegible] the building of the generators, principally because there has been so [illegible] of time. An electrical design is something on which it is par-[illegible] It is very hard to foresee electrical conditions, particularly thermal conditions, eddy currents, mechanical strains, effects of vibrations, and other [illegible] machinery, centrifugal strains are extreme, and since they are made up of copper and iron, it is necessary to devise all sorts of means for holding the copper and all parts together. The copper, under such centrifugal strains as here exist, will, if unsupported, flow almost like putty; it has to be bound, held and confined by strong steel structures in order to make it stay in place, and all this has to be taken care of in the rotating element.

Furthermore, the machine, while highly efficient, as most of the General Electric Company's generators are, involves losses like other electrical machines—possibly 3½ per cent. in a machine like this 14,000-kilowatt turbine unit I have mentioned. Three and one-half per cent. of 14,000 kilowatts is a lot of power and represents a great deal of heat. I may roughly say that the heat represented by the losses in this highly efficient generator amounts to about the same that we would have in the furnace of a 60-horsepower boiler.

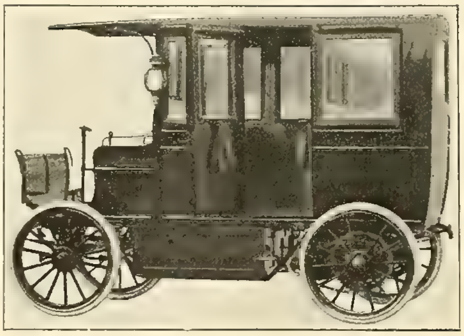
If you imagine a generator about 10 feet high and 11 feet in diameter, almost solidly filled with magnetic material—an extremely compact structure, with certain spaces through it for ventilation—and then imagine this structure having heat delivered into it as fast as a 60-horsepower furnace could put it in, you will see that the problem of keeping that thing cool is quite a serious one. To keep it cool, we must have 30,000 feet of air a minute pass through, and keep that air uniformly distributed; so that in no part will it become very hot; otherwise we will have some part of the machine burning itself up.

Most of this work on the generators has been splendidly done, and a vast amount of inventive ability, skill and foresight have been put into it; but naturally, some mistakes have been made, and every little difficulty with a generator tends to hold back the turbine industry as much as if it were in the turbine. These troubles, however, have been overcome and corrected. All this has been very expensive, but the result is, that in five years, we have made the largest and by far the most efficient steam engine ever produced.

[1] [illegible] Fisk Street station in Chicago, and not the still later and probably larger machine of 14,000 kilowatts "maximum [illegible]

An Electric Bank Wagon.

The National Bank of Commerce of St. Louis, Mo., has recently put into commission an electric bank wagon which was built for it by the Studebaker Automobile Company of South Bend, Ind. The chassis of the wagon is a regular Studebaker



ELECTRIC BANK WAGON.

electric chassis of 1,500 pounds capacity. The body was built upon the bank's specifications. A door opens on each side in the center. Just in the rear of the driver's seat and extending under it, and wholly inside of the body, is located a strong box made of wood and lined with heavy sheet steel. This is divided into five compartments and fitted with a strong lock. Inside the body in the rear extending across its full width is located a seat for the person in charge of the wagon and the officer or guard. The inside dimensions of the body are: Length, 6 feet 8¾ inches; width, 40½ inches; height, 57 inches.

The wagon is used for carrying money between the bank and sub-treasury, and also between the offices of various express companies. When a customer wishes to pay off in currency, the money is carried to his place of business in this wagon under the protection of a guard. There are times when the wagon transports over 9,000 pounds of money between different parts of the city in one day's time. With a 1,000-pound load the wagon has a radius of 40 miles and a speed of 12 miles an hour. Since its installation it has not been out of commission for five minutes, and the officers of the bank are much pleased with the wagon's performance.

Insurance of Telegrams.

A Copenhagen dispatch to the Chicago Daily News recites that the Danish State Telegraph Department has established connections with an insurance company in order to put into effect a new plan for insuring telegrams. The financial loss caused to business through the delay and distortion of telegrams is so cosiderable that the Telegraph Department for a long time has tried to find a way of insuring against these risks. The department itself could not take the responsibility for the losses, because that would involve raising the tolls on messages. When the new plan is put into effect any telegram can be insured for any amount, or a whole year's telegraphic correspondence can be insured up to a certain sum. Denmark is perhaps the first country to adopt telegram insurance.

Indiana Engineering Society.

The Indiana Engineering Society held its twenty-eighth annual convention in the Assembly Room of the Commercial Club, Indianapolis, January 16th, 17th and 18th. President W. K. Hatt, professor of civil engineering at Purdue University, in his annual address, welcomed the members. He said that he could not allow the opportunity to pass without noting the increasing recognition of the work of the engineers in Indiana. Trained engineers play a part of increasing importance and responsibility, and the money value of his training and experience becomes increasingly evident as the problems become larger and the cost of mistakes become more striking and more prohibitive of the work of the amateur. The state engineering society occupies a field not covered by the larger or national society. It gives an opportunity for discussion and acquaintance which is not to be obtained in the meetings of the national society.

President Hatt closed his address by calling attention to the unusual amount of attention given in the programme to electrical engineering, and called for the report of the committee on central-station light, heat and power, which was presented by J. B. Nelson of Indianapolis, chairman.

This report was followed by the reading of a committee report by H. B. Marsh of Indianapolis on electrical engineering.

Another committee report related to electric railroads and was presented by Robert P. Woods, an electric-railway engineer of Indianapolis.

John P. Moore gave an account of the 1,200-volt, direct-current type of electric railway. Mr. Moore said that, in the endeavor to attain economy in current distribution for interurban railways, various systems of transmission and feeding have been within the last few years placed under the test of actual operating conditions. On interurban railways the expense of operating rotary-converter sub-stations fed from a power station by high-tension transmission lines is warranted, as this method is more economical than direct feeding at only 600 volts; but notwithstanding the great improvement in recent years in the design of rotary converters, transformers, high-tension switches and accessories, there has always been present the desire to operate interurban roads successfully as well as economically without the sub-station.

The first 1,200-volt, direct-current interurban railway to be placed in operation in this country was opened on November 6, 1907, between Seymour and Sellersburg, Ind., for a distance of 41 miles, by the Indianapolis and Louisville Traction Company. The general scheme of the 1,200-volt, direct-current system is indeed simple, as two standard 600-volt railway generators, mounted on same engine shaft, are connected in series, thus furnishing 1,200 volts direct current, which is fed direct to feeder and trolley, there being no sub-station on the entire 41 miles of road. The power station is a substantial brick building, with a partition wall between the engine and boiler rooms. Installed therein are two Allis-Chalmers single-cylinder, non-condensing Corliss flywheel-type engines rated at 750 horsepower each. The engines have extended shafts, two 300-kilowatt, 600-volt railway generators being mounted on each shaft. The boilers are four in number, of Babcock & Wilcox water-tube type, rated at 300 horsepower each at a steam pressure of 150 pounds per square inch. There has been provided ample space for additional boilers and engines with generators.

The switchboard consists of four plain slanting panels in a row, and an independent panel located at each generating unit. On this latter panel is a special 1,200-volt laminated type of circuit-breaker for connecting the two generators, composing one unit in series, also a knife switch for equalizing both units when required to run together. The main switchboard controls the output of the two 1,200-volt generating units and consists of two generator and two feeder panels with two voltmeters mounted on a swinging bracket. Each of the four panels has mounted thereon a special type of circuit-breaker at the top of the panel underneath an ammeter, and below this a knife switch. The generator panel, in addition, has a Thomson recording wattmeter.

The trolley wire at the power house has a section insulator cut in and is fed for 17 miles in each direction by a tapering feeder.

The electrical operation of the generating units is simple and no different from the operation of two 600-volt standard railway-engine-type generators.

Thomas B. McMath, engineer of the Indianapolis Traction Terminal Company, spoke on "Track Construction in Streets for Interurban Service." Mr.

McMath said that the first car built for heavy, fast freight was that of the Union Traction Company. He described the manner of constructing the city tracks, going into detail concerning the concrete foundation and the kind of ties and rails used.

There were several other interesting and important papers read before this convention on various subjects relative to the engineering profession. The meeting closed with a banquet, which proved to be a very enjoyable affair.

The officers elected for the ensuing year are: President, Prof. W. K. Hatt, Lafayette; vice-president, C. C. Brown, Indianapolis; secretary, Charles Brossmann, Indianapolis.

A 25,000-horsepower Rolling-mill Engine.

A visitor to the West Allis Works of the Allis-Chalmers Company one day last week would have been arrested by the sight of two 75-ton cranes engaged in the apparently easy task of picking up, piece by piece, a million and a quarter pounds of metal, which in the aggregate constitute one great machine, and loading the various parts on flat cars for transportation to the mills of the Carnegie Steel Company at Sharon, Pa., where they will be reassembled into an engine of no less than 25,000-horsepower capacity, the largest ever installed. Two of the castings for this engine weighed, after machining, 118 tons each. The engine, as a whole, weighs 550 tons, without foundation plates or flywheel. It is a horizontal, twin-tandem, rolling-mill engine, with cylinders 42 inches and 70 inches by 54-inch stroke, designed to operate condensing at 175 pounds steam pressure and a speed of 150 to 200 revolutions per minute. Being used to operate the rolls in a steel mill, the engine must be quickly reversed at the end of each run, and the load varies within a few moments from nothing to the maximum power exerted. The reversing mechanism used for changing the direction of the engine is of the Reynolds-Marshall type and run by a small independent engine with oil-cylinder lock. Another small engine is also employed in operating the steam throttle valve, all of these units being under the perfect control of the one engineer. No more than a few seconds' time is needed for the act of reversing.

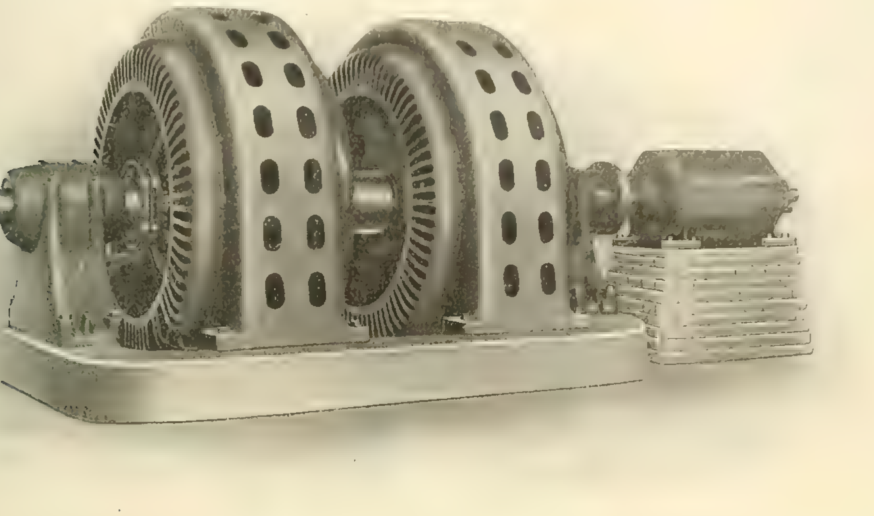
Proposed Electric-railway Operators' Association.

At the recent Atlantic City convention of the American Street and Interurban Railway Association the executive committee was instructed to take steps to form another affiliated organization, to which shall be committed lines of work pertaining to transportation, traffic and general operation. The committee has given careful consideration to the matter and is of the opinion that the new association should bring together general managers, managers, passenger agents, advertising managers, superintendents and other operating officials, for the consideration of problems of interest to those engaged in the actual operation of street and interurban railway properties. The exact name of the new association will be determined at an organization meeting. This meeting will be held at the office of the association, No. 29 West Thirty-ninth Street, New York city, on January 30th, at 10 o'clock in the forenoon. Member companies are urged to have one or more representatives present at this meeting, fully authorized to participate in the organization of such a fourth affiliated association. Calvin G. Goodrich, W. Caryl Ely and James [illegible] committee on organization.

Frequency-converter Sets.

The various frequencies employed in alternating-current work, though each adapted to the particular service required, often lead to complications where it becomes necessary to combine the services from two systems of different frequencies, as, for example, when a 25-cycle isolated power plant becomes overloaded, and it is necessary to purchase power from a public lighting service of 60 cycles. In changing the frequency of alternating-current supply it is necessary to have two machines, each of the full capacity of the power transformed. In transforming a service of 60 cycles, for instance, to 25 cycles, a 60-cycle motor is required, driving a 25-cycle generator.

Frequency converters are also of use in sub-stations of long transmission lines. Low frequency



A CROCKER-WHEELER 1,000-KILOVOLT-AMPERE FREQUENCY CONVERTER.

is desirable for alternating-current transmission, both for regulation and power factor. High frequency, however, is more desirable for lighting distribution. A frequency converter, therefore, can be conveniently used at the sub-station to change the low frequency of the current received from the distant generating station to high frequency for local lighting. A number of frequency-converter sets have been built for this purpose by the Crocker-Wheeler Company for the Shawinigan Falls Water, Light and Power Company's Montreal station.

The accompanying illustration shows a frequency converter of 1,000 kilovolt-amperes capacity installed in the plant of the Pennsylvania Steel Company, Steelton, Pa. The 25-cycle power plant of this company became too small to carry the full load of the plant. This frequency-converter set was therefore installed to utilize the 60-cycle service of the York Haven Power Company during the hours of heavy load. The set consists of two Crocker-Wheeler machines mounted on a heavy shaft and a starting motor.

The motor unit is a 14-pole 1,150-kilovolt-ampere machine and the generator unit is a six-pole machine. The change in frequency is therefore 60 cycles to 25.7 cycles. The starting motor has great starting torque and is specially designed for short runs at very heavy loads. The starting motor is used only to bring the set to synchronism at 514 revolutions per minute. The well-known ability of Crocker-Wheeler alternating-current apparatus to operate in parallel makes the synchronizing of the set a simple matter.

The set is usually employed to carry a part of the load of the plant independently of the company's power plant. In emergencies, however, the plant is thrown in synchronism with the 25-cycle end of the set.

Large Interurban-railway Car Shops.

Car repair shops costing $165,000, said to be the largest and best equipped in the United States, were formally opened for public inspection by the Indiana Union Traction Company at Anderson on the 15th inst. The Anderson Commercial Club, city and county officials, composed the party of invited guests for the opening, and at two o'clock they were taken on a special train of city cars to the shops in North Anderson, a suburb, and adjacent to the central power house supplying the electric current for the 300-mile interurban and city line system. The opening of the shops was marked with no ceremony except the swinging open of the [illegible] new plant. Eighteen tracks lead into the building. Arthur W. Brady, president, and Henry A. Nicholl, general manager of the [illegible] Company, escorted the inspection party through the many departments of the plant.

Opening of the Telephone Convention.

A large number of Independent telephone men, perhaps 800, attended the annual convention of the International Independent Telephone Association, held in conjunction with the Electrical Show, Chicago, on January 21st to 23d. A meeting of the executive and advisory boards, preceding the opening of the convention, was held on January 20th. The importance of this meeting of boards was emphasized by the fact that the time of holding the annual convention of the association has been changed from June to January to bring the dates in conformity with the annual Electrical Show in Chicago, an event of great importance to the majority of the members of the association. The executive committee met, with President Theodore Gary of Macon, Mo., in the chair, at the headquarters of the association at the New Southern Hotel. Other members present were: W. B. Woodbury, Detroit; O. C. Snider, Kansas City; James B. Hoge, Cleveland, and Walter Doolittle, Lafayette. Following an extensive discussion of important business matters, the executive committee adjourned to give President Gary an opportunity of presiding at a meeting of the Advisory Board, comprised of the presidents of the various state, territorial and provincial associations.

The opening session of the annual convention was called to order at 2 p. m. on Tuesday, January 21st, by President Gary. Prayer was offered by Rev. Z. P. Phillips, rector of Trinity Episcopal Church of Chicago. First Assistant Corporation Counsel George W. Miller, representing Mayor Busse, delivered an extended address of welcome. To this address Mr. M. L. Clawson of Indianapolis, Ind., responded at some length, and his remarks were frequently interrupted by tumultuous applause. Especially was this noticeable when he called attention to the fact that the Independent interests proposed to come into Chicago, not for a day, not for a month, but for a long-extended franchise and permanent residence.

Mr. Gary's annual address was a careful treatment of the subject of the benefits of organized co-operation, comment on the widespread interest and substantial growth of the association during his administration, and the necessity for a careful and concerted consideration of any and all legislation appertaining to compulsory interchange of business. The president recommended a continuance of the aggressive and progressive policy of the association and urged some plan by which the association would appropriate and authorize the distribution of a substantial sum of money for publicity purposes, particularly in supplying the newspapers and periodicals with news matter to enlighten the public on the genuineness of the Independent movement and its advantages over monopolistic methods.

The president's report was followed by a report of Assistant Secretary Harney, containing in detail the work of the association and the operations at headquarters prior to and following the removal of the headquarters from Cleveland to Chicago.

A. C. Lindemuth of Richmond, Ind., offered a joint resolution providing first, that the assessments for the National association should be based according to states and on a fundamental calculation of two mills per unit in the respective states, thus equalizing the general assessment; second, that stamps of various denominations bearing the design of the association should be copyrighted and sold to all Independent manufacturers and dealers in Independent supplies, also publications devoted principally to the Independent interests, and said manufacturers, dealers, publishers and others be urged to use such stamps at all times on invoices, goods, subscriptions, etc., and compelled to use the same to secure recognition and admission to the state organizations and in the International Association. Action on these resolutions was deferred and made a regular order of business at the opening of the convention Wednesday morning.

E. H. Moulton of Minneapolis, Minn., read an excellent paper on "The Banker's Opinion of Securities," in which he congratulated the Independent interests on the excellent character of these securities in recent years, and declared that nothing was more acceptable to the banker and the investor now than such public-utility securities as those of gas, electric-light, street-railway and telephone companies.

Following the report of several state organizations, the convention adjourned until 10 o'clock on Wednesday morning. The concluding sessions will be reported in the Western Electrician of next week.

Someone has figured out that the amount of printed matter in the different telephone directories in the United States would cover about 140,000,000 sheets of paper 24 by 38 inches in size.

Automatic Telephony.

By Franklin J. Truby.

Part III.

Fig. 8 represents (with circuits) two adjacent line switches in the relative positions which they occupy when mounted, together with a graphical representation of the master switch, of which two are assigned to each line switchboard unit. Switch No. 1 is shown with plunger released from shaft and engaging trunk No. 6, while the plunger of switch No. 2 is in position to take trunk No. 7 upon the next call.

These plungers are directed to the proper contacts by the operation of the master switch upon the two shafts located centrally in front of their respective panels. The two shafts are operated by one master switch (the second master switch being a reserve only) sufficiently at each call to direct all the plungers not released to the next multiple bank contacts. The shafts are operated through an arc defined by the limits comprised in

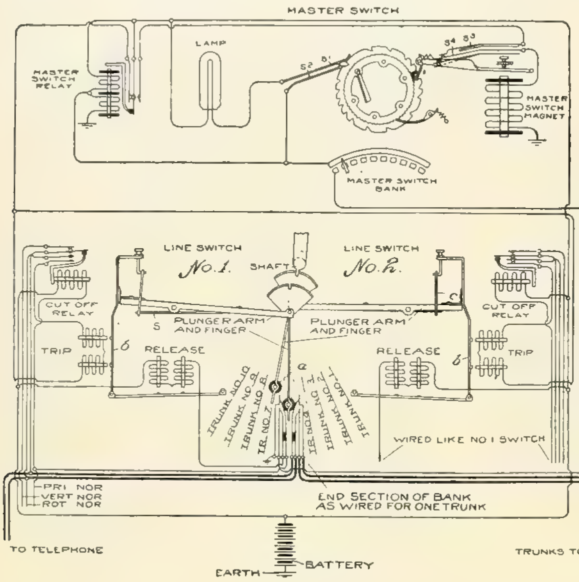


FIG. 8. TWO ADJACENT LINE SWITCHES, WITH GRAPHICAL REPRESENTATION OF MASTER SWITCH.

the bank of 10 contacts. When the plungers have been directed to either extreme they are reconducted back over the same path in the same manner as they were advanced. The plungers thus occupy successively at each operation of the master switch the next adjacent contact.

The wheel of the master switch has a forward movement only and operates the shaft mechanically by an arm reaching from the rim of the wheel to the point where its axis of rotation intersects at right angles the axis of rotation of the shaft. The displacement of the projection of this arm along the diameter of the wheel corresponds to the translation of the plungers along the bank contacts. Since the displacement of a projected point along the diameter corresponding to a constant displacement along the circumference varies, it is necessary that the arm should rotate further near the extremes than when its projection is passing through the center. This is accomplished by a fiber wheel having its circumference divided into segments corresponding to equal displacements along the diameter.

The general principle of bank wiring remains the same, but a radical difference exists in the mechanical construction of the bank. To each switch is assigned a single row of line bank contacts corresponding to the 10 first selectors belonging to a particular hundred. Corresponding contacts in each bank of the hundred line switches are multipled together and terminate in these 10 first selectors.

Instead of the lines running to wipers as heretofore, they are multipled to two spring contacts occurring in each of the 10 positions of the bank row. Paralleling these and adjusted so as to connect with them readily are the trunk lines of the 10 first selectors. Forming the other half of the contacts belonging to each division of the bank row are two springs connected with the release and cut-off coils, in position to engage, respectively, [illegible] connected with the release trunk and with ground. The contacts of these banks are made to come together by means of the plunger arm finger. This finger has a [illegible] on the end engaging the bank, the other end terminating in a fan-shaped [illegible] so as to engage the master switch shaft.

[illegible] the plunger is released [illegible] in the bank, all the remaining plungers being carried to the next position. [illegible]

should they again be used before the shaft has reached the same position returning, they will reoccupy the same trunk. The shaft, as it passes from one position to another picks up, as it comes to them, all the plungers which have been released from the banks and places them again in position to engage an unoccupied trunk.

Referring to circuit of Fig. 8, an initial impulse over the rotary line passes through the springs of the cut-off coil and the trip magnet to battery. The trip magnet, energized, attracts its armature (b) and releases the plunger arm at (c), allowing the spring (s) to drive it into the bank and close the spring contacts of the bank, as here shown.

The lines from the telephone are now connected with a first selector over one of the 10 trunk lines. A circuit to ground through the cut-off relay opens the cut-off springs, leaving the rotary and vertical lines clear to the trunks. Any impulse now sent over the lines in no way affects any part of the line or master switch.

Immediately following the operation of the trip magnet, the rotation of the shaft is accomplished by the master switch. When the plunger closes the bank contacts, main battery through the release magnets is thrown upon that contact of the master-switch bank which corresponds to the trunk occupied, and upon which is resting the wiper arm of the master switch. This bank consists of 10 pairs of insulated contacts. The upper row of 10 is multipled with the corresponding release trunks, while the lower contacts are all connected to ground through the relay coil of the

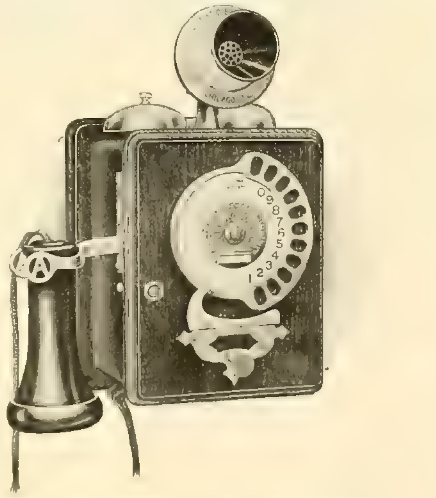


FIG. 10. AUTOMATIC WALL TELEPHONE.

master switch. This relay is a double coil of 3,000 ohms resistance, constantly energized, but wound so that the direction of the magnetic force of one winding is opposed by the other. The wiper arm merely connects the ground contact with the release trunk.

When the plunger of the line switch throws battery on this contact, through the release magnet, the circuit is closed through one winding of the differential relay to ground, while the other winding is shunted out. This allows the relay armature to pull down and throw main battery upon the circuit leading to the master-switch magnet. This magnet, through its armature, causes [illegible] to engage the shaft wheel. As the armature pulls down the circuit through the magnet

coil is broken at springs (S_3) and (S_4), allowing the armature then to fall back. The springs (S_1) and (S_2), however, have been closed by the movement of the fiber wheel, and this retains the conditions at the differential coil unchanged, even though the wiper arm has passed from its bank contact. Consequently the armature of the differential coil remains down.

When the armature of the master-switch magnet falls back, therefore, the coil again receives battery through the springs operated by it and again pulls up and drives forward the shaft wheel. This continues until spring (S_2) reaches a depression in the fiber wheel and separates from (S_1). This point then corresponds to a position of the shaft which holds the plunger directly over a bank contact and the wiper arm upon a contact free of battery. Since the trip magnet receives its battery through the springs of the master-switch coil, no switch can trip in while the master switch is operating.

The line switch is released from the first selector over the release trunk in a manner similar to that in which the first selector is released from the connector. The release armature, in pulling up, catches the plunger arm at (c) and, as it falls back after the impulse, withdraws the plunger from the banks.

It now remains only to add to the ordinary

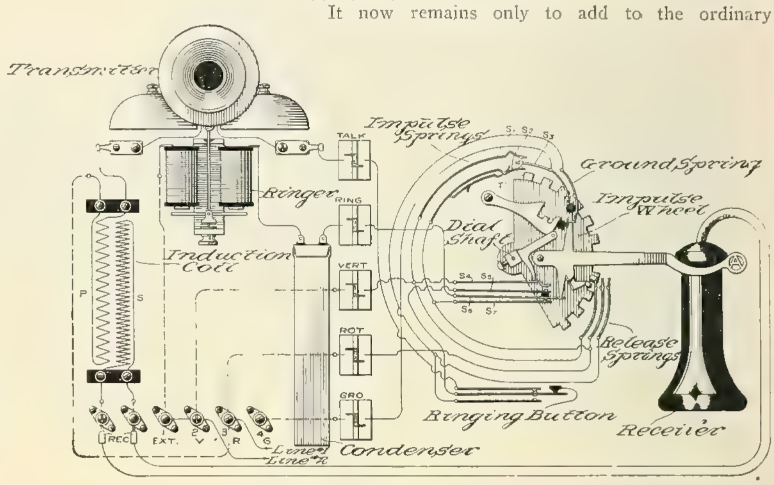


FIG. 9. DIAGRAM OF PARTS OF AUTOMATIC WALL TELEPHONE.

telephone a simple device for grounding the vertical and rotary lines in order to place the system at the command of the subscriber. Fig. 9 shows diagrammatically the interior of the wall telephone shown in perspective in Fig. 10. The dial is the only feature exterior to the telephone.

The impulse wheel consists of 11 teeth. The first 10, corresponding to the 10 finger holes in the dial, operate only the vertical. The eleventh tooth (T) grounds the rotary line once as the dial returns to rest. The subscriber concerns himself only with the vertical impulses. For instance, if he wishes to call No. 567, he puts his finger in hole 5 and, pulling the dial around until his finger encounters a stop fixed for that purpose, releases it. The dial then returns to its former position, by means of a coiled spring, at a speed regulated by a governor. While returning, five impulses are sent over the vertical line followed by one over the rotary line as the impulse teeth ground springs (S_1) and (S_2). These springs are so constructed that they are not grounded on the downward pull of the dial. The same operation is repeated for 6 and 7. After the call is completed the following impulses have been thrown on the line: Five vertical, one rotary, six vertical, one rotary, seven vertical and one rotary. In addition to these a preliminary impulse which trips in the line switch is sent over the rotary line at the first downward movement of the dial after removing the receiver from the hook.

Upon lifting the receiver from the hook and pulling the dial, which otherwise is locked, the ground spring makes contact with (S_3), against which the impulse springs are forced by the returning impulse wheel. At the same time springs (S_4) and (S_5) close, while (S_6) and (S_7) open. After completing the required number of dial movements, the subscriber presses the ringing button, opening circuit through his receiver and throwing ground on the vertical line which operates the bell of the called subscriber. Upon completion of the conversation, the receiver hook, in dropping, throws ground on both sides of the line through the release springs, thus effecting the release of all switches engaged in the call.

In other respects the telephone does not differ from the standard common-battery telephones in general use.

This completes the description of the general principle of automatic operation as employed at the present time for straight line work. There are many variations in construction and circuits to meet special demands. The adaptability of the system to meet any and every demand made upon it has yet reached no recognized limit.

The mechanism and circuit [illegible] complex, but this complication is only apparent, not real. While the successful operation of an exchange depends upon the mechanism being properly adjusted, the parts are not so interrelated that one movement is dependent upon the proper adjustment of the switch as a whole. In general the mechanical movements are successive, not simultaneous, and the result of an impulse over a simple electrical circuit. The adjustments are readily made by anyone with ability to handle a pair of pliers and a screwdriver, and no more than ordinary mechanical ability. It must not be inferred, however, that brains can be dispensed with.

With proper treatment the life of the switch is

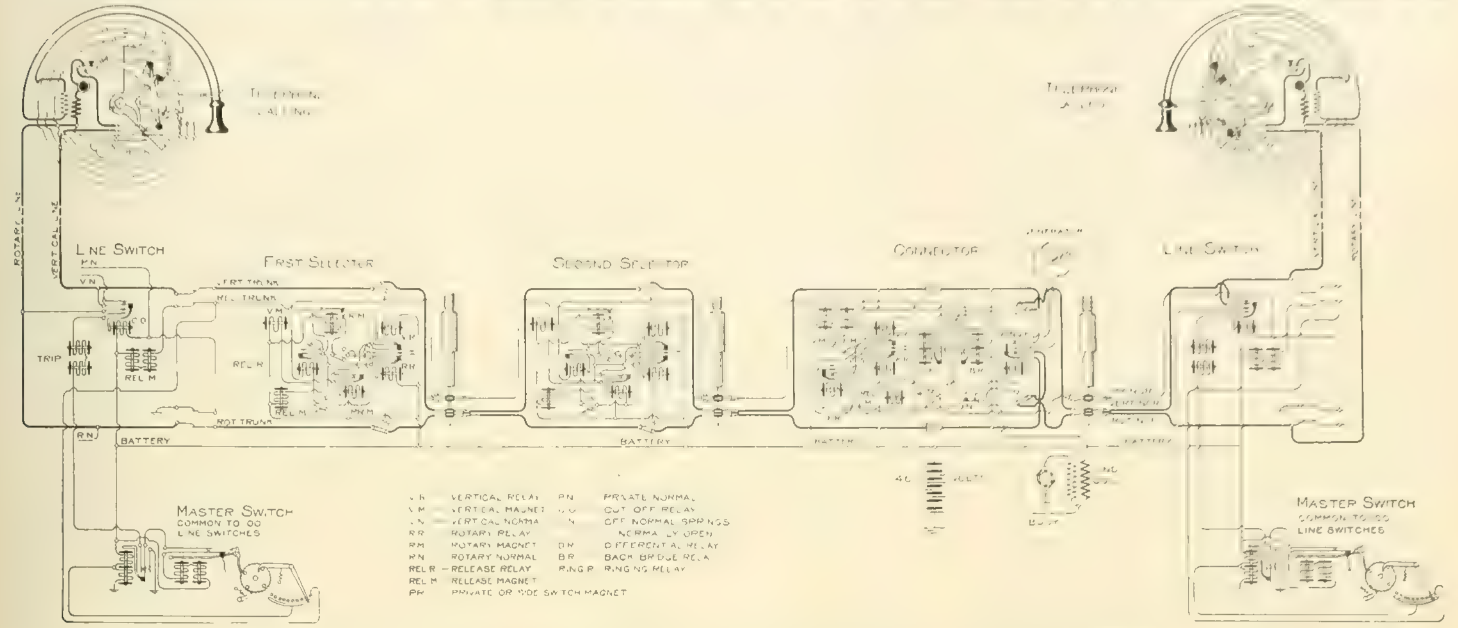


FIG. 11. CIRCUIT OF A COMPLETED CALL IN A 10,000-LINE AUTOMATIC TELEPHONE SYSTEM.

unlimited. The frame is indestructible, and any of the switch parts which become worn are readily replaced.

Fig. 11 represents, in a somewhat condensed form, the circuit of a completed call in a 10,000 system from one telephone to another through the intervening switches. The tracing of the operating and talking circuits will present no difficulty to anyone who has perused the preceding circuits. It should be noted, however, that the switches are represented in the positions that they occupy after establishing a connection, and not in their normal position.

Fig. 12 is a general view of the Omaha automatic telephone exchange.

A word may be added in regard to the trunking capacity of an exchange. While 10 per cent. of trunk lines is generally found sufficient for all the business of the average exchange, the number of

[illegible]

tiples of the new group thus formed are carried to 10 additional connectors in the 100 section, increasing its trunking capacity, thereby, to 20 per cent. The banks of these 20 connectors are, of course, multipled throughout. By this process one-half of the exchange in calling into this particular section obtains one set of 10 connectors, the other set of 10 being employed by the remainder of the exchange.

The percentage of trunk line in any case is not limited to multiples of 10. A number of exchanges are employing between 10 and 20 trunk lines in certain sections of the exchange where the demand for service is excessive. Among the number may be mentioned Chicago, with a trunking capacity of 19 per cent.

Automatic telephony has been developed so as to provide toll service, party-line service, including selective ringing, private-exchange service on the

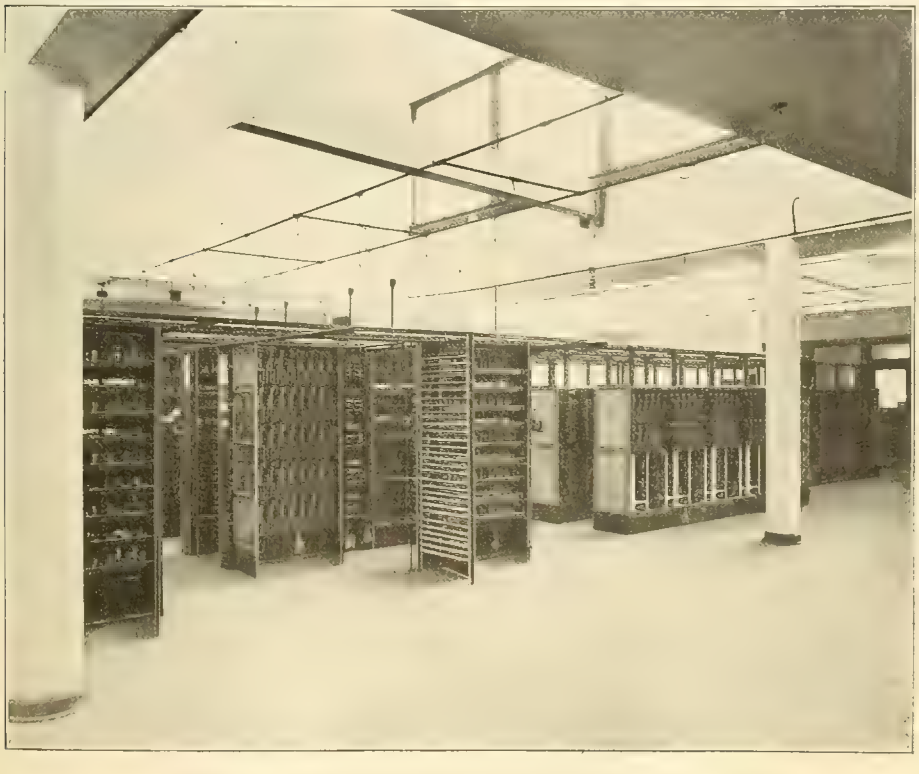


FIG. 12. GENERAL VIEW OF AUTOMATIC TELEPHONE EXCHANGE IN OMAHA.

[illegible]

Co-operative Telephony on a Large Scale.

[illegible]

state, and, according to estimates that have been made by D. J. Neill, president of the Farmers' Union, who is promoting the project, it will serve 2,000,000 subscribers. The plans for this gigantic co-operative telephone system have received the approval of the executive committee of the union and a special department of the organization will be created to direct the new enterprise. The plans contemplate the establishment of central exchanges in 240 farming counties. The remaining counties will have connection with their nearest exchange. Long-distance lines will be built to all parts of the state, and each county will have connection with these lines.

The co-operative company will have a capital stock of about $30,000,000. The shares of stock will be sold to farmers at $15 a share, and each purchaser of a share will be entitled to one year's telephone rent free. The money obtained from the sale of stock will be used to build and equip the system. It is stated that the monthly rent to be charged the farmers for their telephones will be about $2, or just enough to pay the operating and other expenses of the system. The system will be managed by a board of officers to be elected annually by the Farmers' Union. The $2 per month rental which the farmer will have to pay will also give him the privilege, it is said, of using the long-distance lines as much as he may choose.

There are already in operation in Texas more than 100 county telephone systems which are operated by local branches of the Farmers' Union. There are also a large number of precinct telephone systems which are operated by the same organization. It is proposed to consolidate all of these systems which are now established into the one general system.

It is stated that the co-operative system will be established irrespective of existing telephone systems in different parts of the state. While no attempt will be made to establish exchanges in the larger cities, a central office will be maintained in each of these places, so that the farmers can be kept advised daily, if necessary, as to market conditions. The particular object of the enterprise is to put the farmers in closer touch with the business affairs of the world. They will receive each morning in their homes the quotations for the day on cotton, wheat, corn and other products.

It is expected that if the scheme works well in Texas, the telephone system will be extended to all of the states in which the Farmers' Union has a membership sufficiently large to justify the enterprise.

J. A. Thomas, local manager of the Iowa Telephone Company at Oskaloosa, Iowa, died suddenly a few days ago, dropping dead on the doorstep of his office of heart disease. He was not feeling well and had started home when the end came. He was 55 years of age and leaves a widow and six daughters.

CORRESPONDENCE.

Continental Europe.

Paris, January 10.—During the recent Paris Automobile Show there was held a Congress of Industrial Alcohol which was of considerable interest. Efforts are now being made in France to promote the alcohol industry, and the congress was patronized by the minister of agriculture. There were two main groups of sections in the congress—first, the technical sections, and second, the economic part. The technical sections brought out a number of papers upon the use of alcohol as a motive power in explosion motors; also for lighting by means of incandescent mantles. It was said that in the future alcohol may be able to compete with gas and electric light. In the economic sections were considered the statistics, legislation, transport and customs duties. The congress passed a motion favoring the restriction of administrative formalities connected with industrial alcohol, so that its development will not be hindered by this reason, as it is at present.

The Paris Municipal Council, in connection with the different lighting companies which supply the city, has been engaged for some time past in making a new arrangement by which it expects that the light and power system will be better developed in the future. According to the new plans, it is proposed to erect two new generating stations of large size in the suburbs of town. Both of them will lie upon the Seine, one to the north and the second in the southwest suburbs, and will have side-tracks to the railroad lines. Two-phase current will be supplied at 12,300 volts on the high-tension lines. Sub-stations will lower and convert this to direct current at low voltage. There will also be transformer posts which will supply two-phase current at low tension. From the direct-current sub-stations the low-voltage lines for the subscribers will be run on the three-wire or the five-wire system, using 110 volts for the lamps, as at present. It is expected to lay at least 350 miles of wiring, in addition to what is now in use, outside of the wiring from the plants to the sub-stations or posts. Of this, it is decided to lay 60 miles before December 31, 1909, and the same amount each year up to 1912. The remainder will be laid before 1920, at periods which the Municipal Council is to fix. The circuits will run especially in the quarters of town which are not yet provided with current. As to the construction of the new electric plants, the programme will be determined as to boilers, engines and dynamos, by the Prefect of the Seine, upon consultation with the controlling commission and the electric-lighting companies interested.

In Berlin is to be seen a trial section of a proposed aerial or hanging electric overhead system which is to run through the streets. On this system there is a narrow iron structure erected in the center of the avenues, and it carries a platform structure laid across the top. From the ends of the platform are hung the trains, which are suspended from the rail. The structure takes up much less room than an ordinary elevated road, at least as regards the street traffic. It is constructed by a German firm known as the Schwebebahn Company, and the trial section will give an idea of the final structure. Should it be well received by the public, the Municipal Council will no doubt give a favorable decision as to granting the concession for a network of lines through the main streets. The present sample section, which is of short length, is located in the Brunnenstrasse, which has a considerable width.

At Roslaeu, Norway, it is proposed to build an electric plant of a somewhat novel kind, for it is to use peat as a fuel, and, moreover, it will be placed at the source of supply, so as to avoid transportation. The peat will be burned in producers, and the gas will supply a number of gas engines and alternator groups in the station. In this way a cheap source of current can be had. Pole lines will run from the plant throughout the surrounding country for supplying current to towns and villages.

I regret to record the recent death of Prof. A. Sella, professor of physics at the Rome University. His work was better known to scientists than to engineers, as it related mainly to the propagation of light in magnetic crystals, the influence of mechanical strain upon magnetism, X-rays, induced radio-activity, etc. A. DE. C.

Great Britain.

[illegible] electrically driven omnibuses upon the streets of London has enabled a solution of what has always been a [illegible] and manager, viz., the efficient lighting of such vehicles. A con- [illegible] of lighting since motor omnibuses have increased in number during recent years, but the sight of [illegible] it to be far and away superior and equal in all [illegible] this, the directors of the Electrobus company re- [illegible] lamp for lighting the roof. These experiments were carried on for several nights, but have been temporarily discontinued pending the sanction of the apparatus by the police authorities.

I have already mentioned that at the Franco-British Exhibition, which will be held in London from May till October this year, the gas companies will stage a collective exhibit testifying to the use of gas for all purposes—lighting, heating and cooking. Having got wind of the idea, the electric supply companies of London wished to promote a counter attraction in the shape of a similar electrical exhibit. It is pleasing to be able to record that if any indifference to the idea of a collective exhibit ever existed it has now been overcome, for a large number of electrical manufacturing and contracting firms have signified their willingness to co-operate.

A new form of ear for trolley-wire suspension has been developed by the tramway manager at Burton-on-Trent, which is being used on a large number of tramway systems here. The apparatus consists of two ears instead of the one now used. Two eight-inch ears are employed, the tips of each being five feet away on either side from the center of the suspension and the trolley wire is soldered to them as usual. The two ears, however, are joined together by a suspension wire which passes over a grooved insulator attached to the bracket pole. Experiments with the new suspension have shown that the blow on the wire as the trolley passes is greatly reduced, while the downward pull of the trolley wire is transferred from the ear to the insulator.

The indictment of the consulting engineer to the Oxford corporation in respect of the efficiency of the working of the Dolter surface-contact system is somewhat more sweeping than appeared at first sight. It states that a system which requires upon a level road 25 per cent. more current than the average electric railway, besides the services of a patrol numbering four men to the mile for the purpose of locating and dealing with live studs, cannot be deemed satisfactory. The company's side of the question has yet to be heard. G.

Dominion of Canada.

Ottawa, January 18.—The Shawinigan Water and Power Company, Montreal, has just closed a year of remarkable progress. The gross earnings for 11 months of the year amount to $531,362, which is $174,215 more than the company took in during the full 12 months of the year previous. The company is now developing 60,000 horsepower.

A new era was marked this week in local railroad circles when the Grand Trunk Railway, for the first time, turned on the current necessary for the overhead conducting system in the Sarnia Tunnel. The action was taken for experimental purposes and the electric system will not be used until some time next month. A training school was established in the Grand Trunk yards at Sarnia during the week and one of the new locomotives will be used for experimental purposes until the engineers have learned to master electric methods. W.

Winnipeg, January 18.—By a large majority the ratepayers of Prince Albert, Saskatchewan, voted in favor of spending $50,000 on improvements to the electric-light and waterworks systems. A. F. Creighton is the city engineer.

The City Council of Fort William, Ontario, has offered the twin city of Port Arthur $75,000 for the electric car lines within the city limits and half the rolling stock. If the offer is accepted, power will be obtained from the coal docks.

The Alberta government's telephone line between Nanton and Brant is now in operation. Plans are being prepared for a number of additional long-distance lines within the province.

The Van Bergh Electrical and Manufacturing Company has been incorporated at Winnipeg, Manitoba, with a capital of $250,000.

During the coming summer the town of Revelstoke, British Columbia, will install a 400-horsepower gas engine and a suitable gas-producer plant; also a 150-kilowatt dynamo for supplying electrical energy. C. H. B. Topp is city engineer.

The Winnipeg Electric Street Railroad Company has issued its annual report of receipts. The city receives 5 per cent. of the gross earnings, and in addition the company pays $20 tax on each car. For the last year the car tax will amount to about $3,000. The earnings of the company during 1907 were $861,857, showing a large increase.

The Bell telephone system in Manitoba has passed into the control of the provincial government, the transfer taking place at midnight, January 15th. The system will be managed by a commission consisting of F. C. Patterson, W. H. Hayes and H. J. Horan, three former Bell officials. R.

New England.

Boston, January 18.—The Railroad Commissioners of the state of Maine have submitted their annual report, from which it appears that the gross income last year from trolley roads in Maine was $2,214,269, an increase of $113,637, and the operating expenses were $1,382,189, an increase of $75,805, the increase of income over the increase of operating expenses being $37,832. The street railways gave employment to 213 more persons and paid out increased wages to the amount of $67,601 compared with the preceding year.

The drift of sentiment in favor of making Arthur A. Noyes, now acting president of the Massachusetts Institute of Technology, the actual president was strongly evinced at last week's annual dinner of the Tech. Alumni Association in this city, attended by upward of 300 members of the organization. Dr. Noyes devoted his after-dinner address to the advantages of the elective system, his topic being "Education in Engineering and Applied Science at the Massachusetts Institute of Technology."

The hearings before the Massachusetts Highway Commission on petitions submitted by subscribers to the service of the New England Telephone and Telegraph Company, asking the commission to order a reduction in rates in Boston of practically 11.5 per cent., brought out a rejoinder from the company relative to the system by which rates are determined. Hon. Samuel L. Powers, counsel for the telephone company, argued that it would be a short-sighted policy for the company to restrict its income in a large city to the cost of maintaining the service in the limited district comprised therein. If that policy were followed to its logical conclusion it would nearly cut off that district from more remote sections. The rates to such places would be almost prohibitive and arrest development of the service. If Boston people wish communication with other communities in New England they must help to pay for the system as a whole which makes such communication possible. Apropos of comparisons made with conditions in Chicago, from which it was asserted that rates in a large city may be lower than they are in Boston, Mr. Powers rejoined that those rates are ruinous, no dividend having been paid since they were established a few months ago, and nobody knowing whether it will be possible to pay any. B.

New York.

New York city, January 18.—It is announced that all the electric-lighting companies of this city are to be investigated by the Public Service Commission. In addition to the investigation into the franchises, property and operations of the companies, inquiry will be made into the methods employed by the companies with respect to discrimination in rates, and whether such discrimination is unjust. Other phases of the inquiry will be whether contracts are required of customers as a condition to service, and, if so, their nature, and whether legal and reasonable; emergency service and auxiliary or supplemental service; regulations governing the introduction of wires upon the premises of customers and others, including the cost and charges therefor; regulations governing the discontinuance of service and also the price charged for electricity and any regulations governing the same; the kind, condition and accuracy of meters used; the condition of the currents, wires, conduits and services and the methods employed in generating and supplying electricity and in the transaction of their business. The inquiry will not extend to the organization and capitalization of the companies or into the cost of the manufacture and distribution of electricity. Commissioner Maltbie was designated to conduct the investigation. He has not yet fixed the time for the first hearing.

The New York Edison Company has voluntarily decided to make a new schedule of charges for "breakdown" or emergency service for those who have private electric plants for light, heat and power. The company has been accused of refusing to supply breakdown service to those who ran private plants. Under this voluntary action it will supply such service at rates stipulated in the schedules filed. The company reserves the right, however, to charge more for such breakdown current than it does for current to its regular customers.

The first annual meeting of the Morse Electric Club was held on January 8th. The officers elected last year were again chosen. These are: President, J. B. Van Every; vice-presidents, J. C. Barclay and B. Brooks; secretary, F. J. Scherrer; treasurer, R. J. Murphy; Gardner Irving and M. H. Kerner, whose initial term as directors had expired, were re-elected for a period of three years. The directors constituting the remainder of the board are John A. Hill and P. J. Casey, whose terms will expire in 1909, and M. J. O'Leary and A. G. Saylor, who have each two years longer to serve. It was decided to hold a dinner on the evening of February 29th.

The appointment of receivers for the New York City and Metropolitan Street Railway companies has been sustained by the Supreme Court of the United States. All the steps taken by Judge Lacombe were fully endorsed. The decision was handed down by Justice Peckham. In his opinion Justice Peckham said: "We can find no evidence of collusion. The objection to the order permitting the Metropolitan Railway Company to inter-

vene is not of a jurisdictional nature and the granting of the order was within the discretion of the court. Having jurisdiction over the New York City Railway Company and receivers having been appointed for it there was every reason for permitting the intervention of the Metropolitan Railway Company. The facts showed that it was so tied up with the New York City Railway Company that a receivership for the latter ought to be extended to the former."

After hearing New York lawyers acting for the new board of directors of the Yonkers Railroad Company and of the Westchester Electric Railway Company, which operates in Mount Vernon, Supreme Court Justice Mills yesterday consented to appoint receivers for the two roads. At the same time Justice Mills signed an order to show cause why a receiver should not be appointed for the Tarrytown, White Plains and Mamaroneck Railroad Company. The order is returnable on January 21st. It was suggested that the same receiver be appointed for this company as for the Westchester Electric Railway Company. If a receiver should be named for the Tarrytown, White Plains and Mamaroneck Railroad Company every line operated by the Union Railway Company in Westchester County will be in the hands of receivers.

A public hearing on rapid-transit problems was held by the Public Service Commission yesterday. The meeting was attended by official representatives from all the boroughs and by delegations from prominent civic organizations. Chairman Willcox presided. After the meeting it was asserted by a man who knows much of the inside workings of the plan to liberalize the present law, according to the New York Press, that the amendment finally proposed and accepted by the Legislature would provide for an indeterminate franchise for future subways with a fixed minimum. Thus the law might fix the minimum at 20 or 40 years, and after that time the city might take over the subway or other rapid-transit line at a fair price. The city need not necessarily avail itself of that right when the 20 or 40 years had expired, but might do so at any time thereafter when it felt so disposed. The amendments also would provide for the revaluation of the franchise at stated periods. This plan to solve the problem was not announced officially in any sense, but the source whence it was announced indicated that it practically had been decided to submit it to the Legislature. W.

Southeastern States.

Charlotte, N. C., January 18.—The first test of the new power plant at Buckhorn Falls, on the Cape Fear River, 10 miles from Fayetteville, N. C., was made on January 1st, and showed that the work had been most successful, and that the plant was in perfect running order.

The Whitney Company, which is expending several million dollars in developing an electric waterpower on the Yadkin River, near Salisbury, N. C., will build a distributing station in Albemarle, N. C., 15 miles distant, and will probably close contracts for power for the several cotton mills in the town. The surveying of the route for transmission lines will be made at once, and the company is expecting to be ready to turn on the current by July 1st, with a guarantee to have the current available by September 1st.

The Shelby Electric Light and Power Company has been chartered at Shelby, N. C., with a $50,000 capital, and the privilege of beginning business with $14,000. J. J. McMurray and others are the incorporators.

A bill has been presented in the Virginia Legislature to permit the town of Manchester, Va., to enlarge its electric-light plant and sell electricity to citizens at rates agreed upon.

The town of Spartanburg, S. C., has granted a request of the Electric Manufacturing and Power Company to use the streets. The company reserves 500 horsepower for the city for three years, while the city may contract for lights for 10 years. The power will be brought into the city over wires running to the new plant on Broad River, built by Pittsburg capitalists, the available horsepower being 3,500.

It has been given out that the work on the hydro-electric development near Rockingham, N. C., on the Pee Dee River, will not be embarrassed in anywise by the recent financial troubles of the New York banking house which was aiding in the financial end of the development, but that work will be pushed to completion with as little delay as possible. Hugh McRae of Wilmington, N. C., is interested in the work.

A large amount of money is being spent at Hale's Bar, on the Tennessee River, by the Tennessee River Power Company. W. J. Oliver has had charge of a large portion of the construction work at the locks and dam, in East Tennessee. Anthony Brady of New York is interested in the work.

Power from the plant of the Southern Power Company at Great Falls, S. C., 104 miles distant, has been turned on in the town of Statesville, N. C., where contracts have been made for furnishing light and power. The local interests of the company will be in charge of D. J. Cochrane.

According to a report [illegible] and [illegible] have purchased a waterpower 2 miles from Columbia, S. C., on Broad River, and are acquiring water rights along the river looking toward the development of a hydro-electric plant to furnish additional power to the city of Columbia. L.

Indiana.

Indianapolis, January 18.—The traction service between Indianapolis and Terre Haute, by way of Brazil and Greencastle, a distance of 73 miles, was begun this week. By making connection with the Paris (Ill.) line at Terre Haute the traction service of central and eastern Indiana, which has been connected with Ohio lines for some time, made connection with Illinois for the first time. There is a gap between Paris and the terminal of the McKinley line south from Danville which, if filled in, would complete the route across Illinois by way of Danville, thus linking three states. Freight service between Paris and Terre Haute has been begun.

With a view of guarding more closely the lives of the traveling public the Indiana Railroad Commission has sent out a circular to the managers, superintendents and dispatchers of all traction and interurban railroad companies in the state. The circular directs the traction and interurban men to meet with the commission on February 10th for the purpose of conferring on the rules now employed by such companies and the methods used in operating their lines. The purpose of the conference is to agree on some set of rules which may be complied with by all the employes of the traction and interurban companies.

The Hydro-electric Company, which proposes to dam White River at Decker to furnish power to generate electricity, in case it is granted a franchise to bring electricity into Vincennes, will bury all its wires in conduits, furnish free lights for all of the city buildings and public schools, begin work within six months and have all work done on or before the first day of January, 1910. Eugene Rush is at the head of the Hydro-electric company. He says he can get 75,000 horsepower with the use of a dam at Decker and produce enough electricity for all of the towns in the surrounding country, Evansville and Terre Haute included. S. S.

Illinois.

Peoria, January 18.—A "bug" in a cable belonging to the Postal company in Springfield has been repaired. The trouble was caused by a bullet which was found badly flattened and imbedded in the cable. C. L. Bennett of Chicago came down and located the fault which had been giving the company trouble for about 60 days.

The work of grading the Sangamon Valley electric railway between Hillsboro and Butler has been commenced. It is expected that the line will be in operation in the early part of the spring.

A party from Decatur consisting of the mayor and several aldermen visited the city of Springfield last week to inspect the municipal lighting plant there. The plant at Decatur is not large enough to care for the increasing load, and the visitors inspected the new arc lights that the Springfield company has in operation on a test. The Decatur men were much pleased with the lighting system and will recommend that several changes be made in the plant at Decatur.

The park board of this city has installed an electric pumping plant to furnish water for sprinkling the drives and also to serve individuals that the Peoria Water Company cannot reach. The well and the pumping plant are located near the Illinois River, and the water is pumped up to a tank on the bluff that is nearly 400 feet above the plant. The arrangement is automatic and the pump is controlled by a float in the 10,000-gallon tank which starts and stops the motor driving the pump.

Directors of the Central Traction Company have been indicted, charged with criminal negligence as the cause of the disaster and manslaughter as the result of the fatal wreck that occurred on the line between Mattoon and Charleston last August in which 18 persons were killed and 52 hurt. The company distributed $41,000 among the victims of the wreck to satisfy them, but the grand jury has reindicted the directors and the superintendent and two motormen. V. N.

Pacific Slope.

San Francisco, January 15.—The Mutual Electric Company's power station on the corner of Spear and Folsom streets has been enlarged by the erection of an annex adjoining the main building on the east. Additional oil-burning Babcock & Wilcox water-tube boilers and auxiliaries were installed in the new building to take care of the additional 1,200-kilowatt direct-current unit which was recently placed in commission. The Mutual plant now contains three direct-connected units having a combined capacity of more than 5,000 kilowatts.

The damage to the steam line in the main power station of the San Francisco Gas and Electric Company in the Potrero district last week by the fall[illegible] have been [illegible].

The Ocean Shore [illegible] building an electric [illegible] Cruz, has decided [illegible] ing to dispose of [illegible] those who are [illegible] cessful completion of the road. [illegible] cordingly being [illegible] are being advertised for public subscription in San Francisco and in the smaller towns along the line of the road. The sales thus far have been encouraging.

The city attorney of Alameda, Cal., has been instructed to prepare for issue municipal bonds to the amount of $305,000 recently voted. These will be used in part for the [illegible] building for the municipal electric-light plant and in part for other purposes.

Proposals are now being received by the commissioner of public works at Tacoma, Wash., for a 6,000,000-gallon turbine pump, together with a motor, switchboard, switchboard appliances, wiring, etc., for use in the installation.

The owners of the Humboldt Gas and Electric Company and of the Eureka Lighting Company, both of which operate in Eureka, Cal., met in this city a few days ago and completed the transfer of the latter company to the former. This move consolidates all the electric enterprises on Humboldt Bay in the hands of the owners of the North Mountain Power Company, which is constructing a large hydro-electric plant near Eureka. The plants operated in Eureka under the name of the Humboldt Gas and Electric Company are to be extensively improved during the present year.

An investigation of the San Francisco department of electricity, made this week, showed that, owing to the shortage of inspectors, 3,229 buildings with interior electric installation are using the installations without the proper examinations having been made. In order to remedy the matter five additional inspectors were authorized.

President Anderson of the Board of Public Works of Los Angeles has completed a tour of inspection of the proposed power line which is to connect the Edison Electric Company's transmission line with the Elizabeth Lake tunnel. He says that the machinery is now being installed at the power plant on Cottonwood Creek, which will furnish power for dredging Owens River. It is expected that this plant will be ready by May 1st. A.

PERSONAL.

Vice-president E. F. Kirkpatrick of B. S. Barnard & Co. has recovered from quite a serious attack of illness.

Colonel R. E. Crompton, well known in the United States, has been elected president of the British Institution of Electrical Engineers, to succeed the late Lord Kelvin.

Mr. W. P. Bailey, assistant auditor of the Terre Haute, Indianapolis and Eastern Traction Company, has resigned to become superintendent of the Michigan City and La Porte street and interurban railway systems.

Mr. Dudley Farrand of Newark, N. J., general manager of the United Electric Company of New Jersey and president of the National Electric Light Association, was one of the visitors at the Chicago Electrical Show last week.

Mrs. Lydia K. Bradley of Peoria died on January 16th at the advanced age of 92. She was a very wealthy woman, known for her philanthropy. Several years ago she endowed the Bradley Polytechnic Institute of Peoria, affiliated with the University of Chicago.

Mr. Arthur Williams of New York has accepted the chairmanship of the committee on public policy of the National Electric Light Association. Mr. W. H. Gardiner, 60 Wall Street, New York, will continue to act as secretary of the committee.

The plan to put Mr. William Loeb, Jr., at the head of the Washington (D. C.) Railway and Electric Company is said to be assured of realization as the result of the company's election of January 18th. Mr. Loeb said a few days ago that he might remain in his present position as secretary to President Roosevelt until after the fall campaign.

Mr. George Moraine, who has been general superintendent of the Ben Hur Interurban Company since it was first put into operation, with headquarters in Crawfordsville, Ind., has handed in his resignation, to take effect February 1st. Mr. Moraine will be succeeded by Mr. A. H. Stocking, who has been connected with the Electric Installation Company of Chicago, which built the road. It is understood that Mr. Moraine will leave soon to engage in the electrical business on the Pacific Coast.

A dinner was given by the American Museum of Safety Devices and Industrial Hygiene at the Aldine Club in New York on Ja[illegible]

[illegible] decorations bestowed by the French [illegible] Charles Kirchhoff, editor of the [illegible] Age, [illegible] Commerford Martin, editor of the Electrical World, and Rev. Percy Stickney Grant, rector of the Church of the Ascension. All three of the gentlemen named are members of the board of the organization giving the dinner. Elbert H. Gary, chairman of the executive committee of the United States Steel Corporation, presided, and among the speakers was Frank J. Sprague, past-president of the American Institute of Electrical Engineers. Mr. Sprague was the eulogist of Mr. Martin, and among other things he said that the latter gentleman's greatest distinction was "the knowledge that he stands enshrined in the hearts and affections of his electrical comrades."

ELECTRIC LIGHTING.

The taxpayers of Port Hope, Ontario, have adopted a by-law enabling the town to proceed with the construction of a municipal electric-lighting system.

By the reported sale of the Pawtucket Electric Company and the Pawtucket Gas Company to a syndicate composed of interests which recently purchased the Woonsocket Electric Machine and Power Company and the Woonsocket Gas Company, the lighting companies, both gas and electricity, for the entire northern part of Rhode Island will be under one head. The new syndicate includes Stone & Webster of Boston.

The Fort Scott Gas and Electric Company, which owns four public utilities in Fort Scott, Kan., reports a large increase of business for 1907. The extensive improvements begun during the year will be continued in 1908. During the last year the electric department was improved by the addition of new cables and line improvement and the heating department was extended. In the street-railway department the track and trolley construction were greatly improved. During the year the company moved into its new offices and supply house, said to be one of the best buildings for the purpose in the West. It is the intention to install a modern electric-light system to supply 10,000 lights in the residence district.

SOCIETIES AND SCHOOLS.

The Ohio Electric Light Association will hold its annual meeting in August. A preliminary meeting of the executive committee will soon be held in Columbus to make arrangements and determine on the location. F. M. Tait of Dayton is president of the association.

The annual meeting of the New England Section of the Illuminating Engineering Society was held on January 14th in the Edison Building in Boston. These officers were elected: President, John S. Codman; secretary, R. C. Ware; managers, William H. Blood and Theodore H. Piser.

At the meeting of the Chicago Section, Illuminating Engineering Society, on January 17th, at the Coliseum, the following-named were elected officers for the present year: Chairman, J. R. Cravath; secretary, Geo. H. Jones; managers, H. Von Holst and Fred. J. Pearson. The retiring chairman, Geo. C. Keech, reported the section in a flourishing condition.

A meeting of the Chicago branch of the American Institute of Electrical Engineers was held in the rooms of the Western Society of Engineers on the evening of January 21st. Mr. Bernard C. Groh, formerly conduit engineer with the American Telephone and Telegraph Company, read a paper on "Electrical Subway Construction," particularly relating to telephone subways. H. R. King presided.

Mr. Edward P. Burch, electric-railway engineer, is giving a course of lectures to the senior electrical engineering students at the University of Minnesota on "Electric Traction for Heavy Railway Service." These lectures supplement the regular course in electric railways by Professor Springer and include the following subjects: "Introduction," "Advantages of Electric Traction," "Characteristics of Steam Locomotives," "Characteristics of Electric Locomotives," "Problems of Electrification," "Load Factor," "Cost of Steam and Water-power," "Power Plants and Transmission Lines," "Plans of Complete Electrification," "Data Sheets."

PUBLICATIONS.

[illegible] Instrument Company of Newark, N. J., issues circulars describing its new alternating-current switchboard instruments and its [illegible] Both [illegible] the Western Electrician [illegible]

[illegible] the Standard Elec[illegible] Broadway, New [illegible] Western Electrician [illegible] the plat[illegible]

The Ohio Brass Company of Mansfield, Ohio, is distributing a new booklet relating to types B and C Collin pressure-regulating valves for steam. The pamphlet is effectively illustrated and clearly printed, with a gold-embossed cover. The pressure-regulating valve reduces the boiler pressure to any pressure required. The Collin valve is said to be simple and reliable.

One of the handsomest calendars of the year is that issued by President Frank W. Boyer of the Chicago Mica Company, Valparaiso, Ind. This souvenir is a very dainty reproduction of a painting of a beautiful sunlit seashore scene. The calendar portion is interchangeable and covers the entire year. A handsome gilt frame in connection with the picture carries the calendar portion of the souvenir.

Electric welding machines are made by the Warren Electric Manufacturing Company of Sandusky, Ohio, and Bulletin No. 32 illustrates and describes them. The machines are built in sizes and styles to suit the various classes of work. In writing for prices or information it will assist greatly if full details of size and shape and kind of material it is desired to weld are fully specified; also the quantity it is desired to weld per lot or per day. A sketch of any irregular shape giving full dimensions will also be helpful. These machines are sold outright without royalty, rental or restrictions.

Allis-Chalmers Company will send to anyone interested a copy of its bulletin, entitled "Polyphase Induction Motors." The induction motor is very simple in construction and without moving contacts of any kind, insuring freedom from sparking, flashing or burning, which is essential in plants where combustible material is at hand. The voltage in the rotating part is so low that insulation breakdowns do not occur. Allis-Chalmers Company manufactures induction motors of two types, designated as AN and AN(Y). Type AN motors have a rotor with "squirrel-cage" winding and are suitable for all classes of constant-speed service. Type AN(Y) induction motors are provided with a wound rotor adapted to the insertion of resistance at starting or for obtaining variable speed.

Two new bulletins of the General Electric Company, Schenectady, N. Y., relate to "Series Luminous Arc Rectifier System" and "K-34, K-35 and K-36 Controllers." The series luminous arc rectifier system permits the operation of direct-current luminous arc lamps from alternating-current central stations at high economy and with extreme simplicity. The General Electric luminous arc lamp and the auxiliary apparatus, consisting of oil-cooled rectifier tube, constant-current transformers and switchboard panels, with the necessary control apparatus, reactance coils, etc., are described and their operation explained. In the controller bulletin a new line of cylinder controllers, with improved magnetic blowouts, which can be used on systems on which the voltage peaks reach 750 volts, is described. The K-34 controller is suitable for use with either two 150-horsepower or four 75-horsepower motors, the K-35 with either two 100-horsepower or four 50-horsepower, and the K-36 with two motors only, each of 60 horsepower or less.

TRADE NEWS.

Copper is reported slightly higher. On January 20th Lake was about 14 cents a pound and electrolytic a shade lower.

Charles F. Boxter, clerk of Knightstown, Ind., announces that the city is in the market for condensers, generators and steam turbine for the improvement of the municipal light plant.

G. M. Gest, the well-known engineer and contractor of New York and Cincinnati, was represented at the Electrical Show by W. T. Jackson. Mr. Gest's western business has increased to such an extent that he finds it necessary to open a Chicago office.

The manufacturing zone of Chicago embraces about 1,000 square miles, according to W. H. Manss, manager of the industrial department of the Chicago Association of Commerce, who has just finished a map of the zone. The zone extends about 45 miles north from Chicago's center, 40 miles west, 33 miles south, and 30 miles east, describing a part of a circle. The outer curve of the zone is drawn through Libertyville, Elgin, Aurora, Joliet, and thence east to a point five miles south of South Chicago, from which place it extends one mile east of Gary, Ind.

The time for depositing stock of the Western Electric Company under the recent offer made by the American Telephone and Telegraph Company, and recently set forth in the Western Electrician, expired on January 20th. The American company at present owns $9,000,000 of the $15,000,000 of Western Electric stock. The other $6,000,000 has been largely held in and around Chicago. It was this $6,000,000 that the American Telephone Company [illegible] and offered in exchange $250 in its 4 per cent. convertible bonds for every [illegible] Western Electric [illegible] an alternative offered $225 in cash. It is said that a little less than $3,000,000 of the company's stock was deposited under this offer. It is presumed that if within a reasonable time a stockholder still wishes to accept the offer he may be accommodated.

The Excello Arc Lamp Company has opened a depot in the Electrical Building, 116-132 West Jackson Boulevard, Chicago, for the convenience of the western trade. Mr. George W. Armstrong, who has been the western traveling representative of the company for the last two years, will be in charge of this branch, and will carry in stock at all times, for rush orders, a supply of lamps, carbons, globes and all other accessories and parts.

The Lord Electric Company of New York has taken over all rights in patents granted (or pending) to W. P. Cosper, covering controller regulators. Mr. Cosper has been given the agency for the central western territory, making his headquarters at Chicago instead of being located at New York as originally announced. Mr. Cosper's controller regulators are said to cover all the desirable features of a regulator designed to control positively the acceleration of motors. The Lord company has also concluded arrangements with Charles I. Earll for the manufacture and sale of his trolley retriever and catcher. This article is an ingenious contrivance, strong and durable, easy of access and free from complications.

Users of insulated wire will be interested to know that the Diamond Rubber Company of Akron, Ohio, has organized an insulated wire and cable department and is now energetically preparing to enter the rubber-covered-wire market. George H. Porter has been appointed general sales agent for this new branch of the Diamond Rubber Company's business. The importance of this move to the trade will be appreciated when it is understood that the Diamond Rubber Company is the second largest rubber manufacturer in the world. Mr. Porter is well known in the electrical business, particularly in the West through his ten and one-half years' connection with the Electric Appliance Company, Chicago. Mr. Porter had charge of the Appliance company's Columbus office. While the Diamond Rubber Company is as yet purposely withholding details relative to its proposed energetic campaign for the introduction of its new rubber-covered wire on an extensive scale, it may be said that the new product will be sold under the name "Diamond Grey." It is understood further that the company will establish branch offices from which this wire will be handled first, and these will be in connection with the Diamond company's regular offices. W. B. Miller, secretary of the Diamond company, is devoting much of his attention to the development of this new branch of the Diamond company's business. Mr. Miller's headquarters are at the Akron works.

BUSINESS.

One of the most energetic publicity men at the Electrical Show was George Loring of the engineering department of the National Electric Lamp Association. Mr. Loring was indefatigable in his efforts in behalf of his company.

The Weber Gas Engine Company of Kansas City says that it is the only concern in America which concentrates its entire energy, ability and talent to building complete gas power plants. It issues a brochure giving much interesting information.

The Benjamin Electric Manufacturing Company of Chicago has received notice from the National Underwriters' Laboratory, in a letter dated January 20th, that the new Benjamin separable wireless cluster exhibited at the electrical show and recently illustrated and described in the Western Electrician, has been approved. It is therefore National Electrical Code standard.

During the last year the International Electric Meter Company's business has grown to an extent that it has forced President William W. Cheney to commence negotiations for larger and more satisfactory quarters, to be located on the West Side in Chicago. The new International catalogue, illustrated with 50 or more illustrations, was distributed at the Electrical Show, and is now being mailed by the company.

Taking advantage of the Electrical Show, President F. W. Boyer of the Chicago Mica Company of Valparaiso, Ind., issued a call to his department managers for their yearly meeting. Mr. Boyer made his headquarters at the Auditorium Annex, Chicago, and the mornings were spent in business conferences and the afternoons and evenings in entertainment and visiting the Electrical Show. On January 16th Mr. Boyer entertained at luncheon E. H. Heilstedt, treasurer and works manager at Valparaiso; the company's Cleveland agent, O. A. Foote of the Foote-Howard Company, and T. C. White, manufacturer of railway supplies and the company's St. Louis agent. After the luncheon at the Annex the party was taken for a spin through the parks to the South Shore Country Club, where further entertainment was provided. Later in the afternoon the party was taken by Mr. Boyer to the

Coliseum, where the [illegible] and a halt until dinner, after which [illegible] not leave for home [illegible] theater. Relative to the [illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

[illegible] United States Patent [illegible]

876,320. Automatic Electrical Rotary Starter. Anthony J. Burns, Oswego, N. Y. Application filed March 15, 1907.

A three-phase motor starter [illegible] switch provided with knife blades [illegible] no-voltage release. The latter acts [illegible] running position and the [illegible] return the switch to starting position.

876,330. Process of Making Incandescent-lamp Filaments. Walter G. Clark, New York, N. Y., assignor to the Parker-Clark Electric Company, New York, N. Y. Application filed October 4, 1906.

This process consists in heating [illegible] a current through it in the presence of [illegible] pound containing carbon, a volatile compound containing silicon and chlorine, and also in the presence of heated mercury vapor, whereby the latter absorbs the chlorine freed by the decomposition of the silicon compound.

876,331. Process of Making Electric-lamp Filaments. Walter G. Clark and Herschel C. Parker, New York, N. Y., assignors to the Parker-Clark Electric Company, New York, N. Y. Application filed November 30, 1906.

In this process of making filaments an electric current is passed through the filament in an atmosphere containing a silicon compound, marsh gas, [illegible] and carbon dioxide.

876,332. Process of Making Incandescent-lamp Filaments. Walter G. Clark, New York, N. Y., assignor to the Parker-Clark Electric Company, New York, N. Y. Application filed January 14, 1907.

This is a modification of No. 876,330.

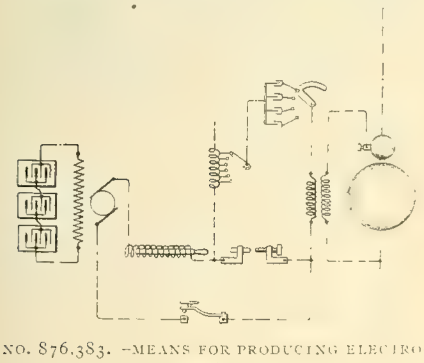
876,346. Process of Precipitating Metals. John E. Greenawalt, Denver, Colo. Application filed April 3, 1905.

Gold and silver are precipitated from their solutions by passing the solutions around and among metallic surfaces which are slightly soluble therein and constituting the cathode element of an electrolytic cell, and applying an electric current to precipitate the gold and silver and also simultaneously reprecipitate the cathode element which has passed into solution.

876,349. Stop motion. Dallas B. Hathaway, Moosup, Conn., assignor to the Whitin Machine Works, Whitinsville, Mass. Application filed January 31, 1907.

In a combing machine there is in combination with the sliver pan movably mounted in electrical connection with the machine frame, a sliver apron, an insulated contact finger carried thereby and a stop-motion circuit having its poles connected respectively with the frame and finger.

876,383. Means for Producing Electromagnetic Waves. Joseph Murgas, Wilkes-Barre, Pa. Application filed January 4, 1905. Renewed November 26, 1907.



NO. 876,383.—MEANS FOR PRODUCING ELECTROMAGNETIC WAVES.

An adjustable condenser and an adjustable inductance are connected in series with the primary of a transformer across a spark gap. The secondary of the transformer is connected across a second spark gap with which is associated an antenna. A direct-current generator, adjustable inductance and a key are connected across the first spark gap. (See cut.)

876,384. Automatic Fire Alarm. Samuel Murray, Dublin, Ontario, Canada. Application filed April 20, 1907.

A compound metal band is fixed at one end and connected to a lever at the other, which extends to a cam. When the band bends under heat the cam is brought into contact with an adjustable contact piece and thus closes an alarm circuit.

876,387. Brake-setting Apparatus for Railways. John J. McNamee, Norwood, Ohio. Application filed August 5, 1907.

The locomotive carries a battery and an electromagnet whose armature can release the air-brake valve. The circuit of the battery and magnet terminates in a contact on the fender and one on the wheels. A contact adjoining the track is connected to the latter through a switch, which, when closed, completes the circuit and thus applies the brakes.

876,390. Incandescent Electric Lamp. Herschel C. Parker and Walter G. Clark, New York, N. Y., [illegible] to the Parker-Clark Electric Company, Jersey City, N. J. Application filed January 14, 1906.

[illegible]

876,394. Telegraphic Key. Roy E. Patterson, Chicago, Ill., assignor of one-half to Matthew Patterson, Chicago, Ill. Application filed December 29, 1906.

[illegible] break the circuit [illegible] rated thereby when [illegible] vertically movable [illegible]

876,400. Electrical Distributing Rack. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed February 17, 1903.

The rack comprises a frame having vertically disposed upright strips and horizontally disposed cross strips extending between the vertical strips, the latter being formed in sections which are arranged end to end and extend respectively between adjacent cross strips. The sections on the front side of the rack are for protectors and on the rear side for terminals, the terminal sections being provided with forwardly and rearwardly extending apertures for cross-connecting wires and being provided with connecting clips in the rear of the apertures.

876,409. Combined Typewriting and Adding Machine. Burnham C. Stickney, Elizabeth, N. J., assignor to the Union Typewriting Company, Jersey City, N. J. Application filed April 13, 1903.

The writing mechanism includes a series of figure and of character types, and also case-shifting means for rendering the figure types either operative or inoperative. An adding mechanism is provided and electric circuits operatively connect the writing mechanism to the adding mechanism, these circuits being controlled by the case-shifting means, so as to be rendered inoperative when the figure types are inoperative.

876,413. Polarized Relay. Chester H. Thordarson, Chicago, Ill. Application filed March 31, 1904.

An electromagnet has a moving armature which carries a working member. A polarized armature, also actuated by the electromagnet, operates to control the direction of action of the working member.

876,416. Electric Time Switch. Robert F. S. Venner and Robert C. Griesbach, London, England. Application filed February 12, 1907.

The clockwork is connected by mechanism to a lever having a pair of contact rods adapted to dip into mercury cups. A spring is slowly wound up and then rapidly lifts the lever so as to break the circuit. Closing the circuit is performed in the reverse manner.

876,418. Weft-replenishing Loom. Horace Wyman, Worcester, Mass., assignor to the Crompton & Knowles Loom Works. Application filed March 28, 1906.

A number of electromagnets are carried on a frame and have a pivotal movement in a vertical plane. Each magnet has a movable core for a feeler and means for moving the core into its forward operative position, preparatory to its entering a shuttle and engaging the filling carrier thereon on the forward beat of the lay.

876,419. System of Automatic Block Signaling for Railways. Samuel M. Young, New York, N. Y. Application filed November 1, 1907.

The trackway is divided into sections and is provided with a single conductor for supplying the signaling current to the sections, reactive cross bonds between the rails at each end of each section, track circuits controlling the operation of the signal relays, branch conductors connected to the supply conductors and to the middle of the cross bonds, and transformers in the branch conductors whose secondary coils supply current respectively to the signals and to the track circuits.

876,423. Device for Indicating the Position of Water or Sluice-gate Valves. Francis E. Adams, Boston, Mass., and Christian W. Kragh, Madison, Wis., assignors to the Coffin Valve Company. Application filed September 7, 1905.

A pair of solenoids has its cores connected with pawls that actuate a gear and dial. The motor that operates the gates is electrically connected to the solenoids so as to separately and alternately excite them.

876,434. Non-interfering Party-line Telephone System. William R. Brown, La Fayette, Ind., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 18, 1907.

A generator is provided at each sub-station wherewith the parties on the line may selectively signal either central office or the other parties on the line. The position of the switch hook changes the selective apparatus from one condition to another.

876,441. Motor-controlling Device. William E. Date, Westfield, N. J., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed March 14, 1907.

The controller has a number of switches governing the direction of running of a motor. The controller drum is continuously revolved and thus causes the switches to operate alternately and the motor to alternately change its direction. The motor can be stopped at a predetermined point.

876,445. Electrolyte for Alkaline Storage Batteries. [illegible] West Orange, N. J., assignor to [illegible] Company, West Orange, N. J. Application filed May 16, 1907.

[illegible]

876,489. Electric-radiator [illegible] and John J. [illegible] Application filed November [illegible]

The working [illegible] plate [illegible] held by [illegible] the [illegible] conductor. (See cut on next page.)

876,492. Trolley-pole Controller. [illegible] Chicago, Ill. Application filed January 12, [illegible]

A pivotally mounted trolley pole [illegible] extension is provided with [illegible] spring connecting member, and [illegible] necting member cooperating with [illegible] means force the member [illegible] is disengaged from the wire, the [illegible] drop below the wire. Means for [illegible] connecting member to its [illegible] also provided.

876,493. Time Indicator for Telephones. John Rounsevill and August Bilms, Cuxhaven, Germany. Application filed July 9, 1906.

This indicator and alarm device comprises [illegible] hand driven around a graduated dial plate [illegible] keyed to the shaft of this hand and having [illegible] periphery in accordance with the time intervals allowed as a unit for telephone conversations, and [illegible] and means for actuating it by the toothed [illegible] end of every time unit.

876,503. Safety Device for Electric Cranes. Marius R. Suliot, Salem, Ohio, assignor of one-half to Frank Klepetko, New York, N. Y. Application filed July 24, 1907.

The cable has a limiting button and [illegible] lever for actuating a trip contact that closes a circuit shunted across the line, which contains an energizing coil of a circuit-breaker. Thus, if the block is raised too high or lowered too far, the circuit-breaker is opened.

876,510. Firing Mechanism for Ordnance. Harry T. Wheeler, Washington, D. C. Application filed April 1, 1907.

The breech block of a gun is provided with means for percussion and electric firing either together or electric firing only. The firing mechanism is locked out of operation except when the breech block is properly locked in position.

876,511. Push-button Snap-switch. John A. York, Hartford, Conn., assignor to the Arrow Electric Company, Hartford, Conn. Application filed July 29, 1907.

The movement of the push buttons is transmitted to a cam plate and from this to a tumbler and lock plate and to the movable contacts.

876,512. Fire-alarm System. Martin A. Abrahamson, Copenhagen, Denmark. Application filed February 1, 1905.

A circuit contains thermostats and relays, the armatures of which have various degrees of sensitiveness. Each local circuit has two branches, having each a relay. The one of lesser sensitiveness closes a circuit that includes a trouble call. The one of greater sensitiveness closes an alarm circuit.

876,515. Electrical Binding Clip. Bradbury L. Barnes, Providence, R. I. Application filed December 17, 1906.

A conduit has a guide bushing attached to its end and a pliable binding finger connected to the bushing, the finger having a free end adapted to be bent around the conductor to make a ready connection thereto.

876,552. Socket Shell. Harvey Hubbell, Bridgeport, Conn. Application filed March 5, 1907.

The shell consists of two members having interlocking threads, one of the members being provided with a guide collar lying exteriorly to the thread and separated therefrom by an annular space receiving the other member.

876,555. Automatic Switching Device for Use in Flash Advertising. Leonard K. Job, Notting Hill, London, England. Application filed December 27, 1905.

A pivoted arm carries a switch contact and a spring on each side of it, and has its free end caught by a spring-held roller. An electromagnet causes a pressure against either of the springs on the arm, so that the latter is caused to move suddenly past the roller.

876,568. Dynamo-electric Machine. Charles E. Lord, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed June 7, 1905.

The stationary armature core has its laminations grouped with ventilating passages between groups that are closed at the inner end. The frame of the machine is shaped so that air is drawn in at the ends, circulates through the ventilating passages and is discharged at the base of the machine without having passed through the air gap between the armature and rotating field. (See cut on next page.)

876,594. Control System. George B. Schley, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed December [illegible], 1906.

[illegible] railway system has a single pipe [illegible] throughout the train that carries air pressure [illegible] master controller to pneumatically operated [illegible] controllers on each car. Variations of pressure bring about the various operating movements of the car controllers.

876,595. Electrical Register and System Therefor. Louis A. Schmidt, Chicago, Ill. Application filed November 2, 1903.

This apparatus is arranged for transmitting tactual [illegible] and consists of an electromagnetically operated register and transmitting mechanism at the sending station and a repeater, relay and interrupter at the receiving station.

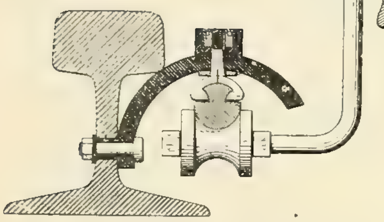
876,600. Trolley Guard. Charles W. Sheehan, Lubec, Me. Application filed October 11, 1907.

Side arms are pivoted at each side of the trolley wheel below its axis. Each arm at its upper end has a pivoted gate normally extending inward over the trolley wire and readily passing by the ears.

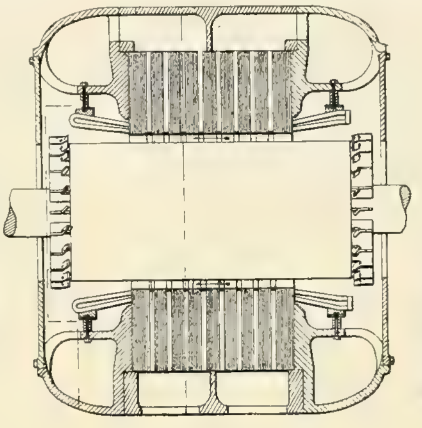
876,602. Cement-burning Furnace. Willoughby E. Snyder, Nazareth, Pa. Application filed March 11, 1907.

A set of arc electrodes is operatively disposed within the hood above the hearth, the members of the set being staggered so that the series of arcs produced covers the entire width of the hearth.

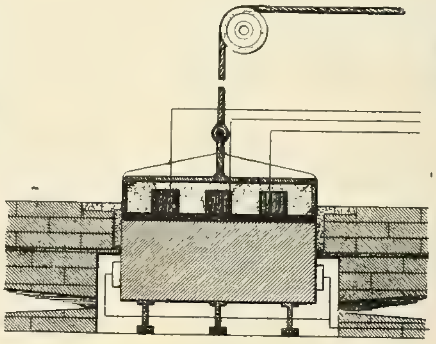
876,619. Junction Box for Electric Wires. Louis P. Bliemeister, Buffalo, N. Y., assignor of one-half to William R. Joseph, Buffalo, N. Y. Application filed July 20, 1906.



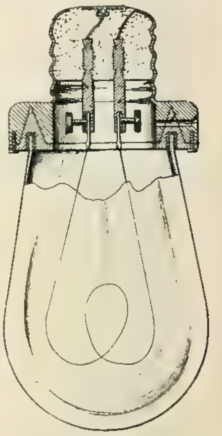
NO. 876,489.—ELECTRIC-RAILWAY SYSTEM.



NO. 876,568.—DYNAMO.



NO. 876,862. METHOD FOR CEMENTATION OF STEEL.



NO. 876,922.—LAMP.

The box has a telescoping body portion and a telescoping cover, the body portion having openings for the introduction of circuit wires.

876,630. Means for Locking Caps to Socket Shells, Canisters, Etc. Arthur C. Gaynor, Bridgeport, Conn. Application filed February 25, 1907.

One member is provided with a series of outwardly projecting ribs struck up from the metal. A corresponding member has a series of inwardly projecting ribs struck up from the metal, and also means for preventing backward movement of the members relatively to each other.

876,639. Electric Sad-iron. Willard M. Harwood, Ontario, Cal. Application filed May 27, 1907.

The heaters are loosely supported in and disconnected from the body and extend substantially to the toe. They radiate the heat directly to the toe and heel of the body. Means independent of the cover and detachably secured to the bottom hold the heaters in place.

876,641. Voltameter. Henry S. Hatfield, Hove, England. Application filed October 14, 1907.

An electric gas voltameter comprises a sealed and calibrated tube containing an electrolyte and an electrode from which gas is given off, and a self-emptying, three-limbed calibrated tube which collects the gas and which is contained within the sealed tube into which it periodically empties.

876,659. Electric Railway. Orlando D. Prescott, New York, N. Y. Application filed May 25, 1906.

A supporting frame for the contact shoe on a third rail is described.

876,669. Telegraphic Transmitter. Dana S. Troth, Fruitvale, Cal. Application filed April 6, 1906.

A set of circuit making and breaking levers is controlled by a series of independent cam disks, one for each lever. The projections and depressions on each disk, when the latter is rotated, produce a definite set of vibrations of its lever. A clutch connects any desired [illegible] for one revolution only.

876,684. Block-signal Apparatus. Alexander Bevan, Providence, R. I. Application filed March 8, 1907.

[illegible] normally held in safety [illegible] magnet has a tubular [illegible]

[illegible] Means for Operating Alternating-current [illegible] Parallel. Morgan Brooks and [illegible] Application filed [illegible] 1907.

[illegible]

[illegible] J. Drew [illegible] filed March 19, 1907.

[illegible]

876,701. Electric Switch. Heinrich Drewell, Charlottenburg, Germany. Application filed March 9, 1907.

The switch is arranged for closing any desired branch of a circuit which has a large number of branches. It consists of a set of individual switches connected by a set of branch conductors in groups. A set of polarized cells is inserted in each branch conductor.

876,722. Trolley. Joseph H. Kroen, Monaca, Pa. Application filed July 23, 1906.

The trolley harp has side arms pivoted on each side. These extend above the trolley wheel and terminate in two adjoining rollers over the trolley wire. At each lower end is a lateral arm to which the rope is attached.

876,735. Annunciator. Lafayette S. Scott, Rochester, N. Y. Application filed December 3, 1906.

An electromagnetically operated street or station indicator is brought into action by a projecting member striking a bar along the track wherever a new indication is to be shown.

876,773. Mercurial Thermostatic Circuit-closer. Frank Cossor, London, England. Application filed August 15, 1907.

A bulb has connected with it an inverted U-shaped stem. Both bulb and stem are almost entirely filled with mercury except for a slight portion of rarified air at the top. Heat causes the mercury to expand and thus close a circuit between the two arms of the stem.

876,803. Street or Station Indicator. Polk M. Higgins and Lee D. Harmes, Houston, Tex. Application filed October 1, 1906.

The tape carrying the names is wound from a spool to a drum, the latter being moved by a pawl actuated through an electromagnet.

876,804. Electric Safety System. Homer A. Hill, Delafield, Wis. Application filed February 18, 1907.

A trip comprises a casing provided with a tubular portion, a plunger mounted within, a lever loosely pivoted to the plunger for the purpose of raising it and a solenoid provided with a movable core having a pin disposed upon one side of a projecting arm. When the solenoid is energized the plunger falls.

876,809. Electric Switch or Cut-out. Isidor Kitsee, Philadelphia, Pa. Application filed October 14, 1905.

The switch consists of a receptable that can be tilted from side to side. It contains a movable carriage carrying one of the contacts. The other is mounted on the receptacle.

876,828. Insulator. Ross C. McNutt, Mendota, Ill. Application filed March 21, 1907.

A molded body of cement contains an internally threaded metal thimble having transversely and longitudinally extending flanges serving to anchor the thimble in the body. A metal cap is fitted on the bottom and has an opening in its bottom registering with the thimble and rods anchoring the cap into the body.

876,862. Method for the Cementation of Steel. Cleland Davis, U. S. Navy, assignor to the Carnegie Steel Company, Pittsburg, Pa. Application filed April 10, 1901.

The method of treating iron or steel plates consists in applying carbon to one face of the plate, screening such face from the air, and then applying an electric current to such face to raise it to an approximately molten condition. (See cut.)

876,877. Wall-box for Electric Switches. Rodolphus W. Hollis, Atlanta, Ga. Application filed June 18, 1906.

The box has flanges on the front, a plate perforated and countersunk to receive screw heads and means for holding the countersunk sides of the plates against their respective flange, consisting of lips formed upon the flanges by turning backwardly and inwardly their extended ends.

876,882. Circuit Controller for Electric Motors. John M. Joy, New York, N. Y., assignor to the Page Machine Company, New York, N. Y. Application filed March 1, 1906.

An electric motor drives a worm. [illegible]

876,883. Cigar Cutter and Lighter. Apollinarius von Kaspus, Pittsfield, Mass., assignor of one-half to Addis K. Botsford, Saranac Lake, N. Y. Application filed December 14, 1906.

[illegible]

876,886. Cable Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed March 3, 1906.

In a system of telegraphy by true reversals there are included two local circuits normally of equal resistance, means for increasing the resistance of one of the circuits through an impulse of one polarity, and for increasing the resistance of the other of the circuits through an impulse of opposite polarity, and an electromagnetic device responsive to the changes of resistance of the local circuits.

876,910. Electric Switch. Charles G. Perkins, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed February 19, 1906.

This switch carries a pair of enclosed fuses in place of knife blades.

876,918. Circuit-breaker. Percy H. Thomas, Montclair, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed December 10, 1903. Divided and this application filed January 6, 1905. Renewed February 19, 1907.

A circuit-breaker is connected in shunt to the main switch, the circuit-breaker including a suitable container having mercury electrodes connected initially by a thin body of mercury, this being so proportioned as to be vaporized by the passage of current upon the opening of the switch.

876,922. Electric Lamp. Joseph de Martino, Breesport, N. Y., assignor of three-tenths to Charles B. Davis and three-tenths to Charles H. Kinley, Breesport, N. Y., and one-tenth to James Francis Burke, Pittsburg, Pa. Application filed January 12, 1907.

An electric lamp consists of a top, filament-holding means mounted therein, a base ring connected with the top and having formed in its lower face a V-shaped groove and provided with holes, one of which connects the groove with the interior of the top and the other of which connects the groove with the external atmosphere; a carrier ring shaped to fit into the groove and formed with a hole adapted to register with the holes in the base ring; a globe mounted in the carrier ring, and means for detachably securing the base ring and carrier ring together. (See cut.)

REISSUE.

12,739. Telegraph System. John J. Ghegan, Newark, N. J. Application filed December 7, 1907. Original No. 872,228, dated November 26, 1907.

A quadruplex telegraph system has a neutral relay and a polarized relay and their local sounder circuits in combination with means controlled by the armature of the neutral relay to momentarily open the local sounder circuit of this relay to prevent false signals.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 20, 1908:

444,807. Combined Electric Motor and Lamp Socket. R. H. Beach, St. Paul, Minn.
444,855. Portable Electric Welding Apparatus. E. E. Ries, Baltimore, Md.
444,881. Electrical Exercising Machine. J. B. Gardiner, Nyack, N. Y.
444,893. Trolley for Electric Railways. H. H. Blades, Detroit, Mich.
444,925. Electric Arc Lamp. E. Thomson, Lynn, Mass.
444,926, 444,927 and 444,928. Method of Electric Welding. E. Thomson, Lynn, Mass.
444,929. Incandescent Electric Lamp. E. Thomson, Swampscott, Mass.
444,930. System of Distributing and Metering Electric Energy. E. Thomson, Swampscott, Mass.
444,931. Electric Meter. E. Thomson, Swampscott, Mass.
444,939. Alternating-current Dynamo. H. Lemp and L. M. Schmidt, Lynn, Mass.
444,946. Method of Electric Welding. E. Thomson, Lynn, Mass.
444,966. Electric Indicator. C. Wirt, Orange, N. J.
444,969. Electrode for Secondary Batteries. F. Bain, Chicago, Ill.
444,997. Electric Arc Lamp. W. H. Elkins, Hornellsville, N. Y.
445,023. Independent Electric Clock. E. Lefebvre, Montreal, Canada.
[illegible] Electric Meter Lock. R. P. Eanes, Wichita, Kan.
[illegible] Electric Motor Reciprocating Engine. C. J. Van Depoele, Lynn, Mass.
[illegible] Electric Signal for Railroads. J. C. Wiley, Bristol, Tenn.
[illegible] Multiplex Arc Lamp. W. H. Elkins, Cambridge, Mass.
[illegible] Electro-magnetic [illegible] R. M. Hunter, Philadelphia, Pa.
[illegible] Electric [illegible] F. E. K[illegible], [illegible], Mass.

WESTERN ELECTRICIAN

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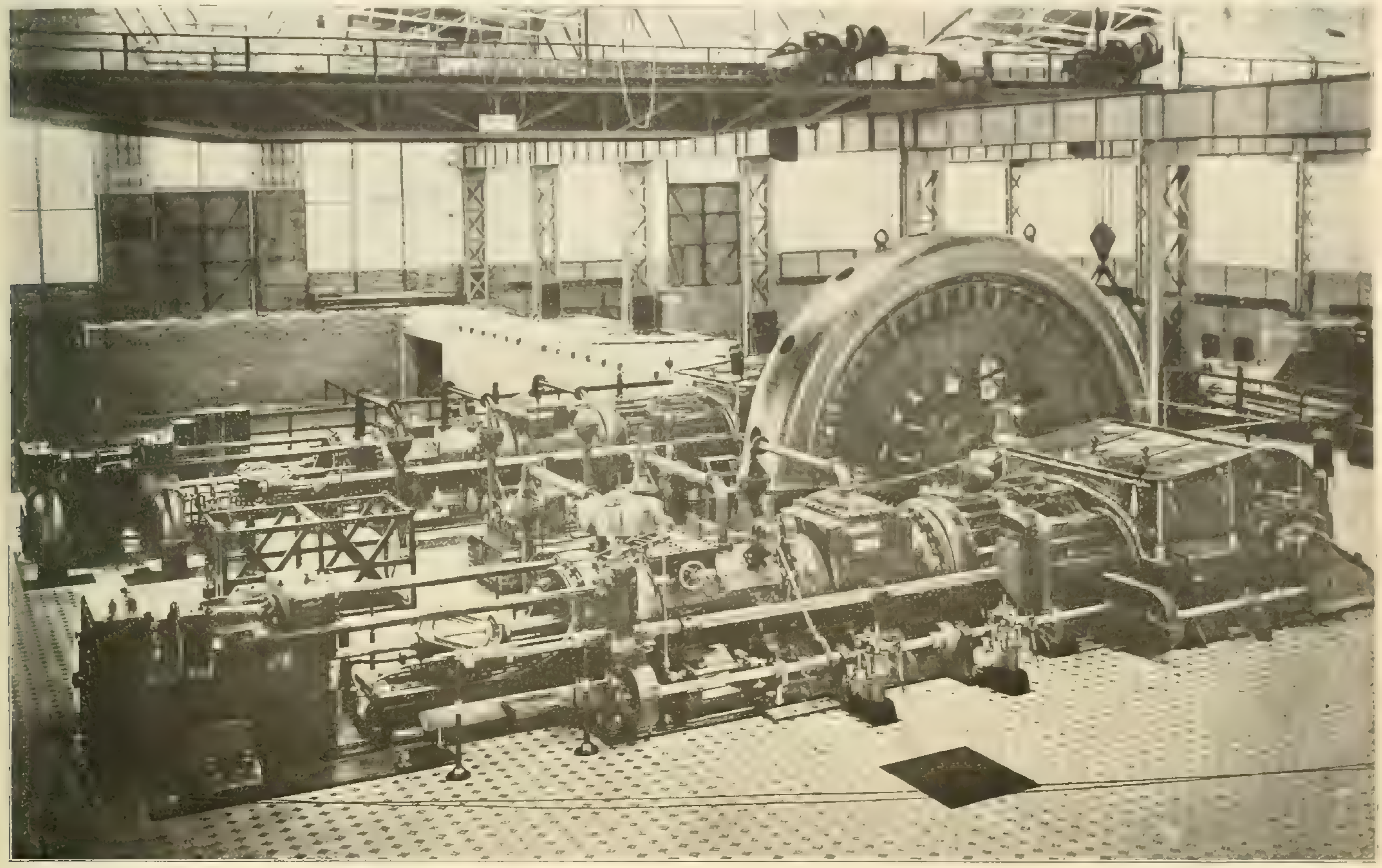
The Progress of Blast-furnace Gas Utilization.

Engineers have been occupied within the last few years with the problem of utilizing the gas from blast furnaces directly in engines for their power, and this question has become one of considerable importance in the iron industry, especially in Europe, where close economies are effected. Owing to the low efficiency of boilers and engines, a large amount of combustible is used in blast furnaces at a great loss. In the case of a blast furnace the greater part of the work which is to be done consists in producing the air blast [illegible] duced.

One of the types of low-carbon gas engines is the one illustrated herewith. Engines of this description are designed on what is known as the Oechelhauser system and are brought out by a [illegible] sion of eight atmospheres. During the compression stroke and the motive stroke the two auxil- [illegible] the cylinders.

In the Oechelhauser gas engine the transverse [illegible] one-half what they are for a four-cycle engine [illegible]



A 600-HORSEPOWER BLAST-FURNACE GAS ENGINE DRIVING ALTERNATOR IN MINING POWER PLANT.

The air is drawn from the exterior into large cylinders and thence it is sent in great volume, but at a pressure scarcely exceeding one atmosphere, into the main part of the blast furnace in order to facilitate the oxidation of the material. A considerable amount of power is needed, therefore, to operate the blast pumps.

Before the use of the low-carbon gas engine the boilers which furnished the steam to the blast pumps were heated by a certain part of the gases coming from the blast furnace, for these gases still contain a certain amount of combustible. A great advance over this method consisted in sending the gas directly into the air-pumping engine itself. In this way the ironmaster is able to economize the greater part of the gas which was formerly used only to work the air-pumping apparatus and to utilize the excess of supply for operating electric generators so as to give a source of current applicable to useful work.

In this way by using the gas from the blast furnace the ironworks not only drive what machinery is needed for the operation of the plant, such as producing the blast and heating the air, pumping water, ore-crushing and roasting, but also secure quite a large surplus of power in the shape of current. Such current can be used to good advantage within the works itself for operating motors for carrying on the smaller operations, such as charging the furnace, drawing cars of material, or operation of iron rolls. Current can be also new company in France. What is to be remarked about the present form of engine is that it is of the two-cycle type. In the case of the more usual four-cycle gas engine with one cylinder there is a single impulse from the explosion of the gas for every two revolutions, so that in order to obtain a sufficient degree of regularity the maker is obliged to use a very heavy flywheel or else couple together two, three and even four cylinders. There is thus a great interest in increasing the number of useful strokes in a gas engine while still keeping a simplicity for the mechanical parts in movement, as this quality is recognized to be necessary for high-speed engines.

The new Oechelhauser engine works upon two cycles and therefore gives an impulse at each revolution. Moreover, the explosive force acts at the same time upon two pistons working in the opposite direction, and this has a good effect in eliminating heads which close the ends of the cylinder and which form one of the parts which it is difficult to keep cool. Besides this, each piston, when it is displaced, uncovers and covers the inlet of air and combustible mixture and the exhaust, respectively, so that the distribution is carried out without the use of valves.

In the illustration is shown a double engine of 600 horsepower which has been installed in the mines of the Hörde Mining and Smelting Company at Hörde, Germany. This group is composed of two similar engines of 300 horsepower the 500-horsepower type uses a diameter of but 26 inches and the 1,000-horsepower engine only 37 inches. The cooling action in the engine is affirmed to be thorough and reliable, as the volume of gas to be cooled, being proportional to the square of the diameter, diminishes greatly with the latter, and, on the other hand, the blowing of the cold air into the interior adds its effect to that of the water jacket.

As the work is accomplished by two opposite pistons, the cylinder of the engine is of simple construction, being a tube which is easily cared for. By taking out the rear piston the cylinder is easily cleaned. Valve mechanism is suppressed to a great degree, thus avoiding accidents due to this cause. The use of opposed pistons gives a very good balance to the engine, and when it is running the absence of jarring is noticed.

The above-mentioned ironworks has now mounted three twin engines of 600 horsepower of the type illustrated here. With a blast-furnace gas of 950 calories on an average, these engines, it is reported, do not consume more than three cubic meters per horsepower-hour and require only 40 liters of water per horsepower-hour for the cooling.

A gas engine of different design but also used for blast-furnace work is the Cockerill type, made in Belgium. A number of these are now installed in blast furnaces and mining plants, especially in Germany and Russia. In this engine two gas-explosion cylinders are coupled in compound upon

[illegible] piston. An efficient system of water [illegible] is employed for the main cylinders and also for the valve chambers. Upon leaving the engine the temperature of the water is not above [illegible] and about 40 liters of water per horsepower-hour is needed in the usual cases. Ignition is carried out by electric spark by means of high-tension magnetos. This type of engine is well adapted for running generators, and it is used for this purpose in many of the plants where it is installed.

A Graphic Recording Wattmeter.

The importance of graphically recording the output as well as the voltage of central stations is becoming better appreciated by managers and engineers of such plants. The value of these records, which are practically load curves, has stimulated the invention of a number of recording instruments capable of making reliable charts. A typical one of this class will be described here. It was devised and patented by Lorin E. Imlay of Niagara Falls, N. Y.

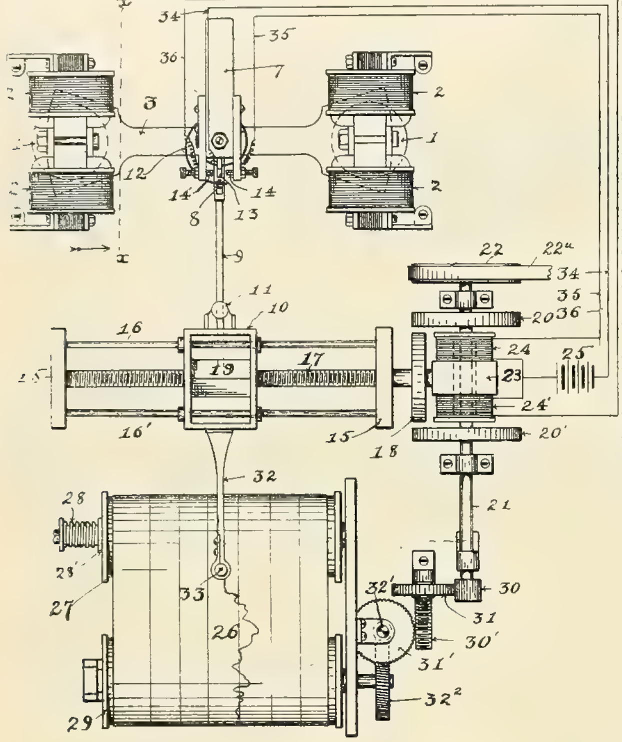


FIG. 1. PLAN OF GRAPHIC RECORDING WATTMETER.

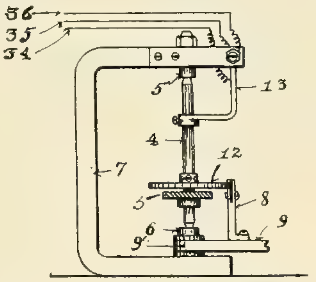


FIG. 2. DETAIL OF ELEVATION OF GRAPHIC RECORDING WATTMETER.

This wattmeter is graphic, self-recording, and capable of measuring power delivered by single or polyphase alternating currents.

The instrument is illustrated by the drawings given herewith. Fig. 1 is a plan view, partially diagrammatic, and Fig. 2 is a detail view in elevation on the line (x x) of Fig. 1 looking in the direction of the arrow.

The current coils (1 1) and potential coils (2 2) form two single-phase wattmeters. The aluminum or copper disk (3) constitutes the movable secondary element. This movable element is mounted rigidly upon an oscillated shaft (4), which is supported in jewel bearings (5 6). These bearings are supported by a frame (7), which is secured to the base of the apparatus. The upper jewel bearing (5) is adjustable in the usual manner. Around the lower jewel bearing (6) is a collet or ring (9'), which rests upon the frame and which is free to rotate about this lower bearing as an axis. Secured to this collet is an arm (9). Secured to this arm is a post (8). The free end of the arm enters [illegible] hole in a lug (11), which is pivoted to the car (10). The arm is free to move axially [illegible] in the pivoted lug.

[illegible] spring (12) has one end attached [illegible] oscillated shaft (4), and the other end [illegible] attached to the post (8). The shaft carries rigidly secured to it a contact arm (13). Secured to the frame (7), but insulated from it, are two contacts (14 14'), with which the contact [illegible] making electrical connection [illegible] (4) is oscillated in one direction or [illegible].

The mechanism for making the record consists [illegible] attached to the base of the apparatus [illegible] frame are guides (16 16'). [illegible] threaded shaft (17), upon which is rigidly mounted an iron driven friction [illegible] travels on the guides [illegible] nut (19), which is threaded to the shaft (17). This shaft is capable of rotating only, and the nut (19) being capable of axial movement only as the shaft (17) is rotated, the car (10) will move in one direction or the other on the guides, according to the direction of rotation of the shaft.

The means for rotating the threaded shaft (17) in one direction or the other, as may be required, consists of two iron friction disks (20 20'), mounted fixedly upon a driving shaft (21), so that both friction disks may be turned in the same direction as the driving shaft. This driving shaft has axial movement to bring the side of either one of the friction disks into action with the periphery of the driven friction disk (18). The driving shaft (21) is driven at a constant speed by any desirable means—as, for example, a driving belt (22^a), working on the pulley (22), connected with a suitable motor.

The friction disks are brought into action as follows: Around the driving shaft (21), but separate from it, upon a block (23), which is fastened to the base of the apparatus, are two stationary electromagnets (24 24'). One of the terminals of each electromagnet is connected to a common conductor leading to one pole of the battery (25). The opposite pole of the battery is connected by a conductor (34) to the contact arm (13) on the oscillated shaft (4). The other two terminals of the electromagnets (24 24') are connected, respectively, by conductors (35, 36) to the contacts (14 14'). The magnetic circuits of the electromagnets (24 24') are through the cast-iron block (23), the portion of the driving shaft (21) between the disks (20 20'), the disks themselves, and cast-iron driven friction disk (18).

The chart (26) consists of a long length of paper ribbon or record sheet having longitudinal lines or rulings, which are calibrated to the spring (12). The ribbon or record sheet is wound upon an inner roller (27) and held in tension by a spring (28), which holds the brake disk (28') against the end of the inner roller. A driven outer roller (29) draws the chart or ribbon forward and holds the same wound upon it after it has been made into a record. Impressions are made upon the chart by a pencil or stylus (33), carried by an arm (32), attached to and moving with the car (10). The longitudinal movement of the ribbon and the transverse movements of the car (10) will determine the curvatures of the record impression made by the stylus.

The chart is given continuous and regular movement in the following manner: Upon the end of the driving shaft (21) is rigidly mounted a spur gear (30), which meshes with the gear (31). The spur gear (30) has sufficient width of face to remain in mesh with the gear (31), whichever of the two disks (20) or (20') is in action. The gear (31) rotates a worm (30'), which in turn rotates a gear (31'), that rotates a worm (32') in mesh with the gear (32^2). The latter gear is mounted upon the shaft of the outer roller (29), and consequently motion in rotation is imparted to the outer roller through the reducing gear just described.

The several parts of the instrument and their relations having been made clear, it will now be desirable to describe its operation.

It will be assumed that a small electric motor is connected with the belt (22^a), that passes over the pulley (22) and drives the shaft (21), and therefore imparts continuous movement to the record blank by the mechanism just described. It will be assumed also that the series and shunt coils are energized. The interaction of these coils, when energized, upon the secondary element will cause the oscillated shaft (4) to rotate slightly, thus bringing the contact arm (13) in touch with one of the adjustable contacts (14) or (14'). Suppose that it is the contact (14). The circuit thus closed will include the battery (25), wire (34), contact arm (13), contact (14), wire (35), electromagnet (24), and thence back to battery through the common return. This will energize the electromagnet (24) and cause it to attract the inner disk (20) and bring its side into frictional action with the periphery of the driven friction disk (18). The driving shaft (21) being in constant rotation, the threaded shaft (17) will be rotated and the nut (19) will move the car (10) in the direction to swing the arm (9) in the opposite direction from that in which the secondary element (3) has been rotated. This will cause the secondary element to swing slightly in the direction to break electrical connection between the contact arm (13) and contact (14). As soon as the circuit just described is broken the car (10) comes to rest, as the electromagnet (24) is no longer energized, and the inner disk (20) is entirely out of frictional contact with the driven friction disk (18) or has so little friction that it will not drive it.

The carriage will remain at rest so long as the current is constant; but suppose the flow of current changes so as to rotate the secondary element (3) to bring the contact arm (13) into electrical connection with the contact (14'). This will close a circuit including the battery, so that current will flow from battery through wire (34), contact arm (13), contact (14'), wire (36), electromagnet (24'), and thence by common return back to the battery. This will energize the electromagnet (24') and cause it to attract the outer disk (20') and bring its side into frictional contact with the periphery of the driven friction disk (18). This will move the car in the opposite direction of travel from that when the secondary element was moved to make electrical connection between the contact arm (13) and the contact (14). In like manner, as above described, the movement of the car will presently break the connection between the contact arm (13) and the contact (14), and the car will remain at rest so long as the flow of current is constant. An equilibrium is thus maintained between the tension of the spring and the torque of the meter elements. When the amount of power flowing through the meter elements changes, then the car must take up a new position in order to restore equilibrium.

It will be evident that during the time of action just described the chart has been moving at a slow but regular speed and that with the variation of load the pencil (33) has made a mark on the chart at an angle to the length of the chart, and that while the current was regular and equilibrium was maintained the pencil has made a mark or line parallel with the length of the record blank. As above stated, the chart is calibrated to the particular spring of the wattmeter to which it is applied, the divisions being longitudinal lines the distances between which correspond to definite amounts of power passing through the meter.

Consolidation of Lighting Properties in Massachusetts.

In the annual report submitted to the Massachusetts Legislature last week by the Gas and Electric Light Commission, considerable attention is given to the matter of the purchase of electric-light and gas companies for consolidation purposes, which has been taking place in Massachusetts during the last year or two.

A resolution directing the commission to inquire into the subject was adopted last year, and in effect the commission reports that, while some of the consolidations recently effected have been advisable and in the public interest, for reasons of economy, and because efficiency of operation is promoted thereby, there are undoubtedly cases where such consolidations are not advisable. The commission concludes the report by suggesting that the terms and conditions of all mergers hereafter be made the subject of supervision on the part of the Legislature itself or the Gas and Electric Light Commission, and, furthermore, that the purchase of gas companies by electric companies, or the reverse transaction, shall be prohibited by law.

Undoubtedly the Edison Electric Illuminating Company of Boston is chiefly concerned in this finding of the state commission. This corporation has expanded with remarkable progressiveness in recent years. It has acquired the properties of a number of suburban plants and is supplying electricity now in the territories formerly served by the Blue Hill, Natick, Framingham, Woburn, Somerville, Greendale, Medfield, Medway, Church Green, D. S. McDonald and other companies.

The commission says that consolidations have been increasing in number, citing the fact also that a semi-consolidation has taken place to such an extent that 10 of the 76 gas companies making returns during the last year have been purchasing their gas from other companies, and 17 of the 69 electric companies are purchasing their electricity to supply their customers.

A bill is submitted to the Legislature with the report, which aims to regulate the merging of lighting corporations. The bill provides, among other features, that consolidations shall take place only after approval by a vote of two-thirds in interest of the stockholders concerned, and that the Massachusetts Gas and Electric Light Commission's approval must be obtained. It also provides for hearings to enable the commission to determine that facilities will not be diminished and that sale or consolidation and the terms thereof will not be inconsistent with the public interest.

A Survey of Electric Power Transmission in Mexico.

By W. D. Hornaday

Electricity is playing an important part in the development of the mineral resources of Mexico. The application of electric power in conducting the operations of mines, reduction mills and smelters in different parts of the country has been the means of greatly increasing the output of the precious metals during the last few years. Notwithstanding the several large hydro-electric enterprises which have already been installed the era of electrical development is believed to be only well begun. The mountains of Mexico are known to be rich in minerals, and within convenient distance to these ores are waterfalls and bold streams of water which only await the "harnessing" to afford an ample supply of electric power for all industrial purposes.

The greatest mining districts in Mexico today are those in which cheap electric power has been installed. Guanajuato, which is now producing its millions of dollars' worth of ores yearly, was dormant for a century and more because the surface richness of the mines had been exhausted by the Spaniards and the cost of fuel was too great to continue operations. It was well known to the mining men of the early days that rich deposits of ores existed in the Guanajuato mines at greater depths, but it was impracticable to go deeper. In those days no power existed which could keep the lower workings clear of water or hoist the ore to the surface at low expense. The mines had to be abandoned with the wealth within easy reach.

The same situation was true in many other mining districts of Mexico. With the discovery that electric power could be transmitted long distances came a solution of the problem. The first step in the direction of awakening the dormant industrial life of Guanajuato was taken by a syndicate of Americans, which organized the Guanajuato Light and Power Company and installed a great hydro-electric plant at El Duro, where a waterfall was utilized to furnish the initial power. Transmission lines were built to Guanajuato, a distance of 110 miles, Irapuato and other points in the states of Guanajuato and Michoacan. Sub-stations were built and the electrical energy was placed at the disposal of the owners of mines and other industrial concerns.

It was soon demonstrated that this cheap power meant the reaping of fortunes out of abandoned mines and in opening new properties. American capital began pouring into the district, and it is estimated that more than $40,000,000 in gold has been invested by Americans in what is known as the Guanajuato district during the last five years that the electric power and transmission plant has been in operation.

It is a long way from the source of fuel supply to Guanajuato, and the cheap power meant a revolution in existing methods of conducting the mining industry at every point reached by the trans[illegible] company. With the inrush of Americans the adoption of electricity to operate hoists, pumps, drills, machinery of the mills [illegible] carried on rapidly.

In addition to causing the reopening of the ancient mines which had been idle for many years, the introduction of electric power made it possible to operate low-grade mines which would not stand the expense of the ordinary fuel being used. It enabled the workings of the old mines to be deepened, and as a direct result of this development ore bodies of great richness have been uncovered in several properties, and the output of the camp and district is attracting worldwide attention.

What has been accomplished at Guanajuato is being done also at El Oro and other mining camps of the republic. The Mexican Light and Power company, which is composed of Canadian capitalists, extended its transmission line to El Oro from its hydro-electric plant, situated at Necaxa, near Mexico City. The mine operators of El Oro were quick to take advantage of the opportunity for cheap power, and many thousand horsepower were contracted for and are being installed at the different mines as rapidly as possible.

One of the first of the larger companies operating in the El Oro camp to adopt electricity for its uses was the Compania Mineralas dos Estrellas. It found that the new power gave the company a great saving during the past two years. In order to reap a still further benefit from the use of electricity the company has taken steps to convert its mine railway from steam to electric drive. To accomplish this it is having built a 450-horsepower motor-generator set, wth alternating-current motor, which will be located centrally with regard to the part of the road to be electrified, this set taking its power from the circuits of the Mexican Light and Power Company. The motor will drive a 300-kilowatt direct-current generator, which will supply the trolley feeders. This company already has in operation six electric locomotives in and about its mines. It is said that since the installation of this electric-railway system the cost of handling has been reduced one-half.

The use of electric tramways in the tunnels of the mines is a big improvement over the ancient method of hauling the ore out in little carts pulled by burros or carrying it out upon the backs of Mexican miners. The new method is swift and safe. One locomotive will haul a number of cars if necessary. It makes no dirt and requires little attention in the way of repairs.

In the Cananea copper district, where the mines and smelter of the Greene Consolidated Copper Company are located, has been built one of the most extensive systems of surface electric mining roads in Mexico. The system covers all parts of the mining camp and extends into the mines. At Cananea, however, the cost of electric power is higher than in other parts of Mexico, for the reason that steam instead of waterpower is used to generate the current. The Necaxa plant of the Mexican Light and Power Company, is [illegible] Necaxa waterfall.

Steps have been taken to establish a great hydro-electric plant at [illegible] Falls, near the city of Guadalajara for the purpose of supplying power for mines and mills in remote districts of the state at Jalisco. The proposed transmission line will be from 100 to 175 miles long.

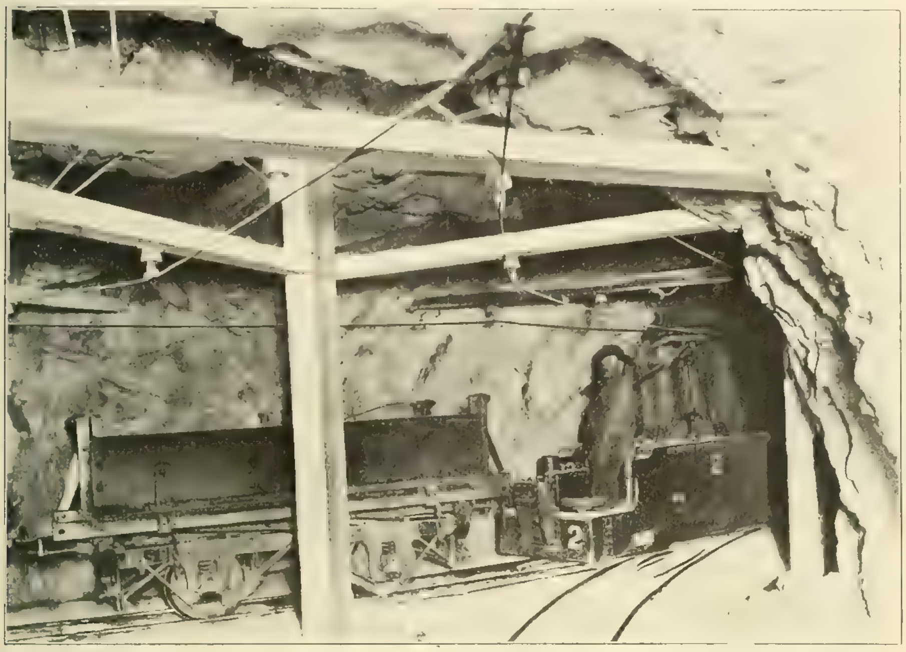
A number of mines of the Sultepec district, state of Mexico, are now being supplied with power from the Sultepec Light and Power Company. The company recently installed a hydro-electric plant at Tamascaltepec and built a 25,000-volt transmission line from there to Sultepec, where a sub-station was built for the purpose of supplying the mines with power. In addition to the mines already being supplied a number of other properties are being equipped with motors and other machinery preparatory to being operated by the new power.

There are individual electric plants at many of the mines in the principal camps of the states of Chihuahua, Sonora, Sinaloa, Coahuila, Zacatecas and San Luis Potosi, but in most instances these plants are operated by steam. Where steam is used the cost of the power is much greater than where the initial energy is generated by waterpower. For this reason scores of waterpower projects are under consideration all over Mexico. The main object in these various projects is to supply mines and smelters with cheap power.

An American company will soon begin the installation of a hydro-electric plant on the Conchos River in the state of Chihuahua, which will generate sufficient power to supply the mining camps of Parral, Santa Eulalia and other remote places. It is planned by this company to build several hundred miles of transmission lines, the longest of which will be about 150 miles. A similar project of magnitude is on foot in the states of Oaxaca and Coahuila.

The establishment of a dozen plants of the size of that at El Duro and the one at Necaxa, if properly distributed throughout the country, will afford sufficient power to operate all of the mines and industries now in existence in Mexico.

In addition to the equipment that is necessary for these hydro-electric plants, transmission lines and sub-stations, the users of the power must also install a considerable amount of equipment, such as motors, controllers, etc. All these mean an increase of the market for American-made electrical machinery and supplies. Mexico is already a large customer of American electrical appliances, and the demand in this line is constantly growing.



ELECTRIC TRAMWAY IN A MEXICAN MINE

Government Conservation of Waterpower Proposed.

A Washington dispatch, dated January 27th, gives a forecast of what may possibly be action of much importance in connection with hydro-electric power development in the United States. It is as follows:

"Within a week the Inland Waterways Commission appointed by President Roosevelt may report to him in advocacy of government conservation of waterpower. Such a report is now being prepared, and early action on this subject will be urged on the ground that the big electric and railroad companies of the country are attempting to forestall action by the government. The commission will hold that the government can control the waterpower on all public lands and also in all navigable rivers of the country. It was on this theory that the waterpower rights at Niagara Falls were apportioned by the secretary of war last year."

Effect of Artificial Light on Vegetation.

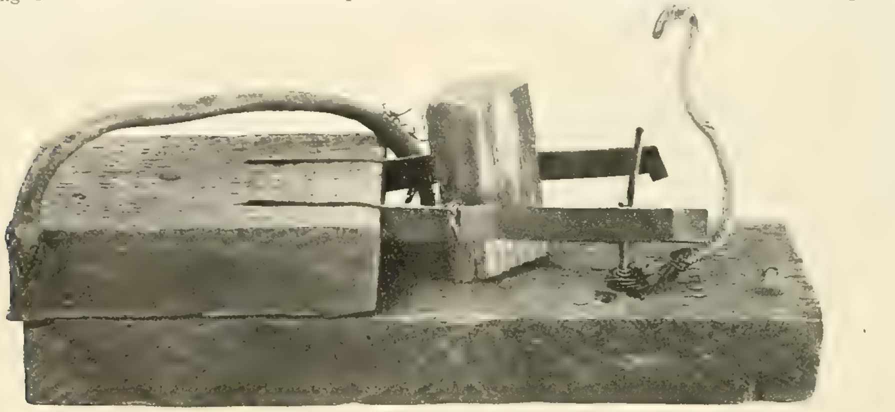
A dispatch from Paris says that Camille Flammarion, the scientist, has just published the results of the experiments that he has been conducting for the last two years to discover the effect of various lights on the growth of vegetation. He has a number of plants which he subjected to red, green, blue and white light, the conditions otherwise being similar.

Under the effects of red light certain vegetables, such as lettuce, grew 15 times as fast as under blue light. On the other hand, blue light has remarkable preservative powers. An oak tree planted two years ago has kept its first leaves, which are now as fresh and vigorous as when they first appeared. In the same way ripe fruit, it is declared, can be kept fresh under a blue screen for 20 days without decay. The strawberry plant can be retarded for a similar period and then allowed to fructify. The experiments are expected to have a wide application to market gardening.

A Unique Double-pole Switch.

In the large number of large and small electrical installations which exist in Chicago it is difficult for the city electrical inspection department to keep them all free from defective wiring and dangerous contrivances. Temporary installations are the sources of the most danger from fire, owing to the carelessness or ignorance of those who install the work. But even in some of the large modern isolated plants can be found wiring and makeshift contrivances of a hazardous nature. An instance of this kind which shows what the inspection department has to contend with is offered by one of the large hotels of the city. Among other dangerous apparatus found in this hotel was a unique switch, which, although dangerous as a fire hazard, showed considerable ingenuity on the part of the designer. The switch was taken out by Mr. D. Battle, district electrical inspector, and loaned to the Western Electrician. A reduced reproduction from a photograph is shown herewith.

This switch is a double-pole affair and was in service in a regular lighting circuit. Wires were attached as shown in the picture, and two pieces of spring steel and two nails formed the points of contact. An oblong block of wood pivotally mounted between the strips of steel served to control the circuit. To break the circuit it was only necessary to turn the block sufficiently to force the steel strips from the nails. This device and others perhaps equally hazardous were removed and the plant has been thoroughly overhauled.



A UNIQUE DOUBLE-POLE SWITCH.

Union Traction Properties Sold.

The North and West Side street-railway properties constituting the Chicago Union Traction Company were sold on January 25th at auction in the county building, Chicago, by Federal Master in Chancery Bishop. The Chicago Railways Company, the corporation of reorganized Union Traction and underlying interests authorized to accept the traction settlement ordinances from the city, was the only bidder. It offered $2,000,000 for the properties as a whole, which amount, however, has no significance, as the new company assumes all the obligations of the old one, according to the plan of reorganization under which the railways company is to assume control.

It was planned to report the sale to Judge Grosscup this week, and upon his approval a day is to be set upon which to hear objections, if any. This is to be followed by a deed of sale, which, if no unforeseen obstacles arise, will put a welcome end to the tangled affairs of the properties.

Last week in Washington, D. C., the Supreme Court of the United States refused the appeal of certain interests to interfere with the reorganization plan to which 95 per cent. of the security holders have agreed, and it is thought no further obstruction will be put in the way of turning the properties over to the new company, which is to take care of all the interests. Immediate results in the way of reconstruction of tracks, through [illegible] transfers, etc., are expected. It is understood that the local transportation committee of the City Council is to take up, soon, plans for a comprehensive subway in the Loop district for all the surface lines. The plan, it is said, may ultimately lead to the abandonment [illegible] The Board of Supervising Engineers has plans in shape for [illegible] week.

A rumor has been current in financial circles [illegible] short time before all the local surface lines will be consolidated. The Morgan interest that controls the City Railway is also the dominating influence in the other local traction properties. It would be cheaper to operate under one company than under two or more and a merging of all the interests is considered a logical outcome. That the elevated lines will be put under one management is considered another probability, it is said.

Effects of Light Upon the Eye.[1]

By Dr. H. H. Seabrook.

The image of the brilliant filament of the incandescent lamp, with its concentration of light, must harm the retina more than the more diffuse images of flames; the benefit from ground glass globes for this light, when the eyes are exposed to its direct rays, must be partly due to diffusion of the light. Without ground glass this light is more steadily brilliant than kerosene, gas or the gas mantle burner, and there is less chance for retinal recuperation. Ground glass reduces all the rays of the light about 25 per cent. In searching for other causes of trouble we note that the movable kerosene lamp may be, and is usually, placed in a good position to illuminate the object, while the incandescent electric lamp is usually not well placed, often in offices being rigidly fixed so that either the eyes must be subject to direct light or the head must be bent forward for work, congesting the eyes. No amount of green on a tin shade will correct this improper permanent position of the lamps. Again, we notice how very thin the glass bulb of the incandescent is compared with the lamp chimney, and since glass of five millimeters thickness absorbs 29 per cent. of the chemical rays of sunlight at an angle of 60 degrees (Hankel), we conclude we have another element of trouble, as chemical rays are absorbed by glass in proportion to its thickness.

The Welsbach mantle changes the ordinary gas flame, with its marked excess of red, to a cold light, deficient in that color. It is less irritating to some eyes than other lights, but more irritating to others.

Many substances absorb chemical rays and allow luminous rays to pass. For practical purposes there seems no need to consider any of them except glass as a protection for the eyes from the intrinsic brightness of too intense light. Neither does there seem any question that yellow is the color to choose to conserve or improve vision and protect the eyes from the chemical action of light. Globes may be used of pink, orange, red or green, as desired, when the light may be diminished in luminous qualities. It is best to choose for protective purposes that shade of yellow which appears in the best ray filters or is shown in the glass used for modifying the light of developing rooms for photographic plates. This amber yellow may be darkened by a brown admixture for weak or diseased eyes, or unusual light exposure. It is difficult to manufacture without imperfections and the supply slowly follows the demand.

That the study of illumination for practical purposes is difficult no one will deny. The difficulty of conveying knowledge about light, even if one possesses it, must be great, for there is no definite language, as of medicine, for instance. Newton first separated light into primary colors, and he also advocated the corpuscular theory of Descartes; and after more than two centuries we use Newton's language and speak of chemical rays in order to be understandable, and compound such sentences as "Since the wave lengths at the violet end of the spectrum are but half the length of those at the red, twice as many chemical rays as heat rays, from white light enter the eye during the same period of time." When we speak of light in general we usually mean light with infra-red, spectral and ultra-violet effects. Light rays may mean the visible spectrum, or the luminous yellow. The expression primary colors has just been used. It meant then the seven colors to be distinguished in the spectrum by many eyes, or the six that can be recognized by the others. It is frequently applied to the fundamental pigment colors, red, yellow and blue, from which all other pigment colors may be produced by mixing; or the fundamental spectral colors, red, green and violet.

Illuminating engineers are not entirely satisfied with standards of measurement of light; they would be still more confused if the visual standards which oculists have used for many years should be presented to them. Vision for distance only has been considered, and the apparent contradictions in facts, the long descriptions of investigations by Germans, often followed by conclusions apparently at variance with the premises; the conclusions of others, especially Americans, upon no premises at all, make "laws," as they were formerly called in these studies, rather difficult to formulate. In the present instance you are asked to believe, what many of you already know, that the desire for intensity of light has been already overdone as regards the good of the eyes. The small but increasing portion of the consumers who wish a light that is soft to the eyes ought to be encouraged.

As regards deductions to be drawn from this paper, they are not difficult. Lights weak in chemical rays are better suited to the eyes than others. Present lights may be improved by attention to position, including the distance of the source of light from the eyes as measured by the course of the rays and protection of eyes by glass properly colored.

Discussion.

In the discussion the logic of the speaker's deductions was quite generally admitted, although both Prof. A. E. Kennelly of Harvard and Dr. Louis Bell, who were among the speakers on the issues raised in the paper, were inclined to lay stress upon the intensity of modern light and to believe that some of the good effects observed in the tests were attributable to this phase as well as to the eliminating of violet rays accomplished by the use of the amber glass as set forth by Dr. Seabrook.

Most of the speakers acknowledged that a valuable hint had been given to them by the paper, and that the effect of various lights upon the eye as well as the illuminating qualities involved required just the sort of scientific research which the author of the paper is giving to the subject.

1. Part of a paper read before the Boston Section of the Illuminating Engineering Society, January 14, 1908.

Car Lighting.[1]

By R. M. Dixon.

Electric lighting for steam-railroad cars is accomplished by either one of three methods:

1. The system of electric train lighting in which the dynamo is carried in the baggage car, and driven by an engine supplied with steam from the locomotive. By this method it is necessary to have storage batteries carried on each car or in the forward car, to maintain the lights in case of the detachment of the locomotive and consequent lack of steam supply. It is customary to use a 25-kilowatt machine, and expert attendance is a practical necessity. All cars are dependent for electric light upon the car which has the dynamo and require some other means of lighting when detached from the electrical supply.

2. Another method of lighting cars by electricity is by means of storage batteries, these being charged at terminal plants. When greater improvements are made in storage batteries, this will be found to be the ideal system, as no special light-producing mechanism is required on the cars, but with the present commercial batteries, which require from six to eight hours for charging for 8 or 10 hours' light, the expense, weight and depreciation of the batteries all make the system costly, and as a lighting means, comparatively feeble.

3. The axle-driven dynamo system, which provides a dynamo mounted upon a car truck and driven by the axle. A set of storage batteries which is charged by the dynamo maintains the lights when the latter is still or revolving at a speed below that at which it will generate current of sufficient voltage. A regulator maintains the proper charging current for the batteries regardless of the increased or decreased speed of the dynamo. A switch prevents the discharge of the batteries through the dynamo when the latter is not generating, and a lamp regulator compensates for the voltage difference of the charging current and discharge current from the batteries to the lamps. Consideration has also to be given to maintain the proper polarity of the charging current to the battery, regardless of the direction of revolution of the dynamo.

The earliest use of this system in America, the idea of which is to make each car independent of a stationary plant or train for lighting, was made on the Central Railroad of New Jersey in the year of 1890, and notwithstanding the comparatively large amount of mechanism involved in the axle-driven electric-lighting systems, some satisfaction has been obtained.

The distribution of light is a subject sometimes ignored. The source of light, if intense, should not radiate directly into the faces of people, for the result is a contraction of the pupils of the eyes and a decreased general illumination effect

1. Part of a paper presented before the American Society of Mechanical Engineers, New York, January 14, 1908

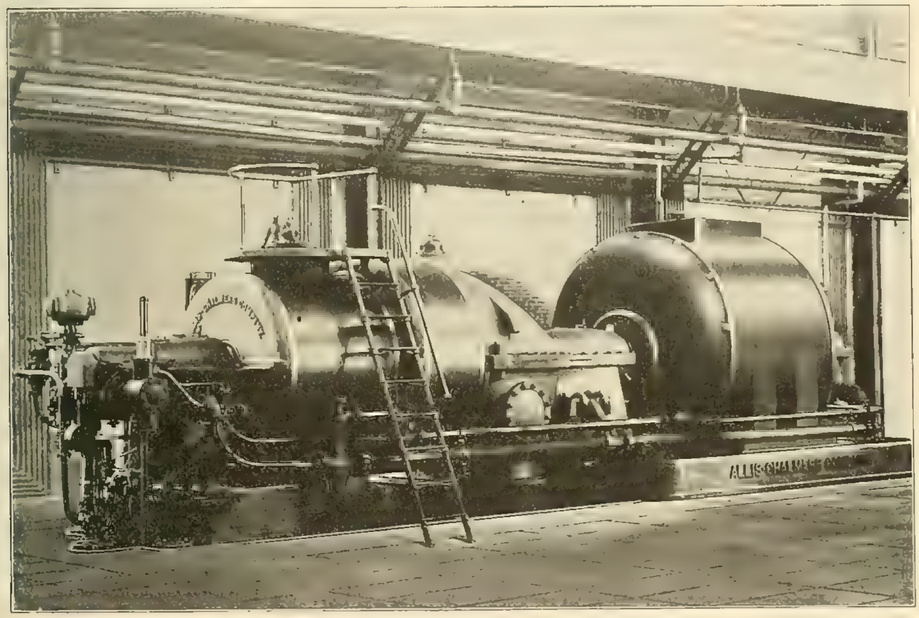
The desirable effect is, of course, an approach to indirect daylight, and the source of light should, therefore, not be less in intensity and should not greatly exceed four or five candles per square inch. Increased illumination should be obtained by increasing the area but not the intensity of the source of light.

For the general illumination of passenger cars the most satisfactory results are obtained by suspending lamps from the ceiling with the light centers as high as possible and avoid considerable deep shadows on the lower deck. Lights so placed are high enough to be somewhat out of the direct range of vision. Center lamps of considerable power are more satisfactory than a great number of small lights, for the many shadows caused by the latter are annoying. Lights placed on the sides of cars, such as reading lights, berth lights, etc., should always be shaded, or they will detract from the general illumination.

The use of reflectors for interior illumination requires much care. The light must not be projected so as to brightly light some parts at great expense to other parts. Cars especially must not be lighted for reading only, but require a general illumination. The interiors are handsomely finished and should not be left dark, and cheerfulness demands brightness overhead.

Largest Generating Unit in Virginia.

An Allis-Chalmers steam turbine and generator of 3,250 kilowatts capacity, on normal load, constituting the largest electric generating unit thus far installed in the state, is now being placed by the Virginia Passenger and Power Company in its Twelfth Street station at Richmond, Va. Here it will provide the additional power needed in the operation of the company's street and interurban railway system, which includes the Richmond Passenger and Power Company, Richmond Traction Company and Petersburg Electric Railway Company.



LARGEST GENERATING UNIT IN VIRGINIA.

This unit, a picture of which is given, will operate at a speed of 1,800 revolutions per minute and is designed to deliver three-phase, 60-cycle current at a pressure of 2,300 volts. From the generator bus-bars the current, after passing through the switchboard, will be stepped up to the transmission voltage and transformed through 1,000-kilowatt motor-generator sets located in a sub-station erected on Broad Street, between Shaffer and Harrison, whence it will be distributed over the trolley lines at the operating voltage.

Under the management of the receivers, Messrs. William Northrup and Henry F. Wickham, represented by the present officers of the company, of which Mr. S. W. Huff is general manager, the Virginia Passenger and Power Company has had the most prosperous period in its history, and with the authority recently granted by the Federal Court, liberal expenditures for improvements are now being made, with the object of still further increasing the earning power of the system. Thus far the principal dependence of the company has been upon hydro-electric power derived from the river, supplemented by current from steam plants, but rapidly growing traffic has necessitated the purchase of the new steam-turbine unit, which, with its large overload capacity, is expected to provide ample power for some time to come.

Central Electric Railway Association.

The second annual meeting of the Central Electric Railway Association was held at the Phillips House, Dayton, Ohio, on January 23d. In addition to a substantial representation of the members, a number of prominent traction men from other states were present. The meeting was called to order by H. A. Nicholl, president of the association. After disposing of miscellaneous business, President Nicholl delivered his annual address. In it he reviewed the progress of the association during the last year. As to the matter of mileage, construction and improvements in the methods of management and transportation, he said it had been the most successful year in the history of the association.

The annual report of the secretary and treasurer, William F. Milholland, showed a membership of 225. The secretary said that many of the papers and addresses which had been presented at the bi-monthly meetings of the association have been in great demand.

The first paper on the programme was read by Charles F. Price, general passenger agent of the Western Ohio Railway Company of Lima, on "The Promotion of Traffic."

One of the points brought out by the discussion of this paper, as well as by President Nicholl in his annual address, was in regard to electric railroads carrying United States mail. It was alleged that the electric roads in many instances were not permitted to carry mail to points that are much more readily reached by them than by the steam roads. It was decided that the attention of the Postoffice Departemnt be called to this matter.

The afternoon session was opened by the reading of a paper by Chauncey P. Button, general manager of the Telegraph Signal System Company, Rochester, N. Y., on "Telegraph Signal Systems." Mr. Button concluded his paper by describing a method of operating the signal apparatus which he thinks would minimize, if not entirely remove, all danger of collision between electric cars in their operation upon single tracks.

The committee on standardization made a partial report, which brought out a discussion on one or two suggestions. The committee will be continued and will report later.

Preceding the meeting of the association, traffic men connected with the electric interurban-railway lines of Ohio, Indiana, Illinois, Michigan and Kentucky met, and, after considerable difficulty, agreed upon articles of association for the formation of the Central Electric Traffic Association. It is the intention to make this traffic association an auxiliary to the Central Electric Railway Association and to be conducted along the general lines of a similar association of the steam railroads. John H. Crall of Indianapolis, who presided over this meeting, appointed the following committee to perfect the organization and start it on an active career: W. S. Whitney, Columbus, Ohio; Charles F. Price, Lima, Ohio; C. G. Lohman, South Bend, Ind.

The following-named officers were elected for the ensuing year:

President—F. D. Carpenter, Lima, Ohio, general manager of the Western Ohio Railway Company.

First vice-president—A. A. Anderson, Columbus, Ind., general manager of the Indianapolis and Southern Traction Company.

Second vice-president—F. J. Sloat, Dayton, Ohio, division manager of the Ohio Electric Railway Company.

Secretary-treasurer—W. F. Milholland, Indianapolis, [illegible] pany.

The meeting [illegible] by Colonel [illegible] president of the association. [illegible] Carpenter, W. [illegible] Joseph A. McGowan [illegible] Indianapolis Street Railway Company [illegible] Dayton, Ohio; A. W. Brady [illegible] A. Swenson of New York [illegible] of the American Street and Interurban Railway Association, and others.

National Electric-light Convention to be Held in Chicago May 19th to 22d.

The thirty-first convention of the National Electric Light Association will be held in Chicago, with headquarters at the Auditorium Hotel, on May 19th, 20th, 21st and 22d. The meetings of the association will be held in the assembly room of the Fine Arts Building, adjoining the hotel on Michigan Avenue. Exhibits will be displayed in the old dining room of the hotel, which is on the same floor as the meeting room and connected with it. The arrangement, therefore, will be similar to that at Washington last year. The banquet room of the hotel, on the sixth floor, will be used for auxiliary meetings.

The date of the meeting is a little earlier than last year in order to avoid conflict with important conventions, including the national Republican convention, which will be held in Chicago in June. Final arrangements will be made at a meeting of the executive committee of the association in Chicago about the middle of February. The members of this committee are Dudley Farrand, Newark, N. J. (president of the association); Alex Dow, Detroit (first vice-president); W. C. L. Eglin, Philadelphia (second vice-president); Arthur Williams, New York; Charles L. Edgar, Boston; John Martin, San Francisco; Frank W. Frueauff, Denver and New York; Charles R. Huntley, Buffalo; Louis A. Ferguson, Chicago; Frank M. Tait, Dayton, Ohio; A. J. De Camp, Philadelphia; George H. Harries, Washington, D. C.

Five conventions of the association have been held in Chicago, the latest in 1903.

A New Hydro-electric Plant in Japan.

The General Electric Company is furnishing complete electrical equipment for a hydro-electric plant in Nagoya, Japan, a city with a population of about 250,000, situated some 300 miles from Yokohama. The main generating station will be built at Yawozo on the Naiko River, where power will be generated at 6,600 volts by four three-phase, 2,500-kilowatt, 60-cycle, 360-revolution, waterwheel-driven generators. The generator voltage will be stepped up to the line voltage of 60,000 volts by 12 water-cooled transformers of 1,000 kilowatts capacity each, and transmitted 30 miles to the main sub-station just outside of the city of Nagoya. Here the line voltage is to be stepped down to 11,000 volts by nine water-cooled transformers of 1,350 kilowatts capacity each, and transmitted underground to the distributing station through triple-conductor, lead-armored cables, the city ordinances prohibiting an overhead transmission of over 3,500 volts. In the central distributing station the voltage will be stepped down to 3,400 volts by nine water-cooled transformers of 1,350 kilowatts capacity each, at which potential it is to be distributed throughout the city by both overhead and underground cables.

It is interesting to note that from the nearest railway station the entire power apparatus for the Yawozo station will have to be transported on specially constructed wagons, drawn by oxen.

The Naiko River is normally 40 feet in depth, but in the rainy season the river rises to 40 and 70 feet above low-water mark. This rising characteristic of the river will necessitate the building of a specially designed dam to take care of the high water.

How Wireless Messages are "Tapped" in Paris.

According to the experiments made by Mr. Ducretet, the well-known constructor of radio-telegraph instruments at Paris, all the "wireless" messages which pass anywhere near town can be tapped very easily, even without erecting a mast for the purpose. Mr. Ducretet simply attaches the wires of the instruments to the gas piping within the house, and, without any further effort, he says that he receives the messages upon the paper strip of the receiver. This matter has given rise to considerable discussion, as it has a great practical bearing. Messages which were sent from the Eifel Tower could be easily recorded in this way, and also the messages which were sent to the Tower station from the outside.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

NEWS of the side-door suburban cars of the Illinois Central Railroad, which have been in use in Chicago for four years, has reached London, and the Times of that city expresses its wonder that the "hustling" American "has not long ago found out the economical disadvantage of the typical saloon car in journeys requiring frequent stoppages, with an inflow and outflow of passengers at short intervals." These Illinois Central cars, it may be remarked, were designed for a particular service where there is a heavy suburban passenger traffic. The same railroad, and probably all others in the country, uses the corridor cars for its long-distance trains. The side-door cars are quickly filled and emptied, but it is the general verdict of passengers that neither the seats nor the general arrangement is so conducive to comfort as is the case with the ordinary type of passenger cars. In cold weather, too, the opening of numerous doors at frequent stoppages tends to lower the temperature of the car. While side-door cars have advantages, it is not probable that the railroads of the country will adopt them extensively, although in limited dense-traffic service their use may be advisable.

CHICAGO will extend a cordial welcome to the National Electric Light Association when it holds its thirty-first convention in this city in May of this year. The annual meetings of this important body have grown to be events of the first magnitude in the electrical field, and the conventions of the last few years have been largely attended and devoted to the discussion of matters of moment to the central-station industry. Questions of public policy, like municipal ownership and unfair competition; of business, such as uniform accounting, street-lighting specifications and relations with fire-insurance companies; of industrial progress, like the "new-business" movement and the extension of electric heating; of technical advancement, as the introduction of the steam turbine, the use of the gas engine, grounding secondaries, meter problems, protection from lightning and the new types of lamps—such questions as these and many others have been discussed by men of keen intelligence and wide outlook, to the great advantage of the industry. The exhibits displayed at the late conventions have also been timely and instructive and arranged with care. Within the last five or six years the association has been greatly strengthened and improved in every way, and it is now a very present help to all its members.

Formed in Chicago in 1885, the National Electric Light Association has held five of its conventions in this city, and that of 1908 will be the sixth. Recent meetings have attracted members and visitors in large numbers. The registered attendance at Washington last year was 1,675. But Chicago is no stranger to big conventions; the electrical men and their wives may come in their thousands, and there will be comfortable accommodations and a cordial greeting for all. In such necessary convention auxiliaries as railroad and hotel facilities, Chicago is, of course, all that could be asked. It has, moreover, one of the largest and most interesting central stations in the country in the Fisk Street plant, besides electrical and other attractions numerous in number and varied in kind. A great convention is assured beyond a doubt, and Chicago will be honored in being the place where it is held.

GROUNDING THE NEUTRAL of high tension alternating-current systems is one of the open questions in electrical engineering, and as considerable has been said in favor of such a course, it is of interest to record an opinion on the other side, put forth as the result of practical experience. In a recent Institute discussion Mr. Philip Torchio of New York mentioned the experience of the New York Edison Company's system, which is operated at moderate high voltage, but without grounded neutral. As the result of their experience the engineers of that company have not found as yet enough evidence to convince them either of the necessity or the desirability of grounding the neutral of 6,600-volt or 11,000-volt high-tension systems operated underground.

The New York Edison system operates at 6,600 volts, three-phase, 25 cycles. The cables are mostly [illegible] conductors and the same between each conductor and ground. The feeders are operated on the radial system, not connected in multiple at the sub-stations. The system was started in 1898 with about three miles of high-tension cable and grew steadily from year to year to the present system of about 200 miles. During the nine years' operation there have been 66 cable troubles of all kinds. Of these 32 developed during operation and 34 were found either by the periodic insulation test or by inspection of the routes. An analysis of these troubles shows that 18 operating troubles might have been due to surges or similar causes—a figure which is said to compare favorably with systems of like extent where grounded neutrals are used.

"Furthermore," says Mr. Torchio, "in every instance, when we had a burnout or disturbance of any kind, we fully investigated all attendant circumstances and tried to figure out how the results might have been modified by having the neutral grounded, and in no case of cable burnouts did we find that the results would have been sensibly improved by the presence of the grounded neutral."

WE ARE NOT so "electrical" as we were in other days. With the broadening of the arts of electrical application, electrical men have broadened also; they are steadied by large responsibilities. It is an important thing to prepare the future electrical engineer for the tasks that will be his, and hence few subjects arouse more earnest discussion among electrical engineers than that of technical education. Such a discussion was held at the New York meeting of the American Institute of Electrical Engineers last week, and a condensed report of it is given in this issue of the Western Electrician.

A broad, sensible, sober outlook is to be noted in the various contributions. The American technical school has done much, but it recognizes its deficiencies with sorrow. A large employer of young men graduated from the electrical engineering departments of American colleges made the bold implication that fifty per cent. of these men should not have been allowed to graduate. A number of college professors were present, but no attempt was made to controvert this declaration. Instead, the professors asked the men of electrical affairs what they would have the students taught. The answer to this question is not easy; it is less difficult to criticize the technical school than to plan practicable improvement. In general, the response was that more attention must be paid to fundamental principles, as physics, chemistry and mechanics. Mathematics is valuable as a tool. The number of studies must be lessened so that the quality of instruction in those that remain shall be better. More attention should be paid to broad cultural studies. Students should come better prepared; entrance requirements should be higher.

The last recommendation touches a grave defect in the entire educational system of the United States. Instruction in the primary and secondary schools is not as thorough and careful as it should be. Here, too, quality is sacrificed to quantity; the children are given a smattering of many things, but know few things well. As a nation, how few among us can write a clear, legible hand; can read aloud to the delight of our hearers; can express ourselves with force and precision, not to say elegance, in the English language; can spell all ordinary words with confidence; can face undismayed a problem in cube root or even a long sum in addition; can tell offhand whether Bagdad is in Arabia or Turkey or name the capital of Oklahoma; can give a brief outline of the history of our own country, much less of any other, or can state the approximate distance from the earth to the sun, or any other simple fact of science! It is true that not all grammar-school children are to become engineers, but all engineers, practically, must go through the grammar schools. The foundations on which technical education rests require strengthening, and electrical engineers who desire to raise the standard of their profession should not overlook the importance of doing their utmost as citizens to make more sound and thorough the teaching of the common English branches in the grammar school and the more advanced studies in the high school.

Educating the Electrical Engineer.

A valuable discussion on electrical engineering education was held at the New York meeting of the American Institute of Electrical Engineers on January 24th. Some of the points brought out in a large mass of useful material are given herewith.

Charles F. Scott, consulting engineer, Westinghouse Electric and Manufacturing Company, Pittsburg: Before discussing how to do something, it would be well to decide what it is we desire to do. What do those who use engineering graduates want them to be able to do? Ideas have varied. Some expect trained artisans; others, trained engineers who are ready at once to do any kind of engineering work. Some expect technical specialists; while others call for men of ability who have a general preparedness for doing any kind of work. Some are disappointed if graduates are not immediately productive, while others provide courses of practical training. As all boys are not alike, and as their future employers have different ideas, and as their jobs will not be the same, it reasonably follows that there is room for more than one kind of training in college. The problem is not wholly abstract; it is vitally concrete. Its solution is not a rigid and narrow one, but it involves general policies.

The best engineering education is that which fits the individual student for his largest development and usefulness in the long run, not necessarily immediately after graduation. The problem, therefore, is to divide the four years spent in school among the three classes of studies in such proportion as will bring about the best results.

The problem is largely one of elimination, as, if all the studies were included which have been suggested as being essential or desirable in the training of an engineering student, the college period of four years would have to be increased to possibly twenty or thirty years.

I venture the prediction that the solution which will find most general acceptance will be that which gives to each student the training which fits him for his largest individual development; that for those who are qualified to take an active rather than a passive attitude toward their work the broader education, which emphasizes training rather than knowledge, will be chosen; that a fairly intimate intermingling of college work with practical work will be found to conduce to the efficiency of each, and that the field in which the greatest difference of opinion will be present will be with regard to the proposed concentric method. This system clashes with time-honored educational ideals, but it presents arguments which are so rational that the existing method must assume the defensive.

Charles P. Steinmetz, consulting engineer, General Electric Company, Schenectady: When in the following I dwell more on those features of our electrical engineering education which appear to me unsatisfactory, it is not that I overlook the many good points, but rather that a criticism of the few defects appears to me more important, for the purpose of urging their elimination.

The great defect of the engineering college is the insufficient remuneration of the teaching staff; the salaries paid are far below those which the same class of men command in industrial work, and as a result the college cannot compete with the industry for its men, but most of the very best men are out of reach for the colleges. It appears to me that a vast improvement could be made in electrical engineering education if a large part of the sums which are now devoted to marble engineering buildings and fancy laboratory equipments could be devoted to offer such salaries as to make available to the colleges the undivided time and interest of the best men in the field.

To the subjects taught and the methods of teaching very grave objections may be made. The glaring fault of the college curriculum is that quantity and not quality seems to be the object sought; the amount of instruction crowded into a four years' course is far beyond that which even the better kind of student can possibly digest. Memorizing details largely takes the place of understanding principles, with the result that a year after graduation much of the matter which had been taught has passed out of the memory of the student, and even examinations given to the senior class on subjects taught during the freshman and sophomore years, reveal conditions which are startling and rather condemnatory to the present methods of teaching.

It stands to reason that with the limited time at his disposal, it is inadvisable for a student to waste time on anything which he forgets in a year or two; only that which it is necessary to know should be taught, and then it should be taught so that at least the better student understands it so thoroughly as never to forget it. That is to say, far better results would be obtained if half or more of the mass of details which the college now attempts to teach were dropped; if there were taught only the most important subjects—the fundamental principles and their applications—in short, all that is vitally necessary to an intelligent understanding of engineering, but this taught thoroughly, so as not to be forgotten.

The better technical colleges realize that the first [illegible] the high school, since during the high-school years the intelligence of the boys is not sufficiently ripened for its grasp and [illegible] necessary.

However, even if no attempt [illegible] to teach or to review general subjects, the work [illegible] carried [illegible] Mechanical engineering, physics, chemistry, and some civil-engineering subjects are recognized as legitimate subjects of teaching in the electrical-engineering course in many colleges, together with literature, some history, etc.; but physiography, physical geography, meteorology, mineralogy, astronomy, etc., are also of importance in a general engineering education.

To illustrate in the case of chemistry: The electrical engineer should have a knowledge of the laws of chemistry, a familiarity with the elements and their compounds, and a general knowledge of the methods of analysis and synthesis. Such a course must, therefore, necessarily be largely descriptive, and the experimental work largely illustrative.

Astronomy is one of the most interesting and fascinating of subjects. But where taught as a part of the general educational programme, it frequently is all mathematics, and so hopelessly dry and repellent. It should be given descriptively, for in a short course on astronomy it is just as ridiculous to delve deeply into mathematics as it would be to start the teaching of geography with a course in spherical trigonometry.

In conclusion, the main defects in the present electrical-engineering training in some of our colleges appear to me as follows:

1. The insufficient remuneration of the teachers, which makes most of the best men unavailable for educational purposes, and is, therefore, largely responsible for the other defects.

2. The competition between colleges, which leads to a curriculum marked more by the quantity of the subjects taught than by the thoroughness of the teaching. The graduates are sent out with a mass of half-understood and undigested subjects, quickly forgotten, and deficient in understanding of the fundamental principles and in the ability to think.

3. The tendency of some colleges to teach the trade of electrical engineering rather than educate intelligent and resourceful electrical engineers.

4. The unsatisfactory state of the teaching of allied sciences, which gives instead of general view and understanding of the science, a fragmentary knowledge of some details.

L. A. Osborne, manager of works, Westinghouse Electric and Manufacturing Company, Pittsburg: Fifty per cent. of the technical graduates that present themselves to be employed might better never have undertaken their profession; at least that proportion of those with whom I have come in contact have apparently chosen an engineering profession more in the hope of the emoluments and not from any real interest or love for the work. Of all those that remain and who may be termed good promising timber, the chief fault that I have to find with them is that they are generally unable to grasp abstractions; that they are unable to generalize. There is a question, therefore, of injecting into the courses something which will stimulate the powers of generalization, which, broadly speaking, is more general culture.

The engineer's training should give him that fine degree of discrimination which enables him to know what is good and bad in engineering, and inasmuch as engineering has become so important an adjunct to our everyday lives, the engineer should likewise have that discrimination as to enable him to judge between the good and bad in mankind itself.

Prof. H. E. Clifford, Massachusetts Institute of Technology, Boston: A poor system may be made effective with a good teacher, and a good system can be ruined by a poor teacher. After all, education has for its primary object the training of men to think straight, to think logically, and the particular type of education, whether it is civil engineering or electrical engineering or chemical engineering, is merely a medium for bringing that thing about. This teaching of men to think straight, to think from cause to effect, must be carried out both in the classroom and in the laboratory. No amount of training will help some men. The spark of genius is not developed in a technical school unless there be some smoldering spark, at least, to begin with, and men without capacity, I believe, should be eliminated early.

After all, the most important thing is to reduce the number of subjects taught in the curriculum. Each institution fears if it reduces its curriculum it will be thought to be narrowing its training, instead of which it is broadening its training. There is too much of a fear that we will turn out a student who will meet something in his career [illegible]

Prof. F. B. Crocker, Columbia University, New York: [illegible] Falls, the so-called concentric method, where he [illegible] enter the institution and fail to graduate? If 50 per cent of the graduates [illegible] apprentices in a manufacturing establishment, it is fair to say that 75 per cent of those [illegible] the institution [illegible] shall we do with this 75 per cent.? We let 50 per cent. go through and go to manufacturing concerns, and we are criticized accordingly, and, I am sorry to believe, very justly criticized. My idea is in the first and second years there should be at least some subjects so severe and so analytical and so eliminating as not to allow men to get into the fourth year who should not get there, and it is still more important not to allow men to graduate to the extent of 50 per cent., or even 10 per cent., who should not do so.

H. W. Buck, electrical engineer, New York city: It is frequently argued that a student should be carefully grounded in the theory before he undertakes any practical operation or handling of apparatus involving that theory. I believe that this is not in accordance with the workings of the majority of human minds. The study of thermodynamics, for instance, takes little hold of the mind of a man who has never personally handled a steam engine. The mathematical theory of an alternating-current transformer is merely a symbolic puzzle to one who has never had personal association with the current and voltage reactions in a transformer under practical working conditions.

This sequence is not usually followed in technical education. It is considered orthodox to give a student a thorough theoretical ground-work before allowing him to handle machinery in which the theory is applied, and I am inclined to think that this sequence should be reversed.

Prof. W. S. Franklin, Lehigh University, Bethlehem, Pa.: We ought in all of our technical schools to plan a curriculum in which the student is carried over the elementary subjects of physics and chemistry in a comparatively brief course, with the idea of accentuating the really fundamental things, and then this course should be followed by more elaborate courses in technology.

The idea of numbers is the most strongly embedded in the human mind of any of the impersonal ideas. One result of that is that it is extremely easy to cheat a young man into the belief that he is studying something real, if only it involves arithmetic, and one of the most dreadful comments on our modern scientific education is that it is so tremendously overweighted with an enormous mass of numerical problems, the data of which are either entirely beyond the student's experience or with respect to the determination of which he has absolutely no idea or understanding. A problem of that kind is to my mind utterly and absolutely useless. You are simply cheating your young men, and, of course, cheating yourself, with the idea that you are accomplishing something, when, as a matter of fact, you are accomplishing nothing at all.

For many years I have felt in the case of my own students that the man who had been in a shop and had had experience with belts and wheels and rods and hammers and saws, was very much better prepared in physics than the man who had been to a high school. I have always been impressed with that fact and never saw one exception to it. I agree with Mr. Buck entirely.

L. B. Stillwell, consulting electrical engineer, New York: The answer to the question, "To what extent should the technical school devote attention to purely professional subjects?" depends upon the relative value to the graduate of professional information as contrasted with education. Undoubtedly professional information may be imparted in such a manner as to educate, but for the purpose of expressing an opinion in reply to the question which has been formulated by the educational committee as the topic for this evening's meeting, it is perhaps sufficiently exact to speak of "education" and "information" not as they are inter-related, but as they are contrasted.

And before the question can be answered it is necessary, as Mr. Scott has suggested, to define one's idea of the part which the engineer should be prepared to take in modern life.

As regards this, the conception which apparently is widely accepted, not only by preparatory and undergraduate technical students, but also by many "over-practical" parents, is narrow and short-sighted. The enormous advances in physical sci-

ence and in the application of physical science to modern life are glibly asserted and reiterated and the effects of utilization of natural laws and forces upon the economic and social structure of society are more or less appreciated. But when we come to educate a boy for the special purpose of taking an active part in this gigantic movement, the tendency too often is to start him at the earliest possible moment in a narrow channel of thought, to narrow his intellectual horizon and make him a mere mental mechanic. This, in my opinion, is all wrong.

If graduates in engineering courses are to become generals, or even colonels, in the army of engineers, it is obvious that the breadth of their training should bear some relation to the fundamental possibilities and demands of the field in which they are to labor. The engineer who desires to rise, therefore, should start, if possible, with a broad education. Truth is truth, fallacy is fallacy, and logic is logic, in any field of thought. In nine cases out of ten mere professional information acquired in the technical school is of comparatively little value to the graduate. This is particularly true in the case of a rapidly advancing art, such as electrical engineering, for the reason that a considerable part of the professional information acquired in school is out of date by the time the graduate attains a position where he has opportunity to utilize it. Practical information which he can readily utilize is acquired rapidly in factory or office, in mine, mill or laboratory. Following graduation, the work which young engineers in almost all cases are called upon to do for a number of years is highly specialized, and professional information comes to him in the most effective manner. During these years, if he is working earnestly for advancement, his field of observation and thought, so far as his professional work is concerned, is necessarily limited and comparatively narrow. The opportunity for fundamental education rarely presents itself after completion of the course in the technical school, and unless prior to that time a broad foundation has been laid it never can be laid.

The ideal education of the engineer who hopes to be more than a private in the ranks is a broad one. It cannot very well be too broad. In my judgment, whenever possible a technical course leading to a degree in engineering should follow a four years' course leading to the degree of bachelor of arts or bachelor of science. In other words, engineering courses should be regarded as professional courses and should perform the same function in the education of the engineer that the law school fulfills in equipping a graduate in the course of arts for the practice of law.

In those cases where this is not possible, and the student finds himself necessarily limited to a course of four years in a technical school, the aim should be decidedly to educate him rather than inform him.

In my experience the following facts of observation have impressed themselves upon me:

(1) American engineers today do not hold positions of leadership in the community to an extent commensurate with the part which engineering plays in modern life.

(2) The graduates of our technical schools, while averaging well in respect of mental ability and earnestness, often lack mental perspective and are rarely capable of expressing themselves with accuracy and force.

(3) The men who rise highest in the engineering profession, generally speaking, are the men of broader education.

(4) Chief engineers and managers have little trouble in finding draftsmen and less in finding competent calculators, but the demand for "all-around men" always exceeds the supply.

(5) The higher executive positions in administration of our great railway and industrial corporations are held rarely by engineers. In recent years undoubtedly the engineer has been making substantial progress in this direction, but in general he fails to occupy his share of the higher places in administration.

I would particularly indorse what Mr. Steinmetz has so ably said in regard to that fault of teaching which aims at quantity and not quality. The result in a great majority of cases is mental indigestion, from which the student sometimes, but not always, recovers after graduation. The cause underlying this unfortunate and very serious state of affairs is to be found probably in the ill-advised competition of schools and colleges. The school of the future is the school which will have the [illegible] its curriculum 25 per cent. [illegible] required for graduation, and [illegible] and not quantity.

[illegible] Institute of Technology [illegible] A number of speakers, including Dr. Steinmetz, have said that we should [illegible] together very

well; we are to cut out some subjects and have less quantity, but yet keep up every subject throughout the whole college course. I expect Dr. Steinmetz does not mean that will be taken literally. For instance, I do not suppose he would intend that the subject of chemistry should be taught to the end of the college course.

Dr. Steinmetz: I do.

Professor Ganz: Then I would very much like to know how we could cut down our course and yet keep every subject throughout the four years. I want to indorse what Professor Crocker said in regard to the concentric method of teaching. I have read that paper very carefully, and while it has many good points, I do feel very strongly that the college is the place where theory must primarily be taught and that this theory must be accompanied by illustrations from practice.

J. G. White, New York: There seems to be a practical unanimity of opinion that the aim of the college education for engineers should be to build up a theory foundation, a groundwork as to the fundamental subjects on which the engineer should have knowledge rather than to give him specific information, and I fully agree as to the thorough wisdom of this. The specific information can be readily acquired after leaving college, whether it be with one of the large electrical companies, or in a consulting engineer's office or out in the field in erecting machinery or other construction. The fundamental, such as a good general knowledge of mathematics, and a thorough knowledge of physics and chemistry, both of which I consider extremely important, cannot readily be acquired in the field.

In addition to English, which I am glad to see is being followed up consistently and persistently, one of the subjects which I perhaps am inclined to unduly estimate is the study of Spanish as compared to other language studies. It seems to me that Spanish has practically as much educational value, and almost as much value as a culture subject, though perhaps not quite so much, as French or German, and so much likely to be of use in practical life after graduation, that I strongly favor the average engineering student studying Spanish if he possibly has the opportunity of doing so, especially if he can study one other language. As a second language, Spanish is distinctly desirable. We have had applications for engineers knowing Spanish, continuously for the last six or seven years, and frequently a man can earn $2,000 or $3,000 more per annum if he has a knowledge of Spanish.

Another suggestion is that ordinarily I believe the college professor is too much inclined to go to lectures and too little inclined to depend on well-worked out, well-planned text-books which some other professor, or group of professors, has written. It seems to me that the lecture room is of great value in physics and chemistry and in electrical engineering as illustrating the fundamental principles, but that the fundamental principles should be put before the student in such shape that he has something to study, can study, in his room, and his time is not wasted by making a lot of notes and going through the mechanical operation of copying them and by the time he has them copied has no particular understanding of the subject.

Prof. W. E. S. Temple, University of Pennsylvania, Philadelphia: One of the most important features in the education of the engineering student, it seems to me, is that he first get the principles and general applications of certain of the important types of machines; he does not need to take up every type of rotary converter which is built, nor every particular kind of switchboard; he must generalize; and the most important part is the method followed in taking up that work. One of the vital features in his training should be the requiring of promptness and accuracy. He should be penalized for absence from classes. In the carrying out of his laboratory work, it seems to me, there should be a sifting process; that is, if the students work in the laboratory in groups of two or three or more men each, if they are not carefully grouped together, good men with good men, the chances are that the inferior man, in greater or less degree, will absorb some of the work of the other man and not necessarily learn from him. By individual instruction this sort of thing is prevented.

Louis A. Ferguson, vice-president Commonwealth Edison Company, Chicago: The great value of an engineering education to a young man about to start in his life's work lies not so much in the actual knowledge he may bring with him, but in the training which he has received. The accumulation of a mass of data is not the important thing, but the reasoning power which he has acquired is what will serve him in good stead in after life. The technical training of our engineering schools develops the analytical mind and teaches the young man to differentiate between right and wrong, promote sound judgment, which, after all, is, with initiative and optimism, one of the great factors in producing the successful man in any walk of life.

It is a mistake, as Dr. Steinmetz has clearly pointed out, to try to jam the maximum amount of information into the student's mind in a given year, only to be forgotten the next.

Premium should be placed upon the development of reasoning power rather than the mere memory of the student, and any subjects that he must know in his practice after graduation should be kept constantly before him throughout the entire course, so that he may carry his knowledge, once acquired, with him into the world.

There is a tendency in some educational institutions to a practice which I think is not conducive to the best results. I refer to what might be called "inbreeding;" that is, the general employment of graduates of a given technical college as teachers and professors in that college. This promotes narrowness in view among the students, mental fatigue among the teachers, resulting in the decline of the educative ability of the institution. The faculty of an engineering college should be made up of men graduated from as wide a range of colleges as possible. Eastern colleges should have some professors who have been trained in the West and South, and western colleges should have professors who have been trained in eastern institutions, so as to give as broad a character to the education as possible and to keep alive in the faculty itself real interest in its work.

We find in the management of industrial corporations that the best results are obtained by following this principle in the employment of engineers. The very college patriotism which exists in the heart of every true American will prompt him to try to equal in efficiency his fellow engineer from another institution, and this rivalry, which must be friendly to accomplish the desired result, is bound to make finally for the interest of the corporation.

Professors and teachers are not as a rule sufficiently encouraged by their college management to come in contact with the practical side of engineering, or the work accomplished in other similar institutions, as they might be were they given the opportunity to mingle more with practicing engineers and industrial managers and by travel in this and other countries. They are as a rule forced to gather their information by reading and study, which is less satisfactory than actual contact and observation.

Why, if the industrial corporations find it profitable to send their engineers and managers to other parts of this country and Europe to study conditions and make comparisons, should not the technical colleges and institutions find it equally so to do the same with their teaching staff?

The scope of the course of electrical engineering in some institutions, it seems to me, is too narrow. The graduate electrical engineer for some reason is considered by some employers to be devoid of ability to discuss anything but electricity, and his opinion on other matters is discounted, and oftentimes very unfairly to him. This is unfortunate, as there is probably no branch of engineering which requires so general a knowledge to be successful as that of electrical engineering.

The course in electrical engineering should include the fundamental principles of mechanical engineering and civil engineering, chemistry and hydraulics, building construction and general business law as well as theoretical and applied electricity. The student should be impressed with the fact that a general fundamental knowledge of the branches of engineering other than pure electrical is paramount to ultimate success in electrical engineering, if by that we mean obtaining a position whereby one is given the responsibility of conducting large engineering undertakings, or the management of large industrial operations.

Dr. Samuel Sheldon, Polytechnic Institute, Brooklyn: In reference to Mr. Scott's paper, the extract of the Institute papers is on the whole so general as to be of little value to one engaged in laying out a curriculum. One, however, and that is the paper presented by Professor Karapetoff, is very definite, and it is accompanied by a specific schedule for each year. Now, the advantages which are claimed for this concentric method should be obtained, I believe, if possible, but I do not consider that it is necessary to make use of such radical method as is outlined in that schedule. If that schedule be followed it has two marked disadvantages: First, the hiatus in the pursuit of mathematical studies must inevitably result in educational inefficiency, and second, a knowledge of physics is absolutely essential for any serious engineering study.

P. H. Thomas, manager Cooper Hewitt Electric Company, New York: The factors of greatest importance underlying successful engineering are perhaps the following:

1. A thorough appreciative knowledge of the laws of nature and of the properties of materials. These laws and properties, as used in engineering, are simple and relatively few.

2. Familiarity with the mathematical and other logical processes by which the fundamental laws are to be applied to special cases and results numerically computed. Here self-confidence and the power of applying knowledge are of the greatest

importance. It is here that many graduates are lacking. This section must be construed very broadly to include the principles of all types of machines.

3. Familiarity with the results of experience: what has actually been accomplished in the past and just how. This is of the greatest importance and is further the basis of the great mass of sound engineering work done. The results of past work are found partly in the general practices of the community, partly in books and periodicals and partly in the records of individuals of experience.

Here should be included, at least for the more ambitious engineers, a knowledge of the more important experimental work done and the new methods and apparatus proposed by inventors.

4. Acquaintance with the actual methods, standards, practices and engineering terms in vogue in any particular community. These may be different places, but an engineer cannot work with another without this acquaintance.

Over and above these, our conditions, the effectiveness of an engineer of course depends on his personality; but this is not properly a matter of education.

Prof. W. L. Robb, Rensselaer Polytechnic Institute, Troy, N. Y.: Under the present condition of things, culture subjects have a place in a technical school, but I believe they only have a transient place, because I do not think a course in English or history or political economy has any more place in a technical school than in a medical school or law school. I think we should see that the entrance requirements of technical schools are brought up to the entrance requirements of colleges.

C. O. Mailloux, consulting electrical engineer, New York: I agree with Mr. Stillwell almost verbatim. I have seldom heard a brief discussion which put the facts from the standpoint of the engineer so well as he put them. I noted with some interest as the discussion went along, in trying to check the points covered, that on reference to some of the formulated statements regarding the technical education requirements, that these had been mostly covered in previous discussions before the Institute, particularly by the papers of Professor Esty and Professor Sheldon. My own view about engineering education is we should attempt much less and we should attempt much more. We should attempt less in so far that we should not try to cover so many subjects, but we should try to cover them more thoroughly.

Two of the greatest achievements in electrical engineering, in my opinion, have resulted from the solution of differential equations. That may seem like a strange statement. The first was when that great electrical engineer over whose memory we held a meeting a few Sundays ago, Lord Kelvin, solved the differential known as the telegrapher's equation, and predicted all it was necessary for us to know, and told us the facts in relation to transatlantic telegraphy. In doing that he had generalized the method. Later on we had another solution, a far more complete solution of that same differential equation by our own member, Dr. Pupin, which, as you know, has done as much for telephony as the solution of Sir William Thomson did previously for telegraphy.

Prof. D. C. Jackson, Massachusetts Institute of Technology, Boston: In regard to Mr. Stillwell's proposition that the solution of the engineer's education is going to be brought about through the plan which is now becoming a shibboleth, the arts course first and engineering course afterward, I am inclined to agree with the proposition, but not as it is carried out today. If we have two horses, it is better to drive them parallel instead of in tandem. It is better to carry general studies throughout the man's college career than to carry them to a certain point and chop them off and start a new line of education.

H. G. Stott, superintendent of motive power, Interborough Rapid Transit Company, New York: The discussion tonight might be summed up by saying that there is a lack of general education of the freshman who starts in college. What is that caused by? The hodge-podge and smattering he gets in primary schools—a little of this and that, and nothing of anything. The cure for that is for our technical schools to raise the standard of entrance examinations. If that is done the other schools will be forced to raise their standard to meet it. The discussion seems to lean distinctly toward the point that engineering schools should teach the fundamental principles and not engineering practice. When a student graduates with a degree he is not an engineer. I do not believe degrees should be granted until a man has been out of college for at least five years.

Mr. Scott: We must recognize there are two classes of men—some who are good for the ranks and some who are good as leaders, and men are adapted by their inherent characteristics for one or the other position. The concentric method of the psychological development appealed to me as being attractive; it seems to me a thing which is [illegible]

[illegible]

[illegible]: [illegible] only by looking at it from every possible viewpoint. [illegible] properly by considering it as a short-circuited armature revolving in a rotated field; it is not understood by considering it as an armature acted upon through the medium of magnetic fields, or by the derivitation of the direct-current shunt motor combined with the transformer action, transferring power to the rotor instead of leading it in by commutator or brushes, nor is it understood by considering it as an electric circuit revolving in a magnetic field; you have to approach it looking at it from all these viewpoints before you can thoroughly understand it. There is no time for this in the present college course when you attempt to teach all you do now.

I do not believe in text books. I agree that a good text book is better than a poor instructor. You may carry that still further and say that a good corresponding school is better than a poor college. A good text book appears to me merely a way of ameliorating a little the objectionable effects of a poor instructor, but a good instructor or professor is vastly superior to the best text book.

The Promotion of Industrial Education.

The first annual convention of the recently organized National Society for the Promotion of Industrial Education was held in Chicago on January 23d to 25th. It was attended by a large number of educators, manufacturers, sociologists and labor representatives. The meetings were preceded by a luncheon given to the officers of the society by the Chicago Association of Commerce at the Great Northern Hotel on January 22d. At this gathering addresses were made by the secretary, Prof. C. R. Richards of Columbia University, New York; Vice-president M. W. Alexander of the General Electric Company at Lynn, Mass.; Prof. George N. Carman, Lewis Institute, Chicago; Prof. Louis C. Monin, Armour Institute of Technology, Chicago, and others, who outlined the objects of the society, and these were heartily approved by the association.

At the dinner given on the evening of January 23d at the Auditorium Hotel some 500 persons were present. This was the opening session of the convention and was presided over by Mr. Theodore W. Robinson, first vice-president of the Illinois Steel Company. The principal addresses were made by Dr. Charles W. Eliot, president of Harvard University; Mr. James W. Van Cleave, St. Louis, Mo., president of the National Association of Manufacturers, and Dr. Henry S. Pritchett, New York city, president of this society and of the Carnegie Foundation for the Advancement of Teaching. A letter from President Theodore Roosevelt was read, in which he expressed his hearty sympathy with the movement for giving the American boy an opportunity to acquire a useful trade or other fruitful occupation. Dr. Eliot advised raising the age limit for compulsory education from 14 years to 17 or 18 years for those not attending the present high schools, and the provision of combined school and shop instruction during these years. He believed that the teachers in the elementary schools should sort out the children according to their aptitudes and aid them in choosing a vocation.

Mr. Van Cleave called attention to two striking statements that had attracted much comment. The first in regard to industrial education in Germany was: "The little kingdom of Bavaria, with a population not much greater than that of New York city, has now 290 trade schools, giving instruction, night and day, in 28 trades and crafts to pupils from the first to the fifth grade. In this whole country of 85,000,000 people there are fewer trade schools than are in that little German kingdom." The other expression, which is taken from a magazine article by Mr. Speed Mosby, Missouri state pardon attorney, was this: "Two-thirds of the convicts in America's greatest prisons are men without a trade or profession." He therefore called attention to the industrial and moral importance to this country of establishing good trade schools.

President Pritchett, in concluding the speeches, referred to the problem the society was organized to grapple with as one for industrial peace and not for war with the laboring interests. He said that advanced labor leaders realized that the old apprenticeship system was practically dead and that the trade school will be a help to all workmen, since it is to provide systematic training [illegible] ble time commensurate with efficiency and skill. [illegible] outlined the apprentice system in use in the railroad shops [illegible] prentices follow. Instruction in educational subjects allied to their trade [illegible] are already doing more and better work, can read drawings better and take a great deal more interest in their occupation. [illegible] principal of the Pennsylvania School of Industrial Art of Philadelhia, stated that more trade schools of the kind that teach the elements or rudiments of most any calling are not wanted. What is needed is a system of schools that will supplement the work of the shop by that of the school, teaching those points that an apprentice at the bench wants to know about. A number of other speakers brought out similar views.

At the afternoon session a paper was submitted by Dr. V. C. Alderson, president of the Colorado School of Mines, on "The Effect of the German Trade School System Upon the Development of German Industries." He showed that through the attention paid to industrial education Germany in recent years has been transformed into a manufacturing nation and its exports of finished products have placed it in the lead in that line. During the last 30 years the number of industrial schools has increased fivefold in that country. Director Charles F. Perry of the Milwaukee Public School of Trades, speaking on "The Trade School as a Part of the Public School System," outlined in detail a type of trade school which would be practically a series of shops with shop hours, to which the necessary classroom work would be added. Mechanical drawing, workshop mathematics, shop talks, lectures and inspection trips must be provided for. Privately endowed schools cannot hope to do much in this line, since they can reach only a small number of pupils. Mr. Milton P. Higgins, president of the Norton Companies, Worcester, Mass., emphasized that the proper trade school should be a shop with a school attachment instead of the reverse, as is true of many schools now. Prof. Graham Taylor of Chicago advocated introducing trade instruction in the elementary grades instead of at the close of the grammar school work. This would keep up the interest of a large number of pupils that now drop out before completing the grammar school work. The sociological importance of industrial education should be considered and proper consideration given to its effect on the interests of the skilled workman in laying out a comprehensive system.

At the evening meeting "The Attitude of the Wage-earner Toward Industrial Education" was the theme of Mr. Luke Grant. The worker has been cautious of his approval of the trade school agitation, because there are now several that profess to turn out finished journeymen in short order. These are operated for private gain, of course, but unless the system of schools proposed shall be under proper supervision and maintained for the benefit of the youth of the land, no encouragement need be hoped for from the working classes. Dr. Emil G. Hirsch of Chicago spoke of the moral aspect of industrial education. He declared that the principal appeal of educators has been to the head of the pupil, and only recently have they considered his hand. By industrial training, however, they will reach his heart as well as hand, for the pride in what he produces will take hold of the pupil and inspire him to do and do well what he undertakes. Other speakers considered this feature also of the general topic, "The Wage-earners Benefit from Industrial Education," and a number discussed the industrial training of girls.

The Saturday morning session was presided over by Mr. E. G. Cooley, superintendent of schools of Chicago, and president of the National Educational Association. A number of prominent educators and other speakers discussed the subject, "The True Ideal of a Public School System that Aims to Benefit All." The consensus of opinions advanced was that manual training should be extended to the lower grades and that the high school should no longer be used as a stepping stone to a college course alone, and also that the function of the public school is to educate its pupils so that at whatever point they leave school their earning capacity will have been increased. One speaker emphatically declared that culture had

been given too prominent a place in present schools.

The convention closed with the annual business meeting on Saturday afternoon. The appointment of a committee of ten was authorized to report to the society on the relations of industrial training to the public school system of the United States. Officers for 1908 were chosen as follows: President, Carroll D. Wright of Worcester, Mass.; vice-president, Magnus W. Alexander of Lynn, Mass.; treasurer, Frederick O. Pratt of Brooklyn, N. Y. A number of vacancies on the board of managers were filed by the election of the following-named persons:

Dr. Henry S. Pritchett, V. Everit Macy, Samuel B. Donnelly and Frederick A. Halsey of New York city; Frederick P. Fish of Boston; Mrs. B. B. Munford of Richmond, Va.; G. Gunby Jordan of Columbus, Ga.; Hon. Horace E. Deemer of Red Oak, Iowa, and George N. Carman of Chicago. Under the rules of the society the secretary is chosen by the board of managers.

A very instructive exposition of the work and product of the industrial schools and institutes of technology of the United States, organized at the Chicago Art Institute under the direction of Secretary Charles H. Morse of the Massachusetts Commission on Industrial Education, was visited by many thousands of citizens of Chicago and by the delegates to the convention during the days occupied by the sessions.

Engineering as a Life Work.

An informal address was delivered before the students of Purdue University, January 27th, by Mr. Henry H. Norris, professor of electrical engineering at Cornell University. Following is a syllabus:

Engineering consists in the industrial application of physical principles by (a) designing and constructing machines and other devices for specific purposes; (b) selecting and arranging such apparatus to produce definite commercial results with maximum efficiency.

Engineering to the individual may mean (a) a business, (b) a profession, or (c) a trade. It may be one or more of these. It should be all of them.

A technically trained engineer owes the community more than does the average citizen, as he represents a greater investment.

The community has a right to expect qualities of leadership from technical graduates. The first of these is the ability and desire to accept responsibility. An embryo leader is one who lightens the load of the people above him. He is doing this with muscle, not wind. A second element of leadership perparation is thoroughness. A third is perspective, seeing the relations of things and thoughts to each other.

The purpose of technical training is not that its recipients may make a better living or make a living more easily. At the same time, as a general rule, a high-salaried position carries with it splendid opportunities. On the other hand, many low-salaried positions afford excellent opportunities for efficient service.

Technical graduates (and others) divide themselves more or less automatically into two classes—wage earners and salaried employes.

The first puts his skill, the second, himself, into his work.

The first is paid for his labor, the second for his interest.

The first is paid for overtime; there is no overtime for the second.

The pay of the first is regulated by the unions. The second is (theoretically) paid a reasonable living salary, consistent with the expenses to which his position subjects him.

Good work on the part of wage earners is usually recognized, as the results are evident. It is not always so in the other case, as the true leader loses himself in his work.

Osborne's maxims for leaders:

1. Allow nothing to be everybody's business.
2. Make everything somebody's business.
3. Let no one interfere with another's responsibility.
4. Put in force a clear and simple system, but
5. Avoid red tape.

Things some technical graduates cannot do:

Answer a business letter by return mail.
Write a clear, brief report or letter.
Defend their own opinions.
Reason from premises to a conclusion.
Realize the obligation involved in a contract.
Inspire others to their best efforts.

Ithaca Section of the Institute.

[illegible] after the Christmas vacation two special meetings of the American Institute of Electrical Engineers were held by the Ithaca (N. Y.) branch. At the first Prof. W. D. Bancroft, head of [illegible] Physical Chemistry, Cornell University, delivered an illustrated talk on "The [illegible] Steel." The speaker described [illegible] furnace used in the manufacture of steel and gave comparisons of the [illegible] and by means [illegible] processes. [illegible] abstracted the papers on "The Mechanical Engineering of Power Stations," delivered in New York in December. The discussion was especially interesting to local members, as all of the students in Sibley College go through a series of elaborate mechanical engineering tests, covering many of the principles laid down in these papers.

It was decided to hold an informal dinner preceding the next meeting. Mr. Charles F. Scott, consulting engineer of the Westinghouse Electric and Manufacturing Company, will be the speaker at this meeting. There are 127 members, associates and enrolled students in the Ithaca branch at present.

Close of the Electrical Show.

The Electrical Show in the Coliseum, Chicago, the third annual exhibition of the Electrical Trades Exposition Company, closed on Saturday night, January 25th, with an impromptu jollification, in which everybody caught the carnival spirit for a few minutes, and celebrated with the ringing of bells or the blowing of whistles or other noises.

The show was an entire success. For its added effort and expense in arranging for the exhibition the management was rewarded by the good will of exhibitors and a large attendance. Mr. H. E. Niesz, the managing director, says that as near as he can estimate it, the total attendance for the two weeks was 125,000. Exhibitors are generally well satisfied with the business returns of the show. Mr. Niesz worked hard for the success of the show, and deserves the praise he won. He was ably assisted by Mr. W. H. Butler, who won the confidence of all through his courteous and business-like methods.

Two exhibits which were not mentioned by inadvertence in the detailed report last week were those of the Kellogg Switchboard and Supply Company and the Universal Manufacturing Company. The Kellogg company exhibited its full line of standard apparatus. In addition, it showed for the first time the oscillograph, an instrument for photographing all wave forms of alternating current. The company says that it is the first telephone manufacturer to use this instrument for scientific development of telephone apparatus. By the use of the oscillograph the exact line conditions for four-party selective signaling, pole-changer development, magneto-generator design, transmitter operations, etc., are most accurately studied. Exact operating conditions must be known as well as the nature of the material entering into the make-up of the apparatus. The Kellogg company has numerous other scientific instruments with which to study its product. W. P. Booth was in direct charge of the exhibit.

Central-station visitors were greatly interested in the exhibit of the Universal Manufacturing Company of Chicago, maker of the Universal flat-rate controller. This device controls the supply of current to customers by switching current off and on at intervals of several seconds whenever the customer exceeds his contracted load by as much as one eight-candlepower lamp. It will restore uninterrupted service the moment the load is normal. The Universal controller is used by many electric-light companies all over the country, and is said to be giving the utmost satisfaction. A number of new customers were added at the show. President Louis Schmetzer, Vice-president Frank Kraemer, Manager E. Roesch and H. W. Eves looked after the interests of the company.

Among the electrical men who visited the show the latter part of the week were: L. P. Sawyer, manager Buckeye Electric Company, Cleveland; A. C. Garrison, president Columbia Incandescent Lamp Company, St. Louis; James B. Olson, general sales manager Habirshaw Wire Company, New York city; F. M. Dusenbery, Western Electric Company, New York; E. J. Kulas, manager Brilliant Electric Company, Cleveland; J. C. Fish, president National Electric Lamp Association, Shelby, Ohio; A. H. Kling, Detroit Fuse and Manufacturing Company; Edwin Zeidler, manager of the Zeidler Lamp and Brass Company, Lomira, Wis.

Among those who registered at the booth of the Western Electrician during the last few days of the show are the following:

Alabama.—William H. Bryant, Home Telephone Company, Mobile.

California.—H. P. Palmer, San Francisco.

Canada.—Jess Fox, Toronto, Ont.

Chicago.—Henry Ahlt, A. L. Appleton, David S. Affleck, Raymond Burley, L. L. Browne, Harold E. Brown, F. L. Dohanan, Francis M. Barton, Henry A. Bowman, P. R. Caley, W. P. Cosper, Fred G. W. Cooper, W. A. Chandler, Frank A. Chapman, G. M. Cox, Harry S. Conover, Guy Crapple, O. S. Dawson, F. W. Derby, W. A. R. Dukes, Aaron Dean, Jr., Edwin L. Eggers, C. Ehnborn, H. W. Eves, August Fogelberg, Charles C. Fricke, A. N. Fox, L. K. Francis, G. F. Gebhardt, C. A. Griner, A. E. Greenawalt, C. A. Hansen, Earl W. Hamlin, W. F. Hruby, Guy W. Jones, H. Jones, Charles L. Kent, L. J. Kennedy, Charles W. Kallas, M. S. Kendall, Walter C. Klok, C. A. Latham, M. E. Lane, P. F. Matteson, A. M. Morse, Frederic Marx, T. E. Martin, H. R. Miller, [illegible] H. Nagelstock, W. W. Newton, C. C. Paver, Charles A. Peterson, Frank W. Pardee, D. S. Pentecost, J. L. Pillmer, [illegible] G. Rogers, J. F. Richards, Myron Ruhman, H. [illegible] Ross, A. B. Stafford, Robert H. Soelke, Marshall [illegible] Seeley, W. [illegible] Sesser, John Schope, Albert Scheible, Geo. W. Smitzer, [illegible] M. Stuart, A. J. Schmitt, H. A. Thomas, C. B. Underwood, R. M. Van Vleet, Karl Wendrich, Wallace K. Williams, James R. Wiley, H. W. Webber, Frank S. Wismeyer, George J. Young.

Illinois.—Robert [illegible], E. H. [illegible], [illegible] Bryan, Grant Works; Wm. J. Bryan, Grant Works; H. H. Kellogg, Antioch Electric Company, Antioch; Charles G. Kester, Downers Grove; James E. Keelyn, Evanston; J. P. Murphy, Pontiac; Loren Y. Means, Saybrook Telephone Company, Saybrook; G. T. Moore, Joliet; G. M. Painter, Milwaukee Telephone and Manufacturing Company, Harvey; J. M. Porman, Decatur; Robert Swearingen, Seaton; J. S. Stephens, Maywood; Henry Roselle, Woodhull; W. v. d. Werf, electrical and power department, Zion City; J. W. Webb, Mt. Carroll Electric Light Company, Mt. Carroll; Harry A. Wright, LaGrange; J. E. Carron, Kankakee; R. I. Davis, Dalton; J. J. Feely, Brookfield; Roy N. Frith, Watseka.

Indiana.—Fred S. Carr, Rochester; C. W. Galloway, Shawnee Telephone Company, Stone Bluff; L. J. Johnson, Terre Haute; J. E. Teaford, Home Telephone Company, Union City; John M. Stanley, Ladoga Telephone Company, Ladoga; Leo. H. Sieffert, Evansville; Clarence Sieffert, Evansville; A. L. Swanson, Evansville; Karl O. E. Swanson, LaPorte; J. E. Reed, Indiana Harbor; Mrs. J. B. Rogers, Franklin Water and Light Company, Franklin.

Iowa.—E. C. Starks, Spencer Telephone Company, Spencer; H. A. Zinn, Anamosa Electric Light and Power Company, Anamosa.

Kentucky.—J. B. Wilkinson, Louisville.

Michigan.—H. R. Erdman, Lewis Electric Company, Grand Rapids.

Minnesota.—O. A. Knell, Faribault.

Missouri.—E. M. Bosley, St. Louis; Hunter L. Gary, Theodore Gary Investment Company, Macon; George A. Irvine, Laclede Power Company, St. Louis; T. C. White, St. Louis.

New York.—P. A. Price, Western Electric Company, New York.

Ohio.—W. S. Carner, Canton; George B. Quatman, Sidney; Guy H. Watkins, American Automatic Telephone Company, Urbana; Ike Wilkoff, Wilkoff Bros. Company, Youngstown.

Pennsylvania.—Charles Frenzel, Pittsburg; Miss Nan R. Martin, American Gas and Electric Company, Philadelphia.

South Dakota.—George E. Brown, Municipal Light Plant, Redfield.

Wisconsin.—W. J. Ferris, La Crosse Water Power Company, La Crosse; G. A. Frogner, Iola; Edwin S. Cary, Evansville.

The fourth annual Chicago electrical show will be held at the Coliseum, Chicago, under the management of the Electrical Trades Exposition Company on January 11-23, 1909. Already a number of contracts for space have been closed.

Chicago and Milwaukee Electric Road in Receivership.

Receivers were appointed on January 27th for the Chicago and Milwaukee Electric Railroad Company, also for the firm of A. C. Frost & Co., bankers, the head of which firm is president of the railway company. It is said that the receiverships are entirely friendly and are intended to facilitate the construction of an eight-mile extension to bring the line into Milwaukee.

In explaining the situation Mr. Frost is quoted as follows:

"The direct cause of the receivership is the fact that the credit of the company and the market for its securities were injured by the receivership instituted on New Year's eve [this receivership was dissolved a few days later], and as a result it became impossible to consummate the sales of bonds which had been substantially completed. After conferences between the principal holders of the company's obligations it was decided that a receivership would be the best means of conserving the property and the interests of the bondholders, creditors and stockholders. There is only about eight miles of the road to be completed and more than 50 per cent. of this work has been done. The total cost to complete the road will not exceed $250,000."

The Chicago and Milwaukee is one of the important electric railroads of the country. It does not actually enter Chicago but runs north from Evanston, Ill., along Lake Michigan to a point near Milwaukee, Wis. Connecting many North Shore suburban towns, it has done an important business.

Electric Drive in a Hardware Factory.

A notable example of the application of the induction-motor drive in a modern manufacturing establishment is found in the factory of the O. M. Edwards Company of Syracuse, N. Y. This company makes hardware specialties of various sorts. Formerly the company purchased power from the Syracuse Lighting Company, using 500-volt, direct-current motors for driving the wood and metal-working machinery. It was so well satisfied with electric-motor drive that when the factory was enlarged an isolated alternating-current plant was installed, together with a complete induction-motor equipment.

The generating equipment consists of a steam engine direct-connected to a 220-volt, 70-kilowatt, 60-cycle, three-phase, revolving-field generator. A tap is brought out from the neutral point of the generator winding for incandescent-lighting purposes. The motors are of the standard squirrel-cage type, the total capacity installed being a little over 100 horsepower. Group drive is used, the motors being suspended on platforms from the ceiling. In each machine room the motors are assembled in four groups, a motor in each corner of room driving separate line shafting, from which machines are belt-driven. Starting compensators are placed conveniently near to the motors. Generator and motors are of the General Electric Company's make.

The entire electrical equipment has been in operation continuously 11 hours a day for over a year without any operating trouble whatever.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. F. Metcalfe.

LIII. Motor Driving.

ROLLING-MILL MOTORS.

Iron and steel mills represent probably the most severe service to which electric motors can be subjected, yet in recent years electric drive has been quite extensively introduced into mills for operating heavy ladle cranes, mill tables, screw-downs, etc. Both alternating and direct-current motors are used in this service, which involves heavy intermittent and reversing operations.

Aside from severe conditions of load, rolling-mill service imposes unusually severe temperature conditions upon the motors, as they are frequently located in places where the heat is so great that ordinary insulation would soon become badly deteriorated. For these reasons special types of motors are generally installed for mill service, the principal characteristics required being massive strength, special insulation capable of withstanding very high temperatures, and facilities for making easy and rapid renewals and repairs.

Geared connections are almost invariably used in this class of service, so that these motors are generally supplied with brackets for supporting a countershaft and gear, by means of which the speed of the motor is adapted to the speed of the machine to be driven. It is also necessary in many applications of mill motors that a brake be supplied where sudden stops are required. There are a number of both mechanical and electrical brakes in use for this purpose, and it is usual to have the armature shaft extended on both sides of the motor so that the pinion may be applied to one end and the brake to the opposite end.

When direct-current motors are used for intermittent service they are compound-wound in order to prevent the motor from racing when the load is thrown off suddenly.

The insulation of mill motors should consist largely of mica, as this is better able to withstand high temperatures than any other insulating material.

ELECTRIC HOISTS.

The use of electric motors for operating hoists has a number of advantages over the steam engine and boiler and has largely superseded steam in this class of work. The steam-driven hoists are heavy, and therefore, if intended to be portable, are difficult to transport from place to place. The engines used on these hoists are noisy and have a very large steam consumption and require the handling of coal and ashes. In the case of stationary hoists there is considerable trouble in cold weather, due to condensation of steam in the pipes, and the freezing of the pipes is not uncommon. All of these difficulties are avoided with electrically driven hoists, and moreover the latter may be operated by almost any laborer without experience, while the former requires the services of a licensed engineer.

For hoisting service both direct-current and alternating-current motors are used. In the former case motors should be similar to street-railway motors and have a series winding. When alternating-current motors are used they should be of the polyphase induction type and should have a high starting torque. For both classes of motors a regulating and reversing controller should be used with sufficient resistance to give the desired speed regulation of the motor.

The series-wound direct-current motor will have a definite speed for each weight of load, and therefore if the load is reduced the speed of the motor will increase. If it is desired that the hoisting be done at a practically uniform speed it will be necessary in such case to insert resistance in the circuit. This is done merely by moving the controller handle over one or more notches until the desired speed is attained, and in this way a practically uniform speed of hoisting may be maintained for any weight of load less than maximum.

If the hoist is running light with a direct-current motor and the controller is on its full-speed notch, the motor will run considerably above the full-load speed, as it will be doing no work except overcoming the friction of the hoist. This increase of speed will not occur if an alternating-current polyphase motor is used, as this is a constant-speed machine and will not exceed its synchronous speed even with no load upon it. In order to vary the speed of this type of machine resistance must be inserted in the secondary or rotary winding and this is done by means of a controller somewhat similar to that used with direct-current motors.

VARIABLE-SPEED INDUCTION MOTOR.

The variable-speed induction motor instead of having a short-circuited squirrel-cage winding on the rotor, has a wire-wound secondary into which resistance may be inserted for varying the speed. To insert these resistances the ends of the secondary windings may be brought out to slip rings mounted upon the shaft. If the rotor winding is three-phase, the three inside ends of the winding will be connected together, and the three outer ends will be connected to three slip rings. The resistances are inserted in each phase of the winding through brushes which bear upon the slip rings.

By inserting all the resistance in the rotor circuit the motor will exert a very high starting torque, which may be two or three times the full-load torque of the motor. As the load is gradually brought up to speed, by means of gradually cutting out the resistance, the rotor windings may be short-circuited when full speed is attained, and if the resistance is proportioned for continuous running the motor may be operated at any speed between its maximum and minimum by leaving more or less of the resistance in circuit.

Such a motor has speed characteristics similar to a direct-current, shunt-wound motor with resistance in the armature circuit. Its speed may be varied within fairly wide limits, but it does not have as good speed regulation as the variable-speed shunt-wound motor, because the speed tends to vary with every change of load. For hoists, cranes and for similar service this variation of speed with change of load is not very important.

WOOD-WORKING MACHINERY.

Wood-working machinery represents a class of machinery to which the constant-speed polyphase induction motor is especially adapted. These machines are not generally started under load, and they run at a constant speed, both of which conditions are favorable to the polyphase motor with squirrel-cage winding. Induction motors are, moreover, very advantageous in this case, as the absence of brushes and commutator or of any sliding contacts makes sparking impossible, and there is no risk of fire from this cause.

As the motors start under very light load, they can be started by means of an auto-starter, which applies a reduced voltage to the motor until it acquires nearly full speed, and then throws on the full-line voltage, bringing the motor up to full speed. These motors are also able to operate successfully under conditions of dust and dirt that would rapidly destroy motors of any other type.

The same reasons which make these motors especially applicable to woodworking machinery apply in the case of cotton and silk mills and many other industries using constant-speed machinery.

[*To be continued.*]

NOTE.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Transformers.

J. A. H., Bismarck, Pa.: What is the difference between a step-up transformer and a step-down transformer?

ANSWER.

This question carries its own answer. In a step-up transformer current of comparatively low electromotive force is converted into current of comparatively high electromotive force. In the step-down transformer this process is reversed. See Metcalfe's "Elements of Electrical Engineering," subhead "Transformers," Western Electrician of June 1, 1907, page 481.

Gasoline-engine Ignition.

M. B. A., Marshalltown, Iowa: Please tell me how one can use 110-volt, alternating-current service for sparking gasoline engines?

ANSWER.

Practically all ignition for gas and gasoline engines is done with very low voltage on the primary of the spark coils, because battery power is so [illegible]

Soldering Aluminum.

A. E., [illegible]: Please give the formula or rule used in soldering aluminum.

ANSWER.

A large number of processes for soldering aluminum with itself and other metals have been devised, with more or less successful results. Dr. Ed. W. Self says: "The great difficulty in uniting two pieces of aluminum is due to the fact that at the place of soldering an extremely thin film of alumina is formed which resists the union of the metal with the solder in question." The use of a solder gives the best results, the autogenous or solderless process not being so reliable. Some 40 different solders are known. Many authorities recommend that the article be first tinned with an alloy of one part aluminum to five parts tin, and some advocate that the same alloy be then used as a solder. Among the solders that are most highly recommended are the following alloys:

Five parts zinc, 2 parts tin, 1 part lead.

Nine parts zinc, 100 parts tin, 165 parts lead.

Forty-six parts zinc, 2 parts tin, 52 parts copper.

Ten parts zinc, 100 parts tin, 20 parts silver, 1 to 6 parts aluminum.

Seventy parts aluminum, 20 parts tin, 10 parts copper or silver.

Thirty parts aluminum, 20 parts copper, 50 parts zinc.

Twelve parts aluminum, 8 parts copper, 80 parts zinc.

Six parts aluminum, 4 parts copper, 90 parts zinc.

Five parts zinc, 95 parts tin.

With the last five the surfaces should be first tinned. The use of a good flux, such as borax, is generally desirable. Quite a number of solders and processes that are trade secrets are now being exploited in the market, some of these being quite satisfactory.

Three-phase Railroad Operation.

Concluding an article on the Valtellina electric railroad in Italy, in the Electric Trunk Line Age, J. M. Graham, vice-president of the Erie Railroad, says: "Technically, the electrical equipment of the Valtellina line demonstrates beyond the shadow of a doubt that the three-phase system is admirably adapted to the longest distances and the most severe traffic conditions that can be found in practice. Indeed, it possesses advantages which seem to make it better suited for real heavy trunk-line work than any other system. Commercially—and I consider commercial practicability the more important consideration for the railroad man—my inspection of the three-phase system here briefly described leads me to the conviction that, wherever the traffic is dense enough, electric traction will not only materially decrease the operating cost per ton-mile, but it will accomplish this end, either with a material decrease in the motive-power equipment, or it will handle as much as 50 per cent. more traffic than could be handled under the most favorable conditions of steam operation."

Electric Power in the Ottawa Mint.

A branch of the Royal Mint has been established in Ottawa, Ont., and all the machinery in it is driven by electric motors. Power is supplied by the Ottawa Electric Company and enters the building as an alternating current at 2,200 volts. It then passes through the transformers, of which there are three for power and three for lighting. For power purposes the current is reduced to 500 volts, at which tension the motor-generator is operated; while for lighting it is reduced to 100 volts so as to make this circuit uniform with the lighting current of the city. The motor-generator supplies direct current at a pressure of 220 volts to the motors which drive the machinery throughout the buildings. The fuel used for all the furnaces for melting and annealing purposes as well as that for die-hardening is crude oil.

Electrical supply dealers of San Diego, Cal., are anxious for the appointment of an electrical inspector by the Common Council. At a meeting held in the office of the San Diego Consolidated Gas and Electric Company an ordinance to be introduced in the City Council was recommended by a majority of those present.

International Independent Telephone Association.

Much importance attached to the annual convention of the International Independent Telephone Association held at the Coliseum, Chicago, on January 21st, 22d and 23d. The convention was not so much of a technical gathering as a sort of general clearing-house of ideas, in which everybody contributed freely to the discussion.

The new administration starts out with full support of the active and representative interests in the association, the operators standing together in assuming the responsibilities, moral and financial, of the Independent work. Special attention is to be paid to the legislative battles that are to be fought for and against compulsory interchange of business. In some states the statutes have already been prepared, and it has resolved itself largely into a question of preserving the rights of the Independent interests. Where any semblance of confiscation or deprivation of Independent rights is attempted the measures will be fought to the last ditch.

With the opening of the second day's session [the first day's business was reported in the Western Electrician of last week] H. D. Critchfield of Milwaukee, Wis., scored any attempt to modify the strength and purpose of the association or anyone connected with it, insisting that the Independent telephone interests in this country had become so powerful that there was nothing to evade or conceal in going after competitive business and defending any business that may be held. "The fact is that we are weak in our very strength," said Mr. Critchfield, and as the speaker proceeded to advise aggressive measures he received tumultuous endorsement.

The Lindemuth resolution, introduced on the first day, providing for an assessment of two mills per unit in each state, with a maximum graduated state fee for association membership and the compulsory usage of the association trade-mark by manufacturers, dealers and publishers of journals devoted to the Independent telephone industry, was adopted.

In addition to the subscription and assurance of the state assessments under the new rating it was decided by resolution to raise a guaranty fund of $15,000 for the maintenance of the association during the ensuing year, and there was no difficulty in obtaining pledges to this amount.

When the convention adjourned on Wednesday, the second day, the delegates and visitors accepted an invitation to attend a complimentary smoker in the convention hall in the evening. This proved an enjoyable entertainment.

Much ground was covered on the last day of the convention. Following the invocation by Rev. Jenkin Lloyd Jones of Chicago, President Gary called for the reports of committees. The committee on changes in the constitution recommended a few minor changes, which were adopted.

The scope and power of the legislation committee were enlarged and the committee increased from five to nine members. It was also decided to admit to membership in the association employes of operating companies.

W. H. Denlinger of Patton, Pa., read a paper on the subject of "The Independence of the Independents," in which he urged all Independent operators to guard against the natural inclination to reach out and endeavor to handle all the business offered where early provision had not been made for such business, with the result of an overload and unsatisfactory service. "Better two thousand satisfied subscribers and a clean dividend than four thousand subscribers, service all gone to the bow-wows and nothing to show for it all." The speaker also elaborated on the wisdom of considering the "man behind the gun," the operator, lineman, toll clerk, and the necessity for keeping after the local manager of the smaller exchanges in a system to maintain at all times an individual and perfectly friendly acquaintance with customers and prospective customers.

Several addresses were made on subjects of general interest, and President Gary called for the report of the committee on nominations. The committee reported the following ticket, which was adopted by unanimous vote:

President, A. C. Lindemuth, Richmond, Ind., president of the Indiana Independent Telephone Association; first vice-president, P. C. Holdoegel, Rockwell City, Iowa, president Iowa Independent Telephone Association; second vice-president, E. B. Fisher, Grand Rapids, Mich., president Michigan Independent Telephone Association; third vice-president, Dr. E. J. F. Demers, Quebec, [illegible] General Telephone Company; [illegible] Arthur Wright, Los Angeles, [illegible] Joseph B. Ware, Grand Rapids, Mich., Citizens' Telephone Company; treasurer, [illegible] Ill., Home Telephone Company. With the report came the practical assurance of the retention of Assistant Secretary J. A. [illegible] assurance that he would continue to serve the interests of the association wherever possible or whenever called upon.

On assuming the chair President Lindemuth presented his associates in the new administration to the convention, and in a few words gave assurance of recognition of the responsibilities of his office. He dwelt on the growth and development of the association and the Independent movement, now represented by 25 state organizations and many minor bodies, and expressed the belief that it would not be long before efforts to obtain entrance in Chicago, New York, Cincinnati and other important points would be successful. The convention then adjourned.

Later in the day President Lindemuth announced the following executive committee: C. E. Wilson, Philadelphia, Pa., Keystone Telephone and Telegraph Company; H. D. Critchfield, Milwaukee, Wis., president Milwaukee Independent Telephone Company; F. H. Woods, Lincoln, Neb., president Lincoln Telephone Company; James S. Brailey, Jr., Toledo, Ohio, president United States Telephone Company; A. C. Davis, Parkersburg, W. Va., president West Virginia Western Telephone Company; W. H. Bassett, St. Louis, Mo., Kinloch Telephone Company.

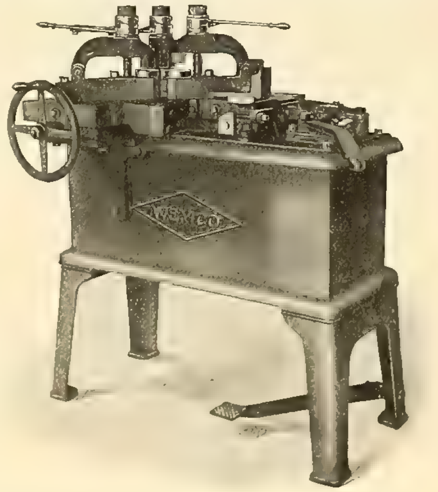
Wemco Electric Welding Machines.

A new electric welding machine is announced by the Warren Electric Manufacturing Company of Sandusky, Ohio. The machine and process are adapted to all classes of wagon and carriage work, tool work, wire work, hoop and tire work, pipe and flue welding, etc.

In these machines a very large quantity of current at a very low voltage is passed through the abutting ends of the pieces which are to be welded. The action of the current is to generate heat immediately at the point of contact, quickly raising the temperature to the welding point. The parts become hottest at the center, so that when the exterior reaches the proper heat, and the softening of the metal is followed up by forcing the parts together, a perfect union or weld is assured. As the heat is generated in the metal itself at the joint, and practically confined there, there is little or no waste or radiation, but the current is all used to the greatest advantage.

The weld is made in the open and can be watched with ease. The parts are held rigidly, insuring accuracy in the joint location. Absolute control of the heat as to intensity and duration is provided. The machines can be furnished to operate on regular alternating-current lighting circuits, so that incandescent lamps can be thrown in when the current is not in use for welding. Sizes and styles are made to suit the particular class of work, and machines for special application can be built.

For welding round pieces of iron or steel the power required at the generator and the time necessary for welding are two horsepower and 10 seconds, respectively, for one-quarter-inch material, increasing with increased size of material up to



WEMCO DOUBLE ELECTRIC WELDING MACHINE.

68 horsepower and 81 seconds for two-inch pieces. Square material requires a little more power and time. Copper welding takes five horsepower and seven seconds for one-quarter-inch stuff and 65 horsepower and 21 seconds for one-inch pieces.

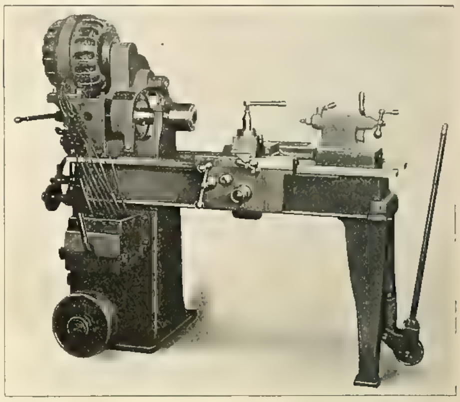
In standard equipment single and double electric welding machines are built. The single machine is constructed to give great flexibility in adjustment of clampng devices, so as to make it adaptable to a very large range of work. The clamps can be set in three different positions and the clamping levers in 12 different positions, thereby making it possible to adjust the machine to almost any irregular shape. Adjustable gauges and stop are provided, with a sufficiently wide range of adjustment to meet all requirements. The machine is entirely self-contained and portable, and the operating movements permit of very high speed, so that very little time is lost in operation.

The double machine, illustrated herewith, is very similar to the single welder and has an additional slide and clamp to facilitate holding stock for double welding or T welding.

The economy and utility of these machines are said to be very great, effecting a great saving in labor, time and material. The Warren company, aside from its large line of motors and generators, has developed an inductor-type belted alternator specially adapted for electric welding.

Westinghouse Motor-driven Portable Lathe.

The flexibility of electric-motor drive has brought into use many types of convenient and labor-saving portable machines. A notable example is the portable bolt-turning lathe designed for use in locomotive repair shops. The illustration shows a lathe made for this purpose by the Williams and Wilson Company of Montreal, Canada, equipped with a Westinghouse motor. The unit is compact in design and is mounted on wheels. It can be lifted by a crane and placed beside an erecting



WESTINGHOUSE MOTOR-DRIVEN PORTABLE LATHE.

pit, and then shifted as desired by hand. When in working position the machine rests on the two rear wheels and the front legs. To move it, the legs are lifted from the floor, and the front wheel is brought in contact with it by simply lowering the handle, which acts as a lever.

The motor which operates the machine in the illustration is of the induction type of two horsepower, and turning at 1,700 revolutions per minute. It is connected through a friction clutch, providing for either 200 or 400 revolutions per minute of the spindle. Direct-current motor applications are equally successful.

The current supply is afforded by flexible cable connection to plugs located at convenient intervals. A simple and convenient connecting plug is made for the purpose. The advantage of using a machine of this type in work requiring the turning of each individual bolt to the proper size is readily apparent. It both obviates the necessity of innumerable trips to and from the machine shop and the consequent loss of time, and permits the mechanic to carry on his work without interruption.

When not in use the machine can be moved to a point in the shop where it will be out of the way of the workmen. When not in use for the purpose designed it becomes a valuable and convenient auxiliary to the machine-shop equipment.

The Westinghouse Readjustment.

In a letter to creditors bearing the date January 20, 1908, the committee having the matter in charge has presented to the creditors of the Westinghouse Electric and Manufacturing Company a plan, approved by the receivers and the directors of the company, for the readjustment of its debt.

A statement of the amount of the debt shows a total of $43,750,000. Of this sum $35,000,000 represents the unsecured indebtedness, consisting of $18,500,000 five per cent. gold bonds, $1,969,000 five per cent. gold debentures, bills payable of $9,209,766, accounts payable of $3,952,843, and indebtedness of subsidiary companies $1,368,390.

To provide for this it is proposed to create an issue of $35,000,000 first-mortgage and collateral trust five per cent. 25-year gold bonds secured by a first mortgage upon the company's principal manufacturing plants and by the pledge of the greater part of the company's unpledged holdings of the stocks and bonds of subsidiary and other companies.

Of such issue of bonds an amount not exceeding $20,469,000 face value are to be convertible at the option of the holder after January 1, 1910, upon such terms and conditions as shall be provided in the deed of trust. The proposed distributions of first-mortgage collateral trust bonds at par are as follows:

For existing convertible bonds, $18,500,000.
For existing debenture certificates, $1,969,000.
For floating debt, $14,531,000.
Total, $35,000,000.

The deed of trust securing the new issue of bonds, according to the plan, shall provide for the retirement at or before maturity of the notes secured by collateral and amounting to $8,750,000. Holders of these notes, it is proposed, shall exchange them for a modified issue secured, and for any deficiency remaining after the collateral specifically pledged thereunder is sold, by pro rata participation with the holders of the bonds in the lien on the property covered by the new mortgage.

Unless otherwise determined by the committee, the consummation of the plan is to be conditioned upon subscriptions for the payment of $7,000,000 new capital into the treasury of the company for stock.

It is believed by the committee that the acceptance of its plan by the creditors of the company and the resulting concentration of the company's debts will bring about an early termination of the receivership and the restoration of the properties to the stockholders.

Meeting of Allis-Chalmers District Officers.

The photograph reproduced herewith, which was taken last month in front of the Allis-Chalmers Club at West Allis, Wis., represents a gathering of department and district office managers of the Allis-Chalmers Company from every industrial center of the country. During the entire meeting, which lasted four days, beginning with a tour of inspection of the works at West Allis and ending with a banquet at the Hotel Pfister in Milwaukee, the prevailing note was that of decided optimism. With the possible exception of a single district, which depends for its prosperity upon one particular product, reports indicate that a general resumption of business activity is being brought about at the present time, and the outlook for purchases of material of all kinds, particularly power and electrical machinery, is most encouraging. Many of the district managers stated, in fact, that during the past two weeks inquiries have been very heavy and customers are only waiting until a little more complete restoration of normal conditions to place large orders for apparatus.

ALLIS-CHALMERS DISTRICT OFFICERS AND DEPARTMENT MANAGERS.

One of the facts emphasized at the meeting was the advantage of taking contracts for the complete equipment of power and lighting plants, electric-railway installations, industrial works, etc., which the company's varied line of machinery enables it to do.

Following is a list of the names of the managers shown in the photograph:

F. C. Colwell, manager Cincinnati office; J. U. Jones, manager Dallas office; E. T. Pardee, manager Boston office; M. W. Thomas, manager Atlanta office; J. F. Harrison, manager flourmill machinery department; B. A. Behrend, chief electrical engineer; J. W. Gardner, manager Chicago office; J. Weidman Murray, manager Pittsburg office; W. L. Loveland, manager mining machinery department; St. J. Chilton, manager Philadelphia office; F. L. Bunton, manager St. Louis office; F. C. Randall, manager New York office; Roscoe Cornell, manager El Paso office; George A. Williams, manager Cleveland office; P. H. Carey, manager Detroit office; C. R. Tatem, manager Buffalo office; H. D. Scribner, manager San Francisco office; A. E. Mosier, manager Kansas City office; A. H. Whiteside, manager electrical department; R. B. McConney, manager Denver office; L. M. Harvey, manager Milwaukee branch office; E. T. Adams, manager gas-engine department; J. H. Denton, manager air-brake department; I. L. Skeith, manager sawmill machinery department; M. C. Miller, assistant to the president; W. J. [illegible] cement making machinery department; W. H. Powell, [illegible] secretary Bullock Electric Manufacturing Company.

Flexible Cord for Pendants.[1]

By Hugh T. Wr[illegible]

In discussing the question of flexible cord for pendants it might be well to start off with an analysis of the Code specifications, taking the first clause of rule 45.

"Must be made of standard copper conductors, strand to be not larger than No. [illegible] nor smaller than No. 30 B. & S. gauge, and each stranded conductor must be covered by an approved insulation and protected mechanically by a braided outer covering."

The determination of the size of these conductors is obvious as being, on the one hand, to insure flexibility and on the other not to have the individual conductors so small as to be liable to break readily with consequent danger of puncturing insulation. The covering of same by an approved insulation is so complete in what it does not express that comment can be left on this point to a later part of this address.

"Protected from mechanical injury by a tough braided outer covering" is so plain that it would need no comments were it not for the fact that, with almost no exceptions, the braided outer covering fails vitally to perform the function specified in the rule.

It is true that rule 45d of the Code prescribes further tests for the insulation resistance and dielectric strength, but, considering that flexible cord for pendants is limited to use in dry places, the value of a high insulation resistance is not apparent.

On the other hand, the fact that flexible cord is almost always subjected to more or less rough handling—tying in knots and otherwise straining the same mechanically—a better mechanical value with greater strength specified in the insulation would seem to be of advantage. Or it might be possible to so limit the usage of flexible cord that so much necessity for rough handling or flexibility would not be apparent.

Turning to the rules for use of flexible cord we find, first, that this cord is only intended for use in dry places, except it is made up as a reinforced portable cord. (See rule 45f.)

Further, we find that cord must be suspended so that the entire weight of the socket and lamp shall be borne by an approved device under the bushings in the socket and above the point where the cord comes through the ceiling block or rosette in order that the strain may be taken from the joints and the binding screws.

This approved device usually takes the form of knots in the cord. In addition to this we find flexible cord subjected frequently to considerable dry heat and to the action of flies and other insects, which can be frequently noticed gathered in groups on pendant cord. These conditions, especially the two former, seem to call for an insulation which is tough mechanically and somewhat elastic rather than possessed of high insulating strength.

The action of flies and other insects in hot weather, and their well-known persistence, would also lead to the belief that strength of insulation [illegible] made with a large amount of rubber in the insulation [illegible] and elasticity in the insulation, covered by a good, substantial braid, preferably attached to the insulation with glue or [illegible] for taking the strain off the binding posts in the socket and rosette other than the [illegible] used.

I would also make up [illegible] age the knotting process, either by the use of larger individual conductors in the strand or by running the wires parallel instead of twisted, possibly by advocating the use of solid wire, which latter is done by the United States Navy in its specifications under the head of "bell wire."

I am afraid, however, that after having made up specifications of this kind the unfortunate situation would exist that nobody would pay any attention to them, as the cost would be excessive and it would be so inconvenient for requirements of ordinary cord that pressure of public opinion would present a very serious obstacle to their adoption.

This, then, would bring us back to our limitations, which are that whatever changes are made in pendant cord specifications must be such as not to increase the price too greatly or limit the use of the cord for purpose for which it was intended.

With this end in view we are, therefore, striving along the following lines from the point of cord manufacture:

First: To get an insulation which is tougher mechanically and has a fair amount of elasticity.

Second—To get a braid which is strong and properly sealed to the insulation, and along these lines we are getting the co-operation of the manufacturers, who say that they are satisfied that this condition can be obtained in the near future without so increasing the price of the product as to limit the use and the sale.

And these steps are being taken without sacrificing the insulation value of the cord itself, as may be readily understood when we advise you that all coils stand 1,500 volts between the conductors, and samples are subjected at factory to 4,000-volt breakdown test on one foot of cord for one minute after one hour's immersion in water.

In regard to the braid, we are meeting with a peculiar situation and would appear to be overcoming a popular fallacy which has heretofore obtained among many of the manufacturers, and that is in regard to the method of sealing the braid to the insulation.

As you may all know, the usual method of sealing the braid to the insulation is partly to vulcanize the insulation, then put on the braid, then put the braided wire into the vulcanizer a second time.

The vulcanizing being done by steam heat, two conditions occur. The first is to shrink the braid into the insulation and the second is further to harden the insulation so that the braid and the insulation take a firm hold on each other.

This process would, unquestionably, avail and make a good article were a high-grade compound used, or were the vulcanizing process carried on to its completion, but, as a matter of fact, in a good many cases the compound is neither high-grade nor the vulcanizing process completed, so while theoretically this process seals the braid, practically it comes far from accomplishing this object.

In further connection with this process we have been told by some that a complete vulcanization of the insulation would lessen its ability to stand ordinary handling, tying in knots, etc., and that if more completely vulcanized before braiding no means would exist to seal the braid to the insulation, even as is now the case. Also, if they vulcanize too much after braiding the action of the steam in the vulcanizer on the braid would be such as to injure the braid.

We are glad to state, however, that three different companies have shown us, practically, that they can vulcanize their compound before braiding and then seal the braid with glue or other adhesive substance, which would appear to be the solution to this part of the problem.

This sticking of the braid with adhesive substance is equally possible with cotton or with silk braid. Even with improvements on both insulation and braid, however, so that the cord is stronger mechanically, the best condition of affairs could hardly obtain if the cord were used, or rather abused, in the future as in the past, and it would seem to the writer as if some efforts should be taken to prevent the knotting of cord in sockets or rosettes and that some form of approved holder should be encouraged which would prevent the necessity for such knots.

This would, apparently, leave it possible to stiffen the cord in other ways without increasing its expense, removing danger from improper handling.

1. Part of a paper read before the Western Association of Electrical Inspectors at the third annual meeting at St. Paul, Minn., October 23, 1907. The author is secretary of the Wire Inspection Bureau in New York.

I do not suppose it would be possible to discuss this subject before a body of men who are better qualified to pass on the last suggestion than the members of your association, and I would like very much to see this point settled in some way, if necessary, by change in the Code, so that, by taking care of abuses in the field, the manufacturer could be encouraged to use his efforts toward proper improvement of the pendant cord.

There is one thought on which I have not touched, and that is the question of the use of swivel attachment plugs, and although the value of these plugs would hardly be apparent on pendant cords, something of this kind would seem to be necessary, especially so if a stiffer cord were found practical, for if the stiffness were removed from the cord, some flexibility would have to be obtained with, say, a swivel-attachment plug, or else the cord would be useless for portable-heater use.

As soon as we get a better enforcement of rules in regard to sealing and flame-proofing of braid, it will probably be in order for us to take up the quality of the yarn used, in regard to weight, fineness and weave. And the importance of specifying weight and fitness will be readily appreciated by anyone who takes the trouble, through perusal of some authority like Draper Standard, to see the enormous range of quality of textile yarns.

Electric Law.[1]

By John C. Nicholson.

My topic is electric law, not the laws of electricity. The manager of an electric-light plant or of a street railway ought to be as familiar with electric law as he is with the laws of electricity. The duties of officers and managers of public utilities are quasi-public. They occupy a different relationship to the public than the ordinary business man.

A slight neglect or oversight, perhaps, and the plant is shut down and all business suspended, or perhaps it is a live wire, and not only many lives are put in jeopardy, but fire breaks out and sweeps the city off the map. An accident, a judgment for damages, and there may be a bankrupt company. It requires but a short step to carry imagination to a reality. It is very important that owners and managers of all public-utility corporations know their rights and liabilities under the law, and this is especially true with electric-light and street-railway companies.

Take the law of negligence, the law of damages. Will you not study them in so far as they relate to your own business? Every man is supposed to know the law. You can at least familiarize yourself with the general principles and the current decisions of the Supreme Court relating to the hazardous business in which you are engaged. I will not attempt more than to call your attention to a few general principles and some recent decisions of our Supreme Court under three heads, viz.:

The relation of the company to the city.
The relation of the company to third persons.
The relation of the company to its employes.

Electric companies furnishing current to the public generally and using the street for such purpose are quasi-public in their nature, and the public has certain rights which it does not have in the strictly private company. Public-utility companies have no right to discriminate in charges for the same service. The legislatures and the courts are giving the people enlarged powers over all public-utility companies, and the extent to which this movement will go no one can tell. The only bar remaining, so far as I know, is the stand the courts have held that the Legislature, or commissions created by it, cannot confiscate private property. In other words, that the owner is entitled to a reasonable return, but on what he is entitled to a reasonable return is still in doubt. Is he entitled to interest on his investment or interest on the present value of the plant, and if so, what rate of interest is a reasonable return? These are still mooted questions. It is admitted that the farmer may double his money each year or the miner make 1,000 per cent. each year or the speculator even do better, but it is quite the thing to say that the owner of public utilities is only entitled to interest on the money invested, or [illegible] no more than a reasonable return on the jhysical value of the plant.

[illegible] of Kansas are a fair and reasonable [illegible] they are in the majority [illegible] Populist law of 1897 was re[illegible] and the wave has passed [illegible] the Atlantic states. [illegible] most comprehensive and [illegible] It is [illegible] reserved by the United [illegible] has control [illegible] the [illegible] the street [illegible] street and [illegible]

[1] [illegible] and Electric [illegible] The author is president of the [illegible]

tend beyond a just regulation of rights for the public good, and when they unreasonably abridge or burden the privileges which the police power is to conserve they are invalid. Whether such ordinances are reasonable is for the court to decide. The police power cannot be delegated or given away by franchise, contract or otherwise. For example, a franchise does not permit the maintenance of a nuisance or the operation of a plant in a dangerous manner to life or property.

Cities of the first class [in Kansas] may under certain conditions grant franchises for not exceeding 30 years, while cities of the second and third classes may grant franchises for not exceeding 20 years. Cities of either class may buy, construct and operate light and water plants, but no city is authorized to grant an exclusive franchise, and whether it can build its own plant during the life of a franchise to a private company is to be seen. Under the police power the city has a right to fix a maximum rate to consumers, but once fixed in the form of a contract it is binding.

Chapter 105 of the Kansas laws of 1905 provides that the lot owner may recover damages for injury to trees planted within the curb line of the street the same as if the same were planted on his lot. In Ohio, where the fee to the center of street is in the lot owner, the court held that the lot owner "had the right to have the trees remain and grow there without injury, whether such injury was necessary or not to the use of the lines of such telegraph company." Our Supreme Court has not passed on the question. An electric company has no power to enter upon private property for the purpose of cutting off branches of trees overhanging the sidewalk or street. If it desires to enter upon private property it must obtain permission; if not, it will be liable for trespass and damages.

The duty is imposed on the company of erecting its poles in such a manner as not to interfere with the abutting owners' right to ingress and egress, and of so constructing its lines as not to interfere with or impede the public in its use of the streets or render them dangerous to public travel, and maintaining them in a safe condition. In New York the court enjoined a company from erecting a pole in front of plaintiff's place of business, which created a hindrance to free access to the store.

The company is bound to use the utmost care in the maintenance of its wires, and if a wire falls or breaks, the company is liable for any injury caused thereby, unless it be some latent defect which by the exercise of reasonable care it could not detect. If a storm of unusual and extraordinary severity causes a wire to fall and it is permitted to remain an unreasonable time, the company is liable for injury caused thereby, otherwise not. If the company permits a live wire to remain exposed for a long time it is liable, or permits it to remain after notice given it is liable. Most of the cases coming under this rule are where telephone wires have broken and fallen across high-tension electric wires.

In Railway Co. vs. Gilbert, 70 Kas., 261, our Supreme Court held that "A street-railway company that employs electricity as a motive power is required to exercise the highest care to protect persons using the streets from the danger of being injured by the electric current, and is liable for any damages occasioned by its failure to do so." It is suggested that electric companies ought perhaps to be regarded as quasi-insurers as toward any third persons.

The relation of the company to employes for personal injuries is largely one of fact, but the general principles are better defined. It is the duty of an electric company to use reasonable care, to furnish its employes with safe appliances and to keep the same in reasonable repair, and this duty cannot be delegated so as to relieve the company. Reasonable care and prudence is a relative term and depends on the facts in each case.

One who chooses to enter the employment of an electric company assumes the risks incident to the employment and which he has no reason to expect to be counteracted or removed. The company is not compelled to furnish printed rules. If the employe choses the more hazardous of two methods he does so at his own risk.

If the company employs knowingly or retains an unfit employe it will be liable for injuries due to that cause. No absolute rule can be laid down for linemen. The degree of care required of the company and the extent of the risk assumed by the linemen are to be measured and determined on the facts in each case. The company is not liable for latent defects in the poles which it could not discover with reasonable care.

In City of Emporia vs. Kowalski our Supreme Court held: "The ordinary risks incident to the business assumed by the employe are those only which occur after the due performance by the master of these duties which the law imposed on him," and gave judgment against the city. In Buoy vs. Milling Co. our Supreme Court held that the servant may rest upon the assumption that the company has performed its duty in respect to a safe place to work and safe appliances, and in Hoffmeier vs. K. L. R. Co. the company was liable where its conductor was struck by a pole and knocked from its car.

In Crist vs. Light Co., in 72 Kas., 135, our Supreme Court held that the question of contributary negligence is for the jury and not the court, and that where a lineman on being told by the foreman, "All right, go ahead," applied his pliers to a live wire and was severely burned, the foreman was vice-principal and the company liable.

The courts are not in harmony as to the liability for accidents due to electricity, and different rules govern for high-tension currents and for low-tension currents. The true rule seems to be that the degree of care changes with changing circumstances and must be in proportion to the danger.

I also find a large number of the cases growing out of the falling of a telephone wire across a light wire, in which case the courts hold the light company liable for injury resulting from touching the telephone wire.

A contract exempting the electric company from liability for damages does not exonerate it in cases where the injury is caused by its own negligence. All such contracts are void as against public policy in the case of employes as well as with consumers.

Watchfulness, inspection and great care are required at your hands, and in closing I would admonish you, under and by virtue of the law, first, not to violate municipal regulations; second, never expose the public to the least unnecessary danger, and, third, be as careful as you possibly can of your employes.

Regulation of Electric Signs.

Answering a question relating to electric-sign ordinances and basing its response on information furnished by S. M. Sheridan of Detroit, Federal Electric Company of Chicago, United Electric Light and Power Company, J. O. Beck, Jr., E. A. Mills and E. S. Mansfield, the N. E. L. A. Bulletin furnishes the following information.

Unfortunately, it is impossible to give the various ordinances submitted in full, and even impossible to take the space necessary for a satisfactory summary. Nevertheless, the following remarks and outline of an ordinance will probably furnish some useful suggestions:

Some sort of an ordinance specifically covering electric signs is an advantage. On account of the illumination they furnish they are in many places favored by special legislation permitting them privileges in the matter of size and location not accorded non-illuminated signs. This seems eminently fair. Furthermore, some legislation, even restrictive, is an advantage. An ordinance, the inspection required, and a fee, if exacted, insure good workmanship, some uniformity, and give the signs a legal standing. If no restrictions are imposed the privileges and opportunities are often abused, thus leading to complaint against illuminated signs and in the end doing the business much harm.

Assuming an ordinance already in force, decidedly restrictive in character as applied to signs in general, the following is an outline of an ordinance with comments that might apply to electric signs:

Section 1—Definition of an Electric Sign.

Section 2—Materials and Manner of Construction.—This insures good workmanship. "Shall be rendered thoroughly waterproof."—Chicago. "Entirely of metal."—New York. "To be most safe, secure and durable."—Beaumont.

Section 3—Size and Location.—This section is to prevent signs from overstepping reasonable limits in the matter of size and location. They should not project beyond the curb in any event, and less than this is considered better in many places. "Shall not project from the building more than 12 feet."—Detroit. "Six feet."—New York. "Beyond the curb-line."—Chicago. "Shall be not less than 15 feet from the sidewalk."—Detroit. "Ten feet."—New York. "Nine feet."—Chicago. "Shall not have a greater height or depth than six feet."—Detroit. "A sign exceeding six feet in length shall not exceed half its length in width."—Chicago.

Section 4—Certificates and Permits.—A plan of the proposed sign should be submitted to the proper authorities and a permit for its construction obtained. After it is erected it should be inspected by the proper authorities (a) as to its mechanical construction and (b) as to its electrical features. If all these are found satisfactory and to conform to rules and regulations, the necessary permits for the operation of the sign are to be issued. For these a fee may or may not be exacted. Most of the ordinances provide that all these permits are mere licenses, revocable at any time by the City Council. This does not seem entirely right.

Section 5—License Fee.—This is an annual fee and, if nominal, seems advantageous. These fees are "10 cents for each square foot of sign space, the square feet on one side only being considered the total square feet of the sign."—New York. "For projecting signs, 15 cents per square foot of sign space."—Chicago.

Section 6—The Illumination Required.—Since an

electric sign is to be given special privileges on account of the illumination it furnishes and pays a license fee on that basis, it is eminently fair that a minimum amount of illumination should be required. "The number of incandescent lamps for each side shall be not less than one lamp to each 1½ square feet of sign surface. Both sides must be equally illuminated each and every night from dusk until 9:30 p. m." Chicago. "Shall be illuminated during business hours after sundown." Beaumont.

Section 7. Next to Private Residences. This section prohibits the use of an electric sign "next to a building used exclusively as a private residence without the consent of the owner." New York. This seems a good provision.

Section 8. Fines. This section is to define violations of the ordinance and provide suitable fines.

Section 9. To State When the Ordinance Becomes Effective.

Of the ordinances submitted, the Chicago ordinance, while complete, seems unnecessarily complicated. The New York ordinance is shorter and more comprehensive.

Electric Drive in Cement Plants.

The manufacture of Portland cement has several features which differentiate it commercially from almost any industry and which make it a particularly suitable field for the introduction of the electric motor. The General Electric Company, Schenectady, N. Y., in Bulletin No. 4555, describes the application of electricity to cement plants, and gives a large amount of information regarding the different processes and the apparatus used. A cement plant is kept in practically continuous production, and the shutting down of any one machine must not affect the operation of the others. The direction and distance of the power transmission should not interfere with the most efficient layout, which should be determined solely by the relative location of the quarries, the storage bins, the best available place for the machinery, and the space available for future growth. The raw material being a very small part of the production cost, a continuous and accurate record should be kept, showing the amount of power used in each of the departments, in order that the manufacturing cost may be maintained at a minimum. It is necessary to start the machines under overload and provide for short overloads during operation, so that the driving power must give the best efficiency at normal loads with a large margin of overload capacity. To the above is added the most severe service conditions, on account of the unskilled labor employed and the character of the material manufactured.

GENERAL TELEPHONE NEWS.

L. C. Bowman of Kansas City, Mo., has purchased the telephone exchange at Alliance, Neb.

I. J. Jamison of Alvo, Neb., has purchased from O. M. Tharp the telephone exchanges in Malmo, Weston, Prague and Morse Bluff, Neb.

J. H. May, formerly of Fremont, Neb., is now manager of the Chadron (Neb.) Telephone Company.

T. L. Benedict and others have organized a company to establish a telephone exchange in Clarendon, Tex. About $20,000 will be spent.

The La Crosse (Wis.) Interurban Telephone Company has bought the lines and property of the Vernon County Telephone Company, which has connections at Viroqua, La Farge, Viola, Readstown, Soldiers' Grove, De Soto and Victory, Wis.

In celebrating the completion of the toll-line connections with Grand Rapids, Mich., opening the state of Michigan to the Indiana Independent service, Independent telephone managers from northern Indiana and southern Michigan met at dinner in South Bend on January 15th. The first talk over the completed system was through a telephone installed at the banquet board. Theodore Thorward, president of the South Bend Home Telephone Company, presided.

The Galesburg Union Telephone Company of Galesburg, Ill., has appropriated $30,000 for the construction of new toll lines in Illinois. The company now has a good toll business and the new lines will give connection with all the larger cities in the state except Chicago. Entrance will be made to Peoria, Rock Island, Streator, Elgin, Joliet, Aurora and other cities. Contracts will be entered into with the Interstate Telegraph and Telephone Company and work on the lines will be commenced as soon as possible.

A dispatch from Spokane, Wash., says that A. H. Kelly has returned to Spokane from Nelson, B. C., with the information that the Nelson Electric Smelting Company's plant, designed to handle zinc, silver and lead ores by an electrical process, will begin operation early in April. The plant is for experimental purposes only, and if it is successful a larger plant will be erected next fall, when it is expected to treat from 150 to 200 tons a day.

CORRESPONDENCE.

Continental Europe.

Paris, January 17.—The radio-telegraph station of Nauen, Germany, has been making some improvements in its apparatus of late in order to commence a series of experiments upon long-distance work. The tests are now already begun, and are very promising. Signals were sent overland to Austria and were received by a small portable military outfit which had been set up in the neighborhood of Vienna, at Kakenenburg. Not long since the Nauen station succeeded in covering an exceptionally long distance at sea. The steamship Cape Blanco sailed from Hamburg for Buenos Ayres, and even when far out at sea it continued to receive the messages from Nauen. The last telegram it received at Santa Cruz, in the island of Teneriffe, which lies at eight days' sailing from Hamburg. The distance to Teneriffe is about 2,300 miles, and this is one of the longest distances which has been covered as yet.

Severe winter weather, accompanied by heavy gales, caused a great disturbance in the telegraph and telephone service between Paris and London and also between Paris and Belgium, Holland and Germany. At one time, although there are 18 or 20 wires connecting the French and English capitals, there was not a single line in working order, and at the French postoffices a great accumulation of telegrams was the result. For London alone there were about 1,500 dispatches waiting to be sent. However, matters have been somewhat straightened out since that time.

The French, English and Swiss administrations have concluded an arrangement which will give an increase in the number of telegrams sent between these countries. At the same time and over the same wire can now be sent two telegrams from Zurich to Paris and two telegrams from Zurich to London, or vice versa. This is carried out by the use of a Baudot quadruplex telegraph apparatus working on the synchronous system, which allows of sending nearly 6,000 words an hour.

Instruments in the physical laboratories in different parts of Germany have been considerably affected of late by disturbances coming from electric plants and pole lines in the neighborhood. One of the principal laboratories in Berlin had much trouble from this cause and for some time the reason was undiscovered. At last it was found to come from the trolley wires of a neighboring tramway line. After some experimenting, in order to overcome the difficulty, the traction company was obliged to run a double trolley wire in order to suppress the disturbances. At Teltow the electric plant, which is used for running the canal system, which is located at the locks of the canal, caused so much disturbance at the seismatic observatory that the latter had to be removed to a greater distance and placed behind a hill, as the current from the plant, as well as the vibration of the machines, was found to cause a marked effect upon the earthquake-registering instruments.

A lawsuit which was recently commenced at Paris brought out some disclosures of a sensational character. Mr. Lemoine, supposed to be an engineer, said that he had discovered a new method for making artificial diamonds in the electric furnace, but instead of the microscopic crystals obtained by Moissan, he proposed to obtain large ones. He presented the affair to the De Beers company, which is the largest one concerned in working the South African fields. Its president, Mr. Werner, was impressed with the supposed discovery and made a contract with the inventor. At his laboratory at Paris Lemoine operated with an electric furnace in the presence of witnesses, and appeared to extract large diamonds from the crucible. On the strength of this Mr. Werner is said to have advanced him sums to the amount of $330,000. Lemoine proceeded to erect a hydraulic plant at Argeliers, in the Pyrenees region, for making operations on a large scale. After waiting in vain for a further outcome, Mr. Werner seems to have concluded that the affair was fraudulent, hence the lawsuit, which is filling columns in the Paris journals. A. de C.

Great Britain.

London, January 18.—The announcement that the American Westinghouse Company has been permitted to accept shares in the Traction and Power Securities Company in liquidation of the debt owing by the British Westinghouse Company has come simultaneously with the issue of a circular to the shareholders of the latter company setting forth the financial position of the undertaking. The striking feature of this circular is the statement that for the 11 months to November, 1907, there has been a trading profit of $380,000, and a net profit of about $90,000 after providing for interest on loans and debenture interest. The directors utter the belief that if there be no unfavorable development in industrial conditions the position of the company will continue to improve. For the year 1906 the trading profits only amounted to $85,000, and after meeting debenture interest there was a deficit of $220,000.

A new tramcar truck is being experimented with in London [illegible] never parallel.

In a short article [illegible] Stevens patent electric system of power transmission for application to heavy road vehicles. This system, with some modification, [illegible] put into service by a London omnibus firm, which is the first to use such a method of power transmission under commercial running conditions.

Liverpool corporation has just added to its fire brigade complement an electrically driven extending ladder, which is hoisted to a vertical position by a small electric motor. The total height of the ladder is 87½ feet and the carriage is driven by separate motors on each of the front wheels.

The electrification of the Lancaster-Heysham-Morecambe section of the Midland Railway, upon the single-phase system, is being rapidly proceeded with, 3½ miles being now absolutely completed. It is given out that on Sunday the first trials of the new rolling stock will be made over this portion of the line. The whole of the section which is being electrified comprises about nine miles of double track, there being four miles between Lancaster and Morecambe and five miles between Morecambe and Heysham.

There has just been ended in London a pretty little squabble between a local authority and an electric-lighting company which serves to illustrate the unreasonableness of municipalities on the one hand and the anomalies of law on the other. The South London Electric Supply Company some years ago contracted to erect a refuse destructor next to its generating station and to dispose of the local refuse. After awhile the local authority said the destructor was a nuisance and asked that it be abated. From the nature of the machinery it was clearly shown that the nuisance complained of was unavoidable, but after carrying the matter through the courts the case went against the electric supply company. In other words, while it was bound by its agreement to continue the destructor, it was ordered to abate a nuisance which it was admitted could not be remedied in the nature of things. Having got to this position, the next move was—and it could have been done much sooner and at much less expense—to come to an agreement to dismantle the destructor at a loss to the shareholders of $330,000. G.

New York.

New York City, January 25.—In the Court of Appeals a few days ago the authority of the Legislature to delegate essential powers to an appointive commission, more especially the old State Commission of Gas and Electricity, but by inference also the newly created Public Service Commissions, was questioned. The case was the appeal of the Saratoga Gas, Electric Light and Power Company from a judgment of the Appellate Division, which upheld an order of the Commission of Gas and Electricity purporting to fix for the village of Saratoga Springs the price of gas at $1.45 a thousand cubic feet and of electricity at eight cents a kilowatt-hour. The company argued that by depriving individuals and corporations engaged in the gas or electric business of the right to apply for an alteration of a rate once fixed by the commission, while conceding this important privilege to their opponents, denies to them the equal protection of the laws.

Several recent short-circuits in the subway which have cut off the power and delayed trains have caused the authorities to look about for a new method of lighting the cars when the power is cut off. The lighting of the cars at present is by current from the third rail and any trouble on the circuit leaves the cars in darkness. Some emergency plan of lighting is to be installed.

The first report of the Public Service Commission has been sent to the Legislature. As one of its chief features is the assertion that as a result of the first six months of its work 15,000,000 seats a year had been added to the subway, elevated and surface street railways of the city.

It is announced that about 60 per cent. of the exhibit space has already been taken for the New York electrical show to be held at Madison Square Garden, October 3d to 14th. The directors of the show are Dudley Farrand, president National Electric Light Association; Arthur Williams, New York Edison Company; W. W. Freeman, Brooklyn Edison Company; James R. Strong, president National Electrical Contractors' Association; James C. Young, Madison Square Garden Company; George F. Parker and Walter Neumuller. Mr. Parker is the manager.

The New York World in the issue of Sunday, January 19th, devotes a page to an article by Co'o-

nel Franclyn Elbert Davis, Ph. D., M. D., exploiting the merits of a 75-pound primary battery that "would light your house, work your electric fans and run your wife's sewing machine; a battery so small and light that you could pick it up and carry it out and place it in an automobile, which it would run down to your office or factory, there to furnish light and power for a lathe or other small machine, which would run your automobile home again, and, reinstated in your house, would furnish light, power and even heat." The inventor of this wonderful battery is a young Philadelphian, Frank A. Decker by name. This battery is mounted in a box two feet long, one foot deep and 18 inches wide and contains 12 jars of hard rubber, each of which in turn holds four separate cells. In each cell is a light framework of hard rubber with a thin plate of corrugated graphite on each side and a plate of zinc in the middle, separated by a flat cup of porous porcelain. The battery is normally discharged. To charge it the energizing fluid is pumped into the cells from a tank below the containing box. The fluid is diluted sulphuric acid and bichromate of sodium, which, we are assured, "can be bought at any drug store in the world." The inventor of this new form of the old "bichromate" battery claims to have had favorable tests made by Prof. F. B. Crocker of Columbia University and by Prof. Carl Hering of Philadelphia. In the absence of authentic reports by these gentlemen it is probably advisable to keep one's enthusiasm in better control than does Colonel Davis, quoted above. W.

New England.

Boston, January 25.—Among the more important electric-railway bills before the Massachusetts Legislature this year is the one just filed for the purchase of the West End Street Railway Company by the Boston Elevated Company, to which the former is now leased. The plan contemplates an increase of the capital stock of the Elevated by an amount equal to the par value of the West End stock outstanding. It is also proposed to give the Elevated the right to do a freight business.

The question of increased fares on the street railways that fail to pay expenses in this section is still under consideration by many boards of directors. The Medfield and Medway line, which has run at a loss ever since it started, and now has a deficit of about $50,000, proposes a seven-cent fare, an increase of two cents per ride, and the Dedham and Franklin will reduce its five-cent fare limits so as to collect one more fare for its through service.

The Boston Elevated Street Railway Company, in spite of the adverse money conditions of the past few months, has succeeded in marketing all of its issue of $5,800,000 in bonds authorized last June.

The Bar Harbor and Union River Power Company at Ellsworth, Me., is completing its dam for its waterpower service, and the power house will be ready for operation next month. Work is progressing on the electrical equipment for 2,500 horsepower.

The attorney-general of Massachusetts, it is understood, in view of a recent decision of the Supreme Court of the state, will institute proceedings against the New York, New Haven and Hartford to determine the validity of the railroad company's acquisition of trolley lines within the state.

The meeting of the New England Street Railway Club, scheduled to be held January 23d in the Electrical Engineering Building at the Worcester Polytechnic Institute, has been postponed till the spring.

Stockholders of the Pawtucket Gas Company of Pawtucket, R. I., have voted to authorize the consolidation of that corporation with the Pawtucket Electric Company. A New York and Philadelphia syndicate engineered the deal. The gas company owns one-half of the electric company's [illegible] B.

Ohio.

Toledo, January 25.—The Columbus Edison Company has called a meeting for March 2d for the purpose of increasing the capital stock from $1,000,000 to $1,500,000.

The connecting link between the Marion and Bucyrus and the Cleveland Southwestern electric roads has been completed, thus making a through line from Cleveland to Cincinnati, most of which is already in operation.

A. J. Coover, an electrician, has patented a device to prevent the spreading of rails. It is made of steel and malleable iron, to set between the tracks, and adjusts itself to expansion and contraction. The electric line between Dayton and [illegible] giving the invention a thorough test.

[illegible] Power Company [illegible]

The city of Bucyrus, Ohio, is considering the [illegible] of the electric-light plant at Hicksville, Ohio. The plant is said to be a paying investment. H. L. S.

Michigan.

Detroit, January 25.—Current was turned on the trolley wire of the Grand Trunk Tunnel at Port Huron this week.

The Berrien Springs Power and Electric Company has secured rights for a dam in the St. Joseph River at Bertrand, four miles south of Niles. Work will be started as soon as the dam at Berrien Springs is completed. The plants at these points will be operated in parallel with those at Buchanan, Twin Branch, Elkhart and South Bend.

Work will be resumed in the spring on the Tyler dam on the Manistee River, which is owned by the Electric Land and Development Company of Traverse City. This is the first of a series of four dams for which the company controls flowage rights.

Arrangements are being made for securing power for Manistee in the spring from the Hamlin dam. The dam is completed, and it is thought that there is sufficient power available for the operation of street cars, lighting and factory power. The head is 18 feet and Hamlin Lake makes an immense reservoir.

The Southern Michigan Railway Company, operating an electric line between St. Joseph and South Bend, through Niles and Berrien Springs, has decided to establish a park at Berrien Springs, where the building of a dam will make a large lake. D.

Illinois.

Peoria, January 25.—The Red Bud and Belleville Interurban Railway Company has been incorporated to build an electric road from Red Bud to Smithton. The incorporators include Conrad Becker, Red Bud, and Ben A. Gundlach of Belleville.

The Golconda Light and Water Company has been incorporated with a capital of $12,000 to operate a combined electric-light and water plant at Golconda. Incorporators are J. O. Williamson, R. H. Williamson and R. Gilbert.

The People's Gas and Electric Light Company of Canton has certified to a change of name to Canton Gas and Electric Company and increased the capital stock from $50,000 to $100,000, with an increase of the number of directors from four to five.

The first through car on the Indianapolis, Terre Haute and St. Louis Electric Railway from Indianapolis, Ind., to Paris, Ill., was run this week. Regular service is expected to be in operation today, with a connection at Terre Haute every hour for Indianapolis.

B. W. Arnold, who has been terminal superintendent for the Illinois Traction Company at Springfield, has been transferred to Decatur, where he will be acting superintendent of the roads there.

Papers transferring the Peoria, Streator and Ottawa Railway Company to the Chicago, Ottawa and Peoria Railway Company have been filed for record here. Included in the assets of the company are franchises in the cities of Ottawa and Streator. The papers bear the signatures of W. B. McKinley as president and George M. Mattis, secretary. The old company was formed to build a line between this city and Ottawa and Streator and the new company will take in the Illinois Valley road and the line from Senaca to Joliet. This is to be a part of the Illinois Traction Company's property and will form a part of the proposed through line from Chicago to St. Louis. The line from this city south to St. Louis is now built and operating.

The Chicago, Joliet and Central Illinois Railway, which is planning to build an electric railway from Chicago through Joliet to this city, has representatives at work in the vicinity of Joliet securing the right-of-way. V. N.

Northwestern States.

Minneapolis, January 25.—The Minnesota Power and Trolley Company is said to contemplate entering the field to compete for electric-light and power business in Minneapolis and will soon ask for a franchise.

The Northwestern Interurban Railway Company has made formal application to the city of Moorhead, Minn., for a franchise through the city. The company has secured a portion of the right-of-way being the distance from Cormorant to Lake Melissa.

Plans are being drawn for a new electric-light plant for Edgeley, N. D. The estimated cost is $6,650.

Livingston, Mont., will vote on February 4th on granting a franchise to the Madison River Power Company for an electric-lighting system.

The Oconto Falls Manufacturing Company of Oconto Falls, Wis., proposes to build a power dam below the present dam and transmit the power to the mill by electricity.

During 1907 there were but 2,341 poles for carrying electric wires set in Minneapolis, against 5,441 for [illegible]

C. A. Snyder, manager of the Auburn Electric Light and Power Company, has purchased the plant of the Blue Springs Electric Light Company of Blue Springs, Neb.

The water and light commission of Fairmont, Minn., has been authorized by the council to enter into a contract for the sale and handling of electric motors, heating devices and other electric appliances.

Negotiations are under way at Wausau, Wis., for the purchase of the Wausau Electric Company's plant by the Wausau Street Railroad Company. The street-railway company is also negotiating for the purchase of the Joseph Dessert waterpower at Mosinee, Wis. It is the intention of the company to erect a power house and transmit power to Wausau manufacturers and for the operation of the street railroad.

It is said that the municipal-light plant at Washburn, Wis., is a failure and that the business is running behind steadily. R.

Dominion of Canada.

Winnipeg, Man., January 25.—The ratepayers of Kenora, Ontario, voted in favor of that town building a municipal street-railway system. D. H. Currie is town clerk.

The conduit system being installed in Winnipeg for the government telephone system consists of fiber pipe. The conduit runs have been laid out after a most careful survey, the aim being to bring each subscriber's telephone circuit into the subway with the shortest possible aerial route.

A company of local business men of Creston, British Columbia, has been formed for the purpose of building a telephone and electric-lighting system in that town. While the company has only been in operation a few months there are already 20 miles of pole line and 100 telephones in operation. Several long-distance lines are in operation, including one to Spokane.

The latest in connection with the civic power question in Winnipeg is the proposition made by Alderman Adams that the city purchase the power plant on the Winnipeg River owned by the Winnipeg Electric Company.

The council of Port Arthur, Ontario, has just completed arrangements with the Kaministiquia Power Company for the supply of 700 horsepower to be used for lighting and the operation of the municipal street-railway system. The town's increased requirements for power and the failure of water supply from its resources in connection with its power plant have made it necessary to obtain outside power. For some time past the Kaministiquia Power Company has been supplying the sister town of Fort William, the Canadian Pacific Railroad, the Ogilvie flour mills, Canada Iron Foundry and several other concerns.

The directors of the Montreal Street Railroad Company have decided to issue $1,000,000 in stock to wipe out the floating debt of the company. R.

Pacific Slope.

San Francisco, January 22.—E. M. Downer of Pinole, Cal., representing the Great Western Power Company, has been granted a franchise for the company's transmission lines over the highways of Alameda County. This franchise is to enable the company to bring its power line into Oakland. The company has a private right-of-way covering most of the distance through Alameda County. The company has also asked for a franchise in Butte County giving it the right to erect and operate a power line to carry 100,000 volts through that county. The petition states that the line will be carried on steel towers 130 feet in height.

The annual banquet of the Electrical Contractors' Association was held in San Francisco on the evening of January 20th at the Fairmont Hotel.

The announcement is made at the United States Navy Yard at Mare Island, Cal., that the federal government will establish a wireless-telegraph station at Valdez, Alaska, to be under the control of the station at Sitka, Alaska.

The property owners along Pacific Avenue, San Francisco, have raised $100,000 toward the bonus to be offered to the United Railroads of San Francisco in consideration of the company's reconstructing the railroad on that street as an underground cable system rather than as an overhead-trolley line, as now contemplated by the company. The line was a cable line before the great fire, and has not been operated since. The company says that the reconstruction of the cable line would cost about $300,000.

A number of the savings banks of this city which had been fighting the proposition of raising by taxation $750,000 for the construction of a municipal street railroad on Geary Street, have decided to pay the extra tax without protest. The action of the supervisors recently indicates that the money raised will be used for other purposes than for that originally proposed.

F. X. Waldron & Co. of Seattle, Wash., have petitioned the Board of County Commissioners for the privilege of operating an electric railway along certain of the county roads and for the construction of its proposed power plant on Vashon Island.

The Chehalis and Centralia Railway Company, which plans to construct and operate an electric railway between Chehalis and Centralia, Wash., has bought from F. M. Boyne and others of Los

Angeles, Cal., an electric-railway line and equipment, including nearly 10 miles of 60-pound steel rails, six passenger cars and 20 freight cars, together with a steam power plant. The entire plant will be shipped to Washington for use in the new road and plant.

The Board of Supervisors of San Diego County, Cal., has granted to P. F. Schaniel and E. W. Jones the right to use the waters of False Bay for the purpose of developing electricity.

F. W. Peterson of San Diego, Cal., has secured an electric-railway franchise in that city.

The Vallejo Irrigation and Power Company has filed articles of incorporation at Napa, Cal. The capital stock of the company is $500,000, the incorporators being Joseph A. Migliavacca, E. W. Doughty and others.

The Quincy Electric Light Company of Quincy, Cal., is preparing to install a plant at that place with a capacity of 2,500 16-candlepower lights.

The Mount Hood Railway Company has petitioned the City Council of Gresham, Ore., for an electric-railway franchise, and the Portland Railway and Power Company has asked for an electric-light and power franchise in the same town.

Bids will be received at Stockton, Cal., until February 10th for an electric-railway franchise recently applied for by the Central California Traction Company.

The Phœnix and Eastern Railroad Company will soon build a trolley line across the Gila River at Winkleman, to be used in transporting ore.

The Home Telephone Company of Alameda County has applied to the Board of Supervisors of that county for a franchise to operate its lines throughout the county. A.

PERSONAL.

Mr. B. E. Sunny, vice-president of the General Electric Company, has been elected chairman of the committee on political action of the Union League Club, Chicago, after a spirited but friendly contest.

Judge Lauch McLaurin of Dallas, Tex., has withdrawn from the official family of the Southwestern Telegraph and Telephone Company to accept a professorship at law in the University of Texas.

William S. Love, general sales manager of the Wheeler Condenser and Engineering Company of New York and formerly in charge of the Chicago office of the company, died in New York a few weeks ago.

Mr. A. W. Paine of Kansas City, Mo., has been named as general manager for the Escanaba Electric Street Railway Company of Escanaba, Mich., to succeed A. R. Moore, who retired at the annual meeting of that company. Mr. Paine has had several years' experience as a street-railway operator at Kansas City and in other cities and is regarded as a capable man.

Mr. William W. Power has been appointed manager of the electrical department of the Boston branch of the H. W. Johns-Manville Company. Mr. Power was formerly district manager of the Allis-Chalmers Company's Philadelphia office, and previous to that he was connected with the Christensen Engineering Company. Mr. Power is well known in the New England States, and his wide experience in the electrical field, combined with a pleasing personality, will assist him in his new position.

Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, has accepted the appointment as a member of the American honorary committee to represent the United States at the International Exhibition of the Applications of Electricity, to be held in Marseilles, France, beginning April 19th and continuing to October 31st, this year. Mr. Insull will be the representative of the National Business League of America. The appointment was made by Paul Dieny, general United States commissioner of the French government.

Mr. H. S. Potter, superintendent of transportation of the El Paso Electric and Railway Company, El Paso, Tex., for several years, has been promoted to the position of general superintendent in charge of both railway and lighting departments, while Mr. George G. Morse of Jacksonville, Fla., becomes superintendent of transportation. Mr. George D. Hittrick has assumed the duties of chief engineer and Mr. S. D. Rowan, who formerly did erecting throughout the Southern states and Mexico, becomes assistant chief. The plant will be improved.

Mr. Enrique C. Creel of Chihuahua, Mexican ambassador to the United States and governor of the state of Chihuahua, has been elected president of the Compania Electrica y de Ferrocarriles of Chihuahua. This company recently took over the entire holdings of the Mineral Railroad Company and the street-railway system and electric-light plant in the city of Chihuahua. The Mineral Railroad is at present a steam line, and the plan is to install electric power upon this road and all the city lines. A large electric-power plant will be built. The company [illegible] of the [illegible] as general manager.

Mr. N. Miner [illegible] department of the Union Electric Company of Dubuque, Iowa, has accepted a similar position with the Topeka Edison Company, Topeka, Kan., and will have full charge of that company's advertising and [illegible] department. Mr. Miner will be remembered as one of the hosts during the splendid Denver national electric-light convention of 1901. Soon after the Denver convention he became one of the staff of the Curtis Advertising Company and did excellent pioneer work in the fertilization of the central-station field relative to modern advertising. Later he occupied a position on the staff of the Charles Austin Bates Company of New York. He left this company to go to Dubuque.

ELECTRIC LIGHTING.

Winnfield, La., is about to enlarge its electric-light plant.

The city of Perkins, Okla., may vote bonds to purchase the electric-light plant.

F. P. Hooper is reported to be about to establish an electric-light plant at Lead, S. D.

Bonds have been voted for the establishment of an electric-light plant in Edgeley, N. D.

Jenkins & Frost will begin installing an electric-light plant in Central City, Neb., in March.

S. B. Howard is applying for an electric-light and waterworks franchise at Quasqueton, Iowa.

The Florence (Ariz.) Water, Light and Ice Company has applied for an electric-light franchise.

The city of Le Compte, La., will expend $10,000 for an electric-light plant and plans are wanted.

Z. S. Jenkins and others have been granted a franchise for an electric-light plant at Central City, Neb.

Martin Bros. of Cleveland, Ohio, have been granted an electric-light franchise in Springdale, Ark.

M. A. Holzmark and others are applying for a franchise for an electric-light plant at Kansas City, Kan.

The Queen City Electric Company of Sedalia, Mo., has been incorporated with a capital stock of $2,000.

The Las Cruces (N. M.) Electric Light and Ice Company is about to remodel its plant and put in new machinery.

The Gorman (Tex.) Light and Power Company has been incorporated with a capital stock of $15,000.

The Melen (Wis.) Water and Light Company proposes extensive changes, including the establishment of a day service.

L. A. Pearson expects to install an electric-light plant in West Milton, Ohio, this summer. Water-power will be utilized.

New boilers, engine and generator are to be installed in the plant of the Stanberry Electric Light and Power Company of Stanberry, Mo. J. R. Creighton is manager.

The City Council of Crawfordsville, Ind., has refused an offer of $57,632.33 for the electric-light plant which for the last 17 years has been operated under municipal ownership.

A modern electric-light plant is proposed for Columbus, Miss., for which David L. Parsons of Columbus is said to be preparing plans. A machine and repair shop is included in the project.

The electric-light plant at California, Mo., has passed under the management of J. M. Boyd of Tipton and others, and it is planned to run a line to Tipton and furnish lights from the California plant.

The Anadarko (Okla.) Ice, Light and Power Company contemplates extensions and improvements to its plant to cost about $50,000. A new engine and generator are among the additions contemplated.

The village of Osceola, Wis., has granted C. C. Ladd of the Osceola Mill and Elevator Company a 20-year franchise to furnish electric light and power for the village. Mr. Ladd will organize a company.

C. C. Bird and associates of Earle, Ark., have incorporated as the Earle Light and Power Company. The company is capitalized at $10,000 and it is proposed to furnish electric light and power in the city of Earle.

Plans have been perfected for the incorporation of the Andrews Light and Power Company with a paid-up capital stock of $50,000 at Boise, Idaho. The company will build a power plant on the Lemhi River, near Salmon City, Idaho.

The city of Little Rock, Ark., plans to erect a new building and install electrical machinery and [illegible]

[illegible]

[illegible] kilowatt-hour.

With a view of considering the undertaking of a municipal electric-light plant the Board of Public Works at La Fayette, Ind., has engaged Prof. J. Walter Esterline of Purdue University to prepare plans and specifications and an estimate of the cost of such an enterprise. The time has come either to let another 10-year contract or to establish a municipal plant.

The city of Missoula, Mont., is now lighted with electricity generated at the new power plant of the Clark-Montana Realty Company, near Bonner. The installing of the new machinery was completed on January 15th. Electrician S. R. Inch and Engineer George Slack say that the new turbines and dynamos are running smoothly and that the tests made have been entirely satisfactory.

The report of the special committee of the Collinwood Board of Trade on the Collinwood (Ohio) municipal electric-light plant is a favorable one. Politics, it seems, has been kept out of the management of the Collinwood plant, and depreciation is figured at only five per cent., with no allowance for insurance, water or taxes. C. G. Beckwith is superintendent and the management of the plant is praised.

The Citizens' Light, Heat and Power Company, Johnstown, Pa., which has been operating two horizontal Parsons turbines, recently installed a third unit of the type built by the Allis-Chalmers Company. This runs at 1,800 revolutions per minute and delivers 1,000 kilowatts continuously under normal conditions, with large overload capacity. Distribution of current is made in the neighborhood of the power house at 2,300 volts, but through an additional feeder brought out from suitable connections in the armature winding, current generated at 4,000 volts is also transmitted to a sub-station three miles distant, where it is stepped down in the usual manner and used for operating motors in the vicinity.

ELECTRIC RAILWAYS.

The Rockford and Interurban Railway Company since it inaugurated the freight service on its electric road from Rockford, Ill., to Beloit and Janesville, Wis., has met with such an increase in business that a new freight depot will have to be built at Beloit. Officials say that the company is doing a large freight business and that it will probably increase still more as the summer months draw on.

The proposed electric railway to connect New Orleans with Grand Isle, an amusement resort on the Gulf, is to be constructed soon by the New Orleans and Seashore Air Line Railway Company. The main line will be 50 miles long, with branches. Extensive improvement of Grand Isle and of the land along the route of the railway is included in the project. Directors of the company include some influential men, among them J. W. T. Stephens, chief engineer, of New Orleans.

An American consul in Europe forwards a list of specifications for the construction of a new electric railway, work upon which, it is expected, will commence during the coming summer. The equipping of this railway will offer an opportunity to American manufacturers to supply steel rails, iron sleepers, double-truck motor cars, turbines, generators and other necessary items. Reference may be made to File No. 1864, Bureau of Manufactures, Washington, D. C.

The new Salem electric road out of Portland, Ore., will conduct an express and freight business. General Manager Talbot has signed a contract with the Wells-Fargo Express Company by virtue of which that company will handle all express business on the new line. Express matter will be carried in separate compartments in passenger cars for a time and the service will be as frequent as the business warrants. It is likely that separate express cars will be put on during the coming summer and that at least three cars will be operated over the line in each direction daily.

POWER TRANSMISSION.

The North Yuba Electric Light and Power Company has filed articles of incorporation at Reno, Nev. The capital stock of the company is placed

at $1,000,000, the incorporators being Samuel B. Crane, William B. Barstow and E. Talbot. The announced purposes of the company are to erect a power plant near the waters of the North Yuba in California and to supply light and power to various towns in Nevada and California.

A 9,700-horsepower Francis type hydraulic turbine, built by the Allis-Chalmers Company, Milwaukee, has just been placed in commercial operation at the Centerville plant of the Valley Counties Power Company, owned by the California Gas and Electric Corporation of San Francisco. This installation is unique among hydro-electric plants from the fact that never before has a Francis wheel been designed for the extremely high head of 550 feet.

Engineer R. S. Masson, formerly connected with the Huntington electric-railway lines in Southern California, is in Prescott, Ariz., arranging for the settlement of water-right and right-of-way questions connected with the proposed development of electric waterpower on Fossil Creek, 50 miles from Prescott. The project involves the building of two power plants, and a total of 10,000 horsepower will be developed. This will be transmitted to Prescott and elsewhere. Steel towers 45 feet high and 500 feet apart will support two circuits of three wires each, which will carry current at a voltage of 40,000.

SOCIETIES AND SCHOOLS.

Announcement of speakers for meetings of the Worcester Polytechnic Institute Branch of the American Institute of Electrical Engineers is as follows: January 31, W. E. Foster, illustrated lecture on "Railway Signaling," both steam and electric-railroad practice; February 14, Dr. George R. Olshausen, "German Educational Methods;" February 28th, L. S. Storrs, "A Consideration of the Fuel Supply of the United States;" March 13th, T. H. Parish, "Submarine Cables for Telegraphic Purposes from Factory to Operation;" March 27th, Dr. C. P. Steinmetz, subject to be announced later; April 11th, Mr. K. C. Randall, subject to be announced later. The meetings of May 1st and May 15th will be devoted to abstracts of thesis investigation by students in the Electrical Engineering Department.

Among the courses of study available in the college year 1908-9 for graduate students at the Massachusetts Institute of Technology, Boston, are a number of particular interest to electrical engineers. Prof. H. E. Clifford will continue his lectures on high-tension phenomena and the characteristics of alternating-current circuits. The advanced course which Professor Clifford addresses to graduate students is intended to be accompanied by a considerable amount of original investigation and research, carried on by each student. Each student in the electrical-engineering department who becomes a candidate for a higher degree is expected to follow a major course of theoretical lectures and one or two minor courses of lectures. Other courses of an advanced nature which are particularly planned to meet the requirements of the graduate students are given by Professor Laws on electrical testing, by Professor Shaad on the design of electric generating stations and systems of distribution, and by Professor Derr on the design of electrical machinery. Courses are also offered in subjects relating to mill engineering, the design of stationary structures, mathematical electricity, electrochemistry, etc., for those students who do not elect to take both their major and their minor subjects in the department of electrical engineering. A seminar is provided for studying the trend of contemporary advance in the electrical arts and its relations to historical development. A course of instruction in the organization and management of public-service companies is also provided for the benefit of graduate students. This course will include lectures by Professor Jackson and others.

PUBLICATIONS.

D. A. Britten of the Britten & Haines Electric Company, 177 Grand River Avenue, Detroit, Mich., has compiled a set of standard specifications for the installation of electrical work.

A recent circular (No. 132) of the United States Forest Service gives useful information relating to "The Seasoning and Preservative Treatment of Hemlock and Tamarack Cross-ties." It is written by W. F. Sherfesee, forest assistant.

The Illinois Traction System issues a useful wall calendar provided with an interesting map of the company's extensive electric-railway system, which extends from Peoria on the north to Danville on the east and St. Louis on the south.

The first number of the Illuminating Engineer has made its appearance in London. It is edited by Leon Gaster and will be published monthly by the Illuminating Enbineering Publishing Company. The January number has 90 pages of reading matter 6¼ by 9⅝ inches.

William H. Bristol of 45 Vesey Street, New York city, has issued as catalogue No. 20 "Electric Pyrometers for Blast Furnaces." This catalogue is the result of a great deal of study of the problem of equipping blast furnaces with these new pyrometers, and Prof. Bristol and his associates have visited nearly all the large steel works of the country for this purpose. The catalogue is one of unusual interest.

The Western Electric Company is about to issue a new bulletin covering "Beck Flaming Arc Lamps," fully descriptive of the most recent and important developments and with full data covering performance. These lamps as now manufactured are suitable for use on either alternating or direct currents and have been so simplified in construction that but little skill is required in operating. This line of arc lamps will supplement the already well-known line of enclosed arc lamps manufactured by the Western Electric Company.

The fifth anniversary number of the Manila Daily bulletin gives an exhaustive review of Philippine commerce and industry. It contains 74 pages and cover, well printed and profusely illustrated. The islands offer exceptional inducements in many lines for energetic young men. One of the leading commercial organizations is the Manila Merchants' Association. The Manila Electric Railway and Light Company in a full-page advertisement points out the advantages of electricity for power and lighting in tobacco factories, rice mills, printing offices, sawmills, etc.

A neat 12-page booklet has just been issued by the Joseph Dixon Crucible Company entitled "Dixon's Graphite Brushes." All those who have ever used graphite brushes will be especially interested in this new publication. Those who have never tried them but desire information on the subject will also find this book of value. Even those who are not especially interested in the subject of brushes but are connected with electrical industry may be glad to read up on this phase of the subject. The booklet begins with a description of the electrical installation of the Dixon company, explaining how Dixon's graphite brushes were first tried. Under headings of "Conditions of Service" and "Variables in Commutation," conditions are pointed out under which graphite brushes are best, while the requirements that must be met in their use are given. There are a few useful hints in the book of a general nature concerning brush tension and how to measure it, care of the commutator, etc. A copy of this booklet may be obtained upon request by writing to the Joseph Dixon Crucible Company, Jersey City, N. J.

TRADE NEWS.

The Houston Armature Works of Houston, Tex., has been incorporated with a capital of $10,000.

The Electric Manufacturing Company of New Orleans, La., has been incorporated by A. C. Schreiner and others with a capital of $30,000.

The Massachusetts Chemical Company of Walpole, Mass., manufacturer of insulating tapes, varnishes, etc., is about to open an office in Chicago, to be located at 464 Monadnock Building. Mr. Arthur E. Duclos, well known to the electric trade in the Middle West, will be in charge.

At the annual meeting of the board of directors of the Wagner Electric Manufacturing Company, held on January 21st, the following-named officers were chosen for the ensuing year: President, S. M. Dodd; vice-president and general manager, W. A. Layman; second vice-president, James W. Bell; treasurer, W. S. Thomas; secretary, Albert Blair; assistant secretary, M. S. Alcorn.

The Hamilton Anchor Company of Hamilton, Canada, has purchased from the Atlas Anchor Company of Cleveland, Ohio, through C. E. Frost, manager, the entire rights to the Atlas anchor and setters in the Dominion of Canada. The Hamilton Anchor Company has been in existence two years and has had good results with its own anchor. But it experienced a demand for an anchor that would resist a greater strain than its present product. After looking into the matter carefully it decided upon the Atlas anchor.

BUSINESS.

H. W. Reade, vice-president and treasurer of the National Pole Company, Escanaba, Mich., was in attendance during the recent telephone convention in Chicago and made many new friends for his company.

The International Electric Meter Company of Chicago reports that it has secured an order for alternating-current portable instruments from the Sanitary District of Chicago. These instruments are to be used by inspectors connected with the Drainage Canal power plant.

The interests of the Standard Underground Cable Company at the Chicago Electrical Show were looked after by J. R. Wiley, manager western sales department, W. M. Rogers and J. E. O'Neill of the Chicago office, and A. B. Saurman of the San Francisco office.

W. D. Woolley, secretary and treasurer of the Woolley Electric Company, St. Louis, maker of the Woolley lightning arresters and B-P fuses, spent a few days at the Chicago show and interested a great many possible users in Woolley products. The Woolley company showed a very handsome board of B-P fuses, which attracted wide attention.

Thomas F. Clohesey, sales manager of the General Compressed Air and Vacuum Machinery Company of St. Louis, an old electrical man, by the way, was indefatigable in his efforts to impress upon the throngs at the Electrical Show the merits of the company's portable and stationary housecleaning appliances. Mr. Clohesey feels that the central station could greatly increase its day load by helping the systematic exploitation of such apparatus which requires in every instance almost the employment of electrical power.

The C. H. Worcester Company, Tribune Building, Chicago, the large and well-known producer of Michigan cedar poles, announces that it has its usual large stock of seasoned poles of all sizes and is well prepared to meet any demand. The company carried over from last year a sufficient quantity of poles to supply the ordinary demands, and in addition it is now cutting a large supply. The company says that the conditions for cutting poles on its lands this winter have been better than for a number of years past, and consequently it will be well prepared to supply the needs of pole consumers. The Worcester Company supplies many of the largest operating companies in the electrical field, and is one of the oldest concerns in the business.

ILLUSTRATED ELECTRICAL PATENT RECORD.

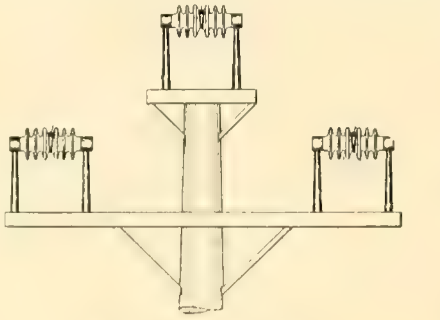
Issued (United States Patent Office) January 21, 1908.

876,923. Starting Motor-converter. Ernest F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 31, 1907.

[illegible]

[illegible] Ernest F. W. Al[illegible], [illegible], N. Y., assignor to [illegible] Company, Schenectady, [illegible] filed July 19, 190[illegible].

[illegible] nected with their armatures in parallel and their com- [illegible]



No. 876,939.—Insulator.

876,930. Dynamo-electric Machine. Sven R. Bergman, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 8, 1907.

A rotor for an induction motor has a laminated core provided with open slots, a winding carried in the slots and a squirrel cage formed of a slotted cylinder of sheet metal of high permeability carried in the top of, and closing, the slots.

876,939. Insulator. Harold W. Buck, Niagara Falls, N. Y. Application filed July 29, 1902.

The body of the insulator is a horizontal spindle with transverse external corrugations. The conductor is supported by the middle groove. The insulator is held by supports entering recesses in the opposite ends. (See cut.)

876,943. Dynamo-electric Machine. Charles E. Canfield, Norwood, Ohio, assignor to the Stanley

Electric Manufacturing Company, Pittsfield, Mass. Application filed June 8, 1904.

A balanced rotor [illegible] between which is a diagonal portion of aluminum [illegible] the specific gravity as the magnetic material, but [illegible] metrically placed with respect to the [illegible] of revolution.

876,941. Railway Signal. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 6, 1905.

A semaphore signal adapted to give three different indications has an operating mechanism therefor and a casing which contains a lens, a lamp enclosed in the casing, three translucent disks of different color [illegible] between the lamp and lens, a number of electromagnets controlling the disks, and switch contacts controlling the electromagnets and controlled by the semaphore signal.

876,945. Arc Lamp. George W. Cravens, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 16, 1904.

A pair of electrodes inclined to the horizontal are horizontally fed together. The arc between them is deflected by a magnet and the latter is gradually moved upward by the feeding mechanism to compensate for the change of position of the arc.

876,949. Armature Banding. Malcolm Dickerson, Newark, N. J., assignor of one-half to Frederick L. Luz, Newark, N. J. Application filed October 10, 1905.

At least two series of wire convolutions are made from a continuous piece of wire. Insulating material is placed between the series. The beginning and end of the wire are arranged in close connecting contact with each other. A wire wrap is placed around the contacting ends and a layer of solder around the joint.

876,952. Release Mechanism for Morse Telegraphs. Eugène Ducretet, Paris, France. Application filed June 15, 1905.

The receiving instrument is arranged so that its armature can throw a pawl out of engagement with a ratchet wheel which is provided with a balance and stop arm that can arrest a governor.

876,953. Railway-signaling System. Carl Enderlein, Cassel, Germany. Application filed March 22, 1906.

Block signals are operated by a number of cams that are driven on cam drums and controlled by electromagnets included in track circuits.

876,955. Dynamo-electric Machine. Russell S. Feicht, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 3, 1905.

The end connections of a rotor are rings of conducting material separated by circumferential slots. A set of air-propelling vanes is attached to the rotor inside the inner diameter of the rings.

876,956. Gas Cap. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 4, 1905.

A gas cap for an enclosed arc lamp has a double spiral passage therethrough for the arc gases which communicates at one end with the arc enclosure and at the other with the atmosphere.

876,962. Semaphore Signal. Reinhold Herman, Crafton, Pa., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 27, 1903.

A pivoted semaphore casting has two series of openings arranged on arcs of different radii concentric with the axis of the casting, two lamps mounted to coact with the openings, and a blade carried by the castings, the openings in the casting being so disposed as to show two lights in each position of the signal.

876,970. Electric Switch. Walter F. Jones, Eccles, near Manchester, England, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 13, 1907.

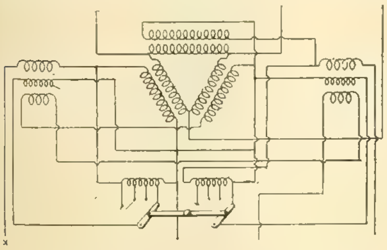
This switch comprises a ring of conducting magnetic material having projecting teeth around its periphery between which are arranged insulated contacts connected to the elements of the circuit to be controlled, and a relatively movable ring or frame provided with contact brushes and blow-out magnet pole tips adjacent thereto.

876,973. Motor-cooling Device. Arthur F. Knight, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 25, 1902.

In combination with an electric motor provided with a belt pulley whose inner end overhangs the shaft bearing is a fan attached to the inner end of the pulley and extending outwardly therefrom.

876,979. Potential Regulator. Edwin Lehr, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 13, 1905.

A three-phase alternating-current feeder system is provided with two series transformers and two regulating switches for simultaneously regulating the voltage between the lines. (See cut.)



NO. 876,979.—POTENTIAL REGULATOR.

876,984. [illegible] Electric Company, Schenectady, N. Y. Application filed [illegible] 1904.

[illegible]

876,988. [illegible] for Electric Vehicles. Walter S. [illegible], assignor to the General Electric Company, Schenectady, N. Y. Application filed August 10, 1904.

[illegible] provided with heat-radiating ribs.

876,993. Motor Control. Karl A. Pauly, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 18, 1907.

An induction motor is provided with [illegible] means controlled by the motor speed for varying the resistance in the secondary circuit of the motor, [illegible] controlled by the motor current for varying the resistance in this circuit.

876,996. Intelligence Intercommunication by Magnetic-wave Components. Greenleaf W. Pickard, Amesbury, Mass. Application filed June 10, 1907.

This "wireless" receiving apparatus consists of a large closed circuit, including a condenser of variable capacity and a current-operated detector in shunt therewith.

876,997. Electrical Dental and Surgical Appliance. Harry F. Pressey, Bridgeport, Conn., assignor of one-third to Willis F. Chamberlain, Bridgeport, Conn. Application filed April 24, 1907.

A flexible metallic holder for an incandescent lamp contains a resistance coil between the lamp and source.

876,998. Means for Supporting Brush Holders. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 18, 1905.

An electric locomotive has four driving axles, a frame supported upon them, four motors, each having its armature and commutator mounted upon an axle, brush-holders supported on the frame, a wedge between each brush-holder and frame for adjusting the brush-holder laterally, and means for adjusting each brush-holder longitudinally.

877,002. Telegraph System. Harry O. Rugh, Sandwich, Ill. Application filed December 26, 1906.

This system includes a number of telegraph stations having signal-sending apparatus and operating batteries for connection with the line, and means at one sending station, governed at another sending station, for preventing the connection of its battery with the line.

877,005. Electric Locomotive. Richard Schwarz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 18, 1906.

In an electric locomotive there is a set of driving axles, spoked driving-wheels thereon, a motor armature surrounding each axle, a supporting spider for each armature, and compression springs between the spokes of the wheels and spiders, one set of spokes being hollow and partly surrounding a portion of the spokes of the other set.

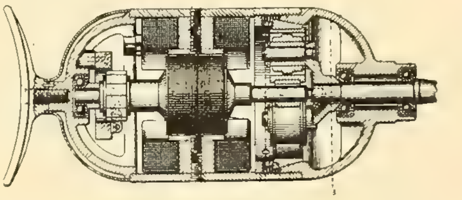
877,013. Machine for Making Incandescent Lamps. Alfred Swan, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 25, 1906.

The machine provides a blowing-off device and a number of sealing-in devices, all arranged to be within reach of a single operator. The several devices are connected so as to operate in a predetermined order.

877,015. Friction Gear. Leonard A. Tirrill, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 28, 1904.

A motor is provided with field ring, an end bearing, an intermediate ring arranged between the field ring and end bearing, and a friction-drive mechanism including an open-ended track ring supported within the intermediate ring, the two latter rings having complementary inclined engaging surfaces.

877,016. Electric Motor. Leonard A. Tirrill, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 7, 1906.



NO. 877,016. MOTOR.

In this motor the field ring has a portion at one end internally threaded and a bonnet is threaded exteriorly to engage the threaded portion of the field ring and formed with an interior tapered surface. The armature shaft and a second shaft are joined by a coupling including a split ring having an outer tapered surface engaging said inner tapered surface, and means for moving this split ring axially comprising an annular member threaded exteriorly to engage the threaded portion of the field ring. (See cut.)

877,017. Dynamo-electric Machine with Compensating Windings. Ludwig Torda, Chiswick, England. Application filed March 8, 1907.

A compensating device for neutralizing the field-distorting effect of the armature and assisting the commutation consists of bars of iron forming part of the main [illegible]

877,024. [illegible]

[illegible]

877,026. [illegible] Ezekiel W. [illegible], assignor to the General [illegible] Company, Schenectady, N. Y. Application filed [illegible] 1903. Renewed July [illegible] 1907.

[illegible]

877,028. Motor Control. Harold L. White, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1907.

An electric motor [illegible] resistance, a number of [illegible] short-circuiting portions of the resistance, [illegible] operated starting switch [illegible] energize the [illegible] ating winding of the [illegible] matically de-energizing a portion of the [illegible] the load on the motor exceeds a predetermined amount.

877,030. Motor Control. Carl E. Zix, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1906.

The motor is provided with a divided-field winding and controlling means adapted to connect one portion of the field winding in series with the motor armature and the second portion in shunt for one direction of rotation and to connect the second portion in series and the first in shunt for the opposite direction of rotation.

877,033. Switching Mechanism for Telephone Circuits. Albert K. Andriano, San Francisco, Cal., assignor to the Direct Line General Telephone Company, San Francisco, Cal. Application filed March 15, 1905.

A desk telephone has a line-selecting switch mounted in its base. The contacts are arranged in two parallel superposed circles, between which the rotatable switch piece can be swung.

877,034. Gyroscope. Hermann Anschütz-Kaempfe, Kiel, Germany. Application filed June 6, 1906.

A gyroscope wheel is arranged so it can turn about a horizontal and about a vertical axis, each of the axes being transverse to the axis of rotation of the wheel. Means are arranged for exerting a torque tending to turn the wheel on the horizontal axis, and means rendered effective by this movement for exerting a torque tending to turn the wheel on its vertical axis.

877,057. Insulated Rail Joint. Philip J. Dalton, Joliet, Ill., assignor to the Rail Joint Company, New York, N. Y. Application filed December 7, 1906.

This joint comprises the rails, side angle bars, a flanged base plate, a wooden block confined between the flanges of the base plate and interposed between the latter and the rail bases, and insulating means.

877,058. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed November 11, 1903.

A polarized cut-off relay is arranged for each line. This is operated in one direction when connection is made with the calling line, thus cutting out the line signal, and in the reverse direction when connection is made with the called line.

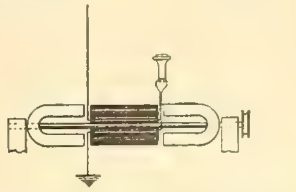
877,065. Waiter's Cabinet. Burt H. Farrell, Deadwood, S. D. Application filed September 24, 1906.

A cabinet has several drawers, one of them a heater drawer. An electric heater is mounted in this drawer and a circuit-closer operated by movement of the drawer to close the heater circuit.

877,067. Automatic Transmitter for Fire-alarm and Sprinkler Systems. James Fiddes and John F. Watt, Aberdeen, Scotland, assignors to the Expansion Sprinkler Syndicate, Limited, Aberdeen, Scotland. Application filed October 26, 1906.

Normally separated contact levers are brought together by the descent of a float.

877,069. Magnetic Detector. Lee De Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. Application filed November 2, 1903.



NO. 877,069.—MAGNETIC OSCILLATION DETECTOR.

A magnetic oscillation detector comprises a number of cores disposed about a common axis, separate coils for the cores connected in series, and a magnet mounted to turn upon a coincident axis. (See cut.)

877,089. Method of Making Electric Condensers. Frank S. Koch, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 15, 1904.

[illegible] consists in assembling the conductors and [illegible], forcing the assembled parts into an enclosing [illegible] submerging the case and parts in molten paraffine, [illegible] the case and contents and subjecting the whole [illegible] pressure, and allowing the paraffine to harden under [illegible]essure.

877,101. Clip for Fixing Conducting Wires to Insulators. Johann Macek, Vienna, Austria-Hungary. Application filed January 29, 1907.

This clamp consists of an adjustable ring for surrounding an insulator neck and has a bent-over portion, a screw for drawing the ring to clamp it to an insulator, a plate fitted upon the ring and resting against the bent-over portion, and a second plate linked to the bent-over portion, for clamping a line-wire between the plates.

877,121. Telephone System. Howard M. Post, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed November 11, 1903.

This patent covers some other features of the system described in No. 877,058.

877,126. Trolley-pole Controller. Oscar A. Ross, Chicago, Ill. Application filed August 6, 1906.

The pole is provided with a supporting member having two seats for holding the pole in an inclined and in a horizontal position. If the trolley jumps the wire the pole is automatically lowered to the horizontal position.

877,130. Igniter. George J. Schultz, New York, N. Y., assignor to Benjamin Briscoe, Tarrytown, N. Y. Application filed January 24, 1907.

A sparking point is carried on a shaft and insulated by disks of mica. Several of these disks at one portion are of larger radius than the normal radius of the disks at the outer portions, thus forming a translucent plate.

877,144. Synchronizing Apparatus for Alternators. Max Vogelsang, Frankfort-on-the-Main, Bockenheim, Germany, assignor to the firm of Voigt & Haeffner, Atkiengesellschaft, Frankfort-on-the-Main, Germany. Application filed February 2, 1905.

The connections for parallel operation consist of a switch controlled by relays that are in turn operated only when the potential, phase and frequency are the same on the machine to be connected as on the machines already in service.

877,154. Electrical Abdominal Heater. Hiram D. Wood, Jr., Minneapolis, Minn. Application filed July 3, 1907.

This is a heating pad made of non-absorbent material with an inner and outer shell fitting the body. The heating coil is mounted between the shells and insulated from them.

877,155. Electrical Face-steamer. Hiram D. Wood, Jr., Minneapolis, Minn. Application filed July 3, 1907.

This heating appliance is made up like the previous one, except that it is bowl shaped and has an air hole in the middle.

877,171. Method of Manufacturing Metallized Electric Incandescent-lamp Filaments, and 877,172, Method of Producing Filaments for Electric Incandescent Lamps and the Product of Such Method. Francis M. F. Cazin, Hoboken, N. J. Applications filed August 15 and September 21, respectively, 1904.

A carbon filament is first made to the right shape and then placed in an electrolytic cell and covered with a deposit of metallic alloys by electrolysis with a number of different solutions successively.

877,175. Speed-indicating Apparatus, and 877,176, Speed-indicating Device. Sylvester C. De Fore, Kansas City, Mo., assignor to the Standard Speedometer Company. Applications filed November 30, 1906, and May 11, 1907, respectively.

A fly-ball governor is connected with a speed-indicating scale and with contacts that close an alarm circuit at a limiting speed.

877,177. Electric Heater. Henry D'Olier, Jr., Philadelphia, Pa., assignor of one-half to George W. Elkins, Elkins Park, Pa. Application filed January 13, 1906.

This electric water heater has a passage therethrough, a thermostat in fluid connection with the passage and an electric circuit feeding the heating element and having points of contact within control of the thermostat.

877,183. Electric Heater. George W. Elkins, Elkins Park, Pa., assignor of one-half to Henry D'Olier, Jr., Philadelphia, Pa. Application filed January 13, 1906.

In this form of water heater there is a removable heat element and a casing therefor, contacting spirally therewith throughout its length and affording inlet and outlet passages to the spiral path formed between. A faucet valve when turned in one direction closes the circuit through the heat element.

877,193. Hydraulic Electric Ice Machine. Daniel L. Holden, New York, N. Y., assignor to the Federal Ice Company. Application filed June 28, 1906.

[illegible] are operated by electric [illegible] that are automatically controlled.

877,242. Insulator Pin. [illegible] V. Snapp, Holdrege, and Charles W. Frainer, Lincoln, Neb. Application filed June 21, 1907.

[illegible] externally threaded [illegible] cross arm [illegible]

877,[illegible]. [illegible] Measuring Instrument. William J. Still, Ealing, England. Application filed June [illegible]

[illegible] adapted [illegible] traversed [illegible] each other upon the [illegible] the position [illegible] of the current and in

which the difference between the forces of the two coils will just support the armature.

877,258. Automatic Regulating Device. Percy H. Thomas, Montclair, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed February 17, 1903. Divided and this application filed June 16, 1905.

In a system of electrical distribution in which a receiving circuit is fed from an alternating supply there is in combination a mercury-vapor tube requiring a reinforced potential, and a starting band for applying this reinforced potential, with means for varying the time of application thereof, together with means responsive to the delivered energy for controlling the varying means.

877,284. Electric Apparatus for the Ignition of Mines. Otto R. P. Berglund, Walter A. W. E. Hjorth and Carl E. Ljungman, Stockholm, Sweden. Application filed October 25, 1905.

A magneto and transformer are connected to the blast-igniting circuit by a set of contact posts and switch levers.

877,301. Wall Switch. John H. Dale, New York, N. Y. Application filed May 18, 1906.

A gear having teeth at diametrically opposite points separated by plain or untoothed portions is moved by racks connected with the push-buttons. A switch blade is connected by a detent and a spring to the gear.

877,311. Electric-signaling Apparatus. Sydney Evershed, London, England, assignor to himself and Evershed and Vignoles Limited, London, England. Application filed December 23, 1905.

There are in combination a transmitter, a current ratio indicator, two double coils, each having its component coils at an angle of 90 degrees to one another, two ellipsoid needles, one of which is snugly enclosed in each of the double coils, an arm fixed to each of the needles, a crank fixed at the end of each arm, and connecting links pivoted on the cranks and connected to the rear end of a pivoted indicating pointer.

877,312. Electrical Transmission Apparatus. Sydney Evershed, Chiswick, England, assignor to himself and Evershed and Vignoles Limited, London, England. Application filed February 28, 1906.

The receiving apparatus for repeating the movements of the transmitter consists of a bridge motor in a balancing circuit, a repeating device, a subdivided resistance, a multiple point switch connected thereto, a gear connecting the repeating device and the switch to the bridge motor and means for securing exact correspondence of the receiver with the transmitter.

877,319. Transformer Employed in High-frequency-current Circuits. Georges E. Gaiffe, Paris, France. Application filed November 8, 1904.

A safety device for protecting high potential transformers against oscillation of high frequency comprises a secondary winding, resistances connected with the ends thereof and electric capacities joined intermediate the resistances and secondary winding.

877,326. Electric-light-socket Cap. John H. Goss, Waterbury, Conn., assignor to the Scoville Manufacturing Company, Waterbury, Conn. Application filed May 29, 1907.

The cap has an opening surrounded by a double flange and a hub arranged in the opening and embracing the double flange on the outside of the opening and on the inside as well.

877,362. Sign-illuminating Device. William H. Nicolay, New York, N. Y. Application filed May 6, 1907.

A hood having top and side reflectors has a series of lamps extending centrally of the hood, and a sign arranged below the lamps and in line therewith.

877,369. Electropneumatic Machine. William K. Rankin, Philadelphia, Pa., assignor to John E. Reyburn, Philadelphia, Pa. Application filed February 15, 1906.

The motor is mounted in a casing and drives the pump pistons through a worm and worm wheel mounted on the crank-shaft.

877,379. Trolley Replacer. George Q. Seaman, New York, N. Y. Application filed March 23, 1907.

Automatic means are arranged depressing the pole when displaced from the wire and a cradle is adapted to receive the trolley pole when depressed, and affords means for raising the same to its normal position.

877,383. Means for Securing Cords to Lamp Sockets. Frederick A. Swan, Cliftondale, Mass. Application filed March 15, 1907.

Means are arranged within the socket to frictionally hold the cords and thereby to relieve the terminals from any strain.

877,384. Electrical Fitting. Frederick A. Swan, Cliftondale, Mass. Application filed April 22, 1907.

This is a modification of the above adapted to a ceiling receptacle.

877,408. Manufacture of Electric Incandescent Lamps. Francis M. F. Cazin, Hoboken, N. J. Application filed March 17, 1904.

In this patent the process referred to in Nos. 877,171 and 877,172 is specified as using metals of the ruthenium-osmium group.

877,427. Circuit Controller. Lemuel F. Howard, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed August 3, 1906.

Several pairs of contact springs are oppositely arranged with a contact piece for each pair of springs. A two-toothed pinion is connected with the contact pieces, and a reversely reciprocating part operates it at the extremes of its movement so as to have the contact pieces engage the pairs of contact springs, and to hold the contact pieces disengaged when in any position other than an extreme position.

877,439. Apparatus for Magnetically Concentrating Ores. Henry Leighton, Seattle, Wash. Application filed September 19, 1906.

In a magnetic separator for treating material in a wet state there are in combination with a magnet, a water receptacle, means for feeding the material into the water toward the magnet and a reciprocating separator interposed between the discharge end of the feed and the magnet and in the direct path of the material.

877,442. Lightning Rod. Lavake L. Mast, West Milton, Ohio. Application filed July 27, 1906.

The rod is in cross section shaped like a trough, the edges of which are bent outwardly, downwardly and inwardly across the flat bottom and abutting to form three thicknesses at the base.

877,446. Apparatus for Manufacturing Nitric Acid or Oxide from Air. 877,447. Process for the Production of Pure Nitric Acid. Harry Pauling, Gelsenkirchen, Germany, assignor to the firm of Salpetersäure-Industrie-Gesellschaft, G. M. B. H., Gelsenkirchen, Germany. Applications filed December 18, 1905, and April 6, 1906, respectively.

Electrodes for the production of electrical discharges are arranged end to end. At right angles to them are mounted a number of parallel plates insulated from each other and from the shaft with which they can revolve. Air is subjected to the action of the discharges in the closed chamber and the nitrogenous gases formed are mixed with aqueous vapor while at a minimum temperature of 200 degrees C. The gaseous nitric acid formed is then passed into cooling apparatus for condensation.

877,448. Process for the Production of Voltaic Strong-current Arcs. Harry Pauling, Gelsenkirchen, Germany, assignor to the firm of Salpetersäure-Industrie-Gesellschaft, G. M. B. H., Gelsenkirchen, Germany. Application filed June 30, 1906.

The process consists in passing a gas to be acted upon by electrical discharges, in two currents between a pair of electrodes, the latter diverging in two different directions, one of the currents passing in one of these directions, the second current in the other direction.

877,451. Means for Receiving Intelligence Communicated by Electric Waves. Greenleaf W. Pickard, Amesbury, Mass. Original application filed August 30, 1906. Divided and this application filed November 8, 1906. Again divided and this application filed November 12, 1907.

This receiver for "wireless" waves comprises two substantially massive individual conducting solids, one of which has low resistivity and the other high resistivity and also thermo-electromotive power, the conductors being operatively connected together in substantially perfect electrical contact.

877,458. Electric Track Switch. Rollin A. Baldwin, New Haven, Conn., assignor to the Baldwin & Rowland Switch and Signal Company. Application filed December 5, 1906.

A box is embedded at right angles to the switch. It is hermetically closed and contains a water-tight cylinder surrounding two solenoids and filled with oil. The plunger of the solenoids connects with a shaft passing through a stuffing box and through it moves the switch point.

877,464. Railway Signal. John C. Link, Highbridge, Wis. Application filed March 25, 1907.

A swinging signal arm is mounted on the signal board. It carries a mercury cup provided with contacts that keep the main circuit closed when the arm is stationary. A number of spaced set contacts are connected when the arm is moved.

877,467. Cooling System for Electric-railway Apparatus. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed August 10, 1904. Divided and this application filed June 16, 1906.

The transformer on the car furnishing low voltage to the motors from a high-tension trolley is mounted in a casing beneath the car. It is cooled by forcing air through it by the movement of the car at high speed. The intake pipe of the air compressor for the brake system also draws air through the transformer casing, thus cooling it at low speeds after the brakes have been applied and the compressor starts up.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 27, 1908:

445,176. Electric Arc Lamp. J. A. Hayes, Carson City, Nev.
445,207. Electromagnetic Motor. N. Tesla, New York, N. Y.
445,217. Thermal Cut-out. A. Barrett, Kansas City, Mo.
445,220. Coin-controlled Electric Coil. E. J. Colby, Chicago, Ill.
445,234. Electric Cable. J. C. Reilly, Brooklyn, N. Y.
445,253. Electric Cut-out. J. S. Potter, Newton, Mass.
445,295. Electric Bell. J. F. Wollensak, Chicago, Ill.
445,310. Electric Switch. G. Cutter and C. G. Armstrong, Chicago, Ill.
445,331. Electric Guest Call. A. Sriemer, Sleepy Eye, Minn.
445,362. Cut-out. S. Bergmann, New York, N. Y.
445,363. Electric Cut-out. S. Bergmann, New York, N. Y.
445,364. Key for Electric Cut-outs. S. Bergmann, New York, N. Y.
445,365. Electric Cable Connector. S. Bergmann, New York, N. Y.
445,400. Turn-out for Electric Railways. R. M. Hunter, Philadelphia, Pa.
445,422. Secondary Battery. C. F. Brush, Cleveland, O.
445,425. Galvanic Battery. W. A. Crowdus, Memphis, Tenn.
445,442. Telegraph Key. J. Doggett, Plain City, O.
445,448. Regulator for Dynamo-electric Machines. J. H. Holmes, Newcastle-on-Tyne, England.
445,475. Telephone. E. Noriega, Mexico, Mexico.
445,479. Electric Connection for Track Wiring. S. H. Short, Cleveland, O.
445,499. Electric Motor. W. M. Dresskell, Brainerd, Minn.
445,515. Conductor Switch for Electric Railways. F. J. Sprague and J. F. S. Branth, New York, N. Y.
445,521. Commutator Brush-holder for Electric Motors. G. H. Condict, Philadelphia, Pa.

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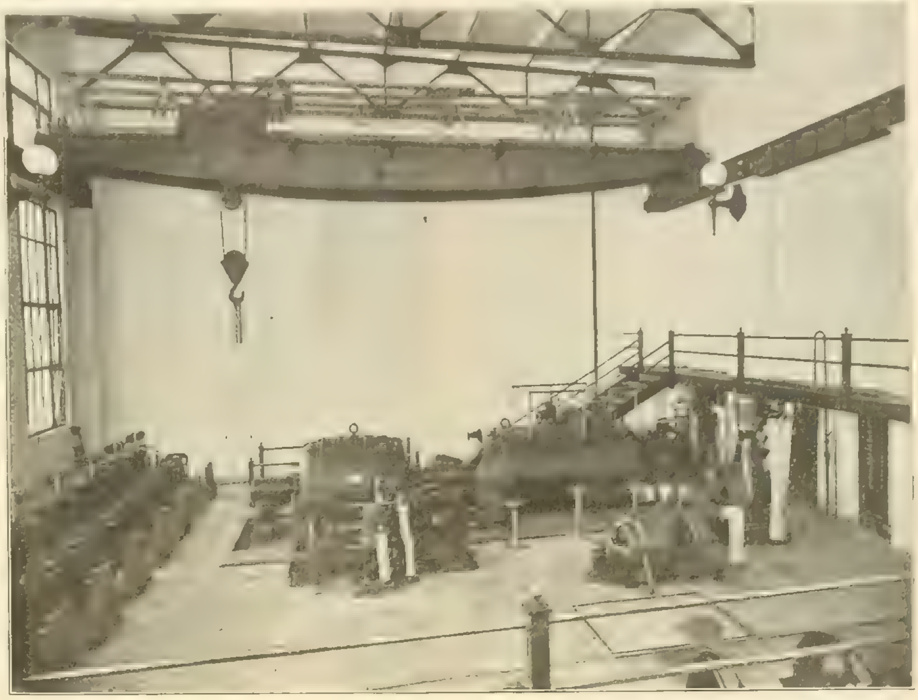
New Power House and Lighting Equipment for the South Park System of Chicago.

In October, 1892, 16 years ago, an electric-light plant was completed in Washington Park, Chicago, located at Fifty-seventh Street and Cottage Grove Avenue, to supply light for two large parks. These parks are now, as then, a part of the South Park system, to light which requires a considerable amount of current and no inconsequential equipment. With the development of the park system by the addition of many smaller parks came the decision some time ago by the South Park Commissioners to generate all their own current, to be supplied from a central point, and the fine, new plant here described, modern in every particular, is the result.

Before taking up the new equipment a word of history concerning the old plant—a good one in its day—may perhaps be timely. The old plant (abandoned last month) is equipped with six 50-arc-light Brush machines, three cross-compound engines and three water-tube boilers. Current was transmitted over 25 miles of underground lead-covered cable to supply 300 9.6-ampere arc lamps. This system has been operated every night in the year since October, 1892, without a complete shutdown, without an accident of any consequence to machinery, and without a man being injured. The plant was shut down apparently in as good shape as it was when started 16 years ago, a record for durability, constant and regular service which the new and modern apparatus will do well to equal. The cable, which was installed for 2,500-volt direct current, is now carrying 9,000-volt alternating current without breakdown. Practically the same operating crew which was connected with the old plant through its long career had the honor of starting the new one.

The new plant is modern and convenient and contains many interesting features. In its design and construction Mr. John A. Radford of Chicago was the engineer. Mr. W. E. Daniels is the chief operating engineer of the South Park Commissioners. The system is designed to furnish current for 19 parks and five boulevards in the South Park system, requiring 130 miles of underground cable, most of which is now installed.



INTERIOR OF GENERATOR ROOM IN THE NEW POWER HOUSE OF THE SOUTH PARK SYSTEM, CHICAGO.

TRANSFORMERS AND REGULATORS IN NEW SOUTH PARK POWER HOUSE.

On this and following pages will be found reproductions of photographs and drawings of the plant. The portion of the power house now built provides for 1,500 kilowatts in turbo-generator capacity. The design is such that the station can be extended on the unit plan so as ultimately to contain a rated capacity of 3,500 kilowatts, consisting of three 1,000-kilowatt and one 500-kilowatt turbo-generator units.

The present installation consists of a 1,000-kilowatt Westinghouse-Parsons turbine and generator unit, which supplies three-phase current at 60 cycles, 2,300-4,150 volts. This unit is shown in the general view of the generator room. The generator is normally rated at 1,333 kilovolt-amperes on a basis of 75 per cent. power factor, and is designed to carry, on the same basis, 50 per cent. overload.

A special feature of the turbine is an arrangement for leading steam from an intermediate stage to supply low-pressure steam heating. In the various buildings within Washington Park, such as the greenhouse, propagating house, lily ponds and other buildings, the design is such that a maximum of 7,500 pounds of steam per hour can be taken from the turbine in this manner while operating con- [illegible]

Excitation is furnished by a 35-kilowatt turbine-driven direct-current generator built by the General Electric Company. This machine, shown in the picture with the main generator, also furnishes power for operating the coal and ash-handling apparatus and supplies current for the incandescent lighting throughout the power house. Future extension provides for the installation of one motor-driven exciter.

For lighting the main parks and boulevards there are nearly 1,600 alternating-current 7½-ampere enclosed arc lamps, operated on series circuits directly from the power house. This equipment includes static transformers, regulators and arc lamps made by the Fort Wayne Electric Works. The transformers and regulators, located along the east wall of the generator room, are clearly shown in the pictures and drawings. There are also about 5,000 16-candlepower incandescent lamps in the system. The arc and incandescent lighting in what is known as the small parks is provided for by three 2,300-4,150-volt four-wire underground transmission lines, trans- [illegible]

[illegible] bracket arc lamp shown in the illustrations. It is a modified structure of the regular 7½-ampere alternating-current series lamp, the entire mechanism and service wires being enclosed in a 20-inch opal globe. This bracket arc lamp was designed by Mr. Daniels, and is now manufacturd by the Jandus Electric Company of Cleveland.

The switchboard is located at an elevation in the north end of the generator room, as shown in one of the illustrations. It carries the usual instruments and switches, besides providing ample room for future extensions of the plant. All the high-tension apparatus is located in a separate room in the basement and is controlled from the generator-room floor. One of the pictures shows the equipment in the high-tension room.

Office room for the chief engineer is provided at one end of the switchboard gallery. A convenient arrangement in connection with the switchboard gallery is the provision for having the driveway directly beneath. The floor in front of the switchboard is made in the form of four large cement trap-doors which can be lifted easily, and any heavy machinery for the power house can thus conveniently be hoisted by the crane direct from wagons into the building.

The power house is built of brick and steel and is large and airy. Floors, foundations, etc., are of concrete. Within, the walls are of white enameled brick and everything is neatly finished. The white walls, together with the large windows, provide an unusual amount of daylight. The generator room is provided with an overhead traveling electric crane.

The relative positions of the different machines and apparatus are clearly shown in the different drawings of the plant.

There are at present installed in the new plant three Heine boilers of 350 horsepower each, of the horizontal, water-tube type. They are equipped with Foster super-heaters and Green chain-grate stokers. Draft is supplied by one 200 by 11-foot brick chimney. The boilers and furnaces operate entirely smokeless, with loads ranging up to 50 per cent. overload.

Coal supply for the station is obtained in wagons, the wagons being of special design for the purpose, with removable dump-bottom bodies. Coal as it arrives is hauled through the driveway provided for the purpose, shown in the drawing, and stopped on a wagon platform scale, the scale beam being located on the boiler-room floor. The fireman records the weight and hoists the load, dumping the

coal into bunkers over the boilers, without leaving the boiler room. The empty wagon body is returned to the truck standing on the scale, and the weight, empty, is recorded. Coal is therefore handled without shoveling, and with the team driving in a direction straight ahead at all times.

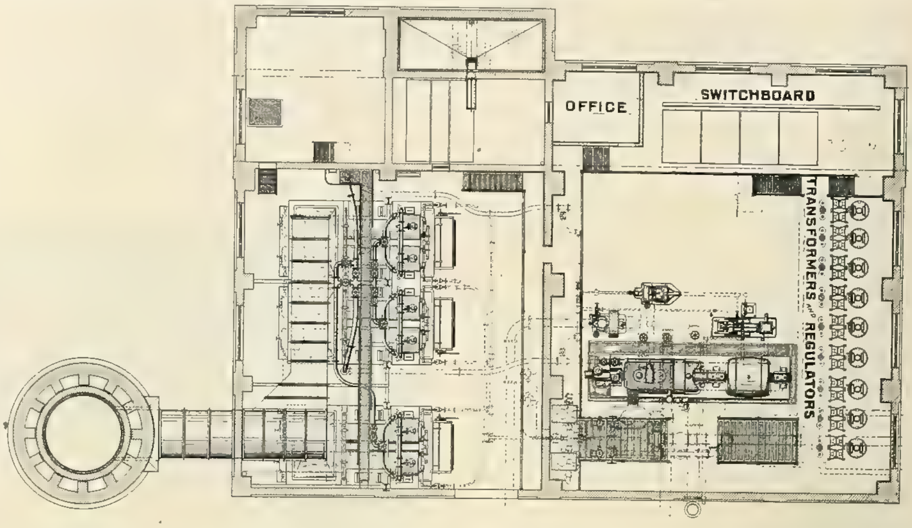
Ashes and fine coal are taken from the pits and hoppers beneath the boilers in the boiler-room basement by a four-ton motor-driven car. The car is arranged to run out on the scale directly beneath the ash and coal hoist. The net weight of each load is determined and recorded. The ashes are hoisted and dumped into an overhead bunker arranged with a chute for loading into wagons, and are used for filling in different places around the park system. The fine coal is hoisted and dumped into the coal bunkers over the boilers. The coal crane is of special design and entirely automatic in its operation. The crane was built by the Case Manufacturing Company of Columbus, Ohio, according to drawings and designs furnished by the consulting engineer.

Of considerable interest is the condensing equipment of the plant. The turbine is fitted with a surface-condenser equipment built and furnished by the C. H. Wheeler Manufacturing Company of Philadelphia. The condenser has 4,000 square feet of cooling surface, made up from one-inch brass tubes 16 feet long. Condensed steam is taken from the condenser by a vertical-pattern direct-acting steam pump, the steam end being located on the turbine-room floor with the water end several feet below the condenser in the basement, so that water of condensation flows by gravity to the pump. This pump discharges into an open feed-water heater, from which the boiler feed pump takes feed-water supply.

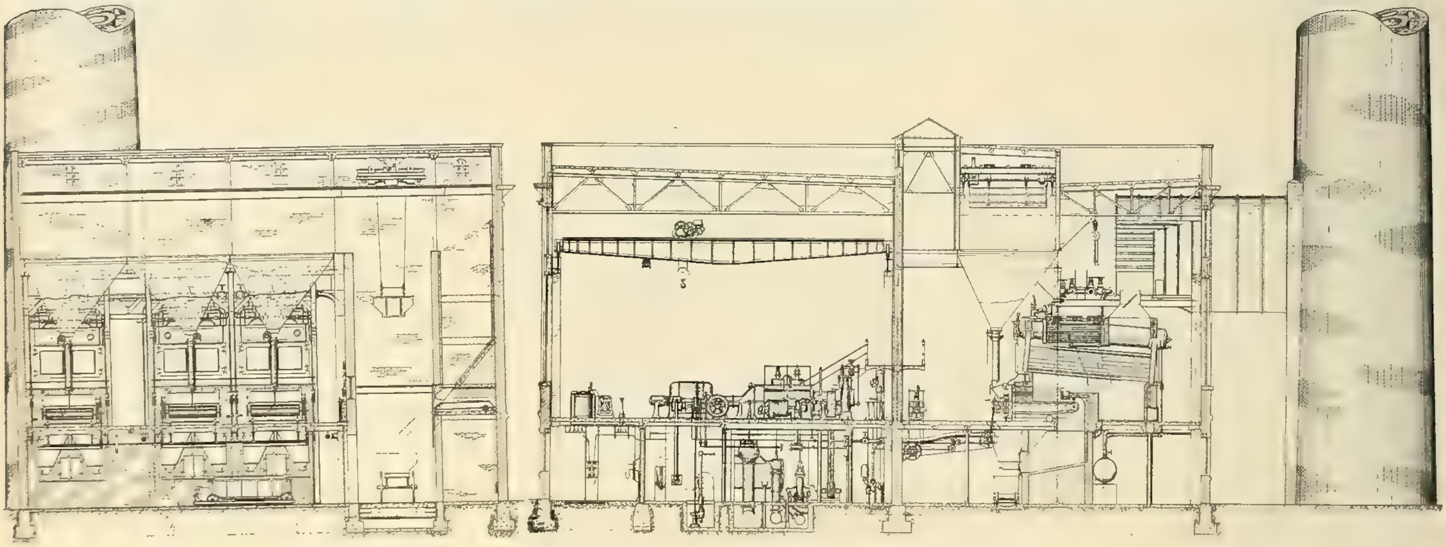
The rotary dry-vacuum pump operated in connection with the condensing apparatus was formerly used in the old power house in connection with a counter-current barometric condenser. Circulating water is pumped by one Yoeman's 5,000-gallons-per-minute centrifugal, double-suction, horizontal pump, located in the basement directly beneath a vertical-pattern single-cylinder Buffalo Forge reciprocating engine, a vertical rope-drive transmission being used to drive the pump.

Condensing water is taken from the Washington Park lagoons, where a storage capacity of 28,000,000 gallons is available, having a surface of slightly more than 22 acres.

The plant is a credit to the South Park Commissioners and to the designing engineer. In its construction convenience and efficiency were the first considerations. Under the careful direction of the chief operating engineer, every economy in keeping with good service is practiced.



GENERAL PLAN OF NEW SOUTH PARK POWER HOUSE.



Section in Front of Boilers. Cross-section.

THE NEW POWER HOUSE FOR THE SOUTH PARK SYSTEM IN CHICAGO.

Chicago Street-railway Rehabilitation.

Now that the Chicago Railways Company has accepted the traction settlement ordinance, the Board of Supervising Engineers, Chicago Traction and representatives of the Chicago City Railway Company and the Chicago Railways Company have been discussing the type of car to be used on all the surface lines. The idea is to adopt a standard for all future purchases of cars, and the purpose is to get as near a model car as possible. The type designed for collecting the fare as the passenger enters is well liked. The new company is to put on 400 new cars this year and 1,200 in the next three years. The two companies will expend about $8,000,000 on rehabilitation this year.

Switchboard Problems in Hydro-electric Plants.

By H. S. Knowlton.

The importance of the switchboard from the operating viewpoint in the modern large hydro-electric plant cannot easily be exaggerated. Designing engineers sometimes fail to realize the way a given layout will work in practice, however, for nothing is easier than to draw the switchboard to scale in a central location on the general plan of the station and to assume that the details can be left to the manufacturers. It is safe to say that a close comprehension of the relations of the switchboard design to the actual handling of the plant in routine service is quite as important as the ability to plan an economical pipe line and forebay construction, to select turbines adapted to the available head and flowage, and to purchase electric generating units of high average efficiency and suitable overload capacity for the special conditions anticipated.

The operating effectiveness of a hydro-electric plant depends directly upon the location of the switchboard with respect to the rest of the machinery and upon the measure of control provided. A central commanding location is essential to the promptest service, but with modern methods of remote control it is not to be expected that the operation of the machines shall proceed exclusively on the strength of what can be seen from the gallery. A certain amount of attendance is always necessary at the machines to take care of lubrication, cleaning, abnormal sounds in the wheels, irregularities in speed control, inspection of the governor and operation of valves. For this reason and also because routine work should be kept out of the mind of the switchboard man if the men on the floor can handle it as well, it is generally undesirable to give the switchboard operator too much control over the governor wheels, especially in cases where he cannot see the immediate effect of speed adjustments. There is a tendency to open gates too far or too rapidly when this is done from a distance, with the possibility of considerable damage. The better plan is to allow the wheel attendant to start the turbines and open the governor valves, bringing the generator without load to approximately the right speed and giving the switchboard operator only such control as is necessary to get the machines in synchronism and throw them upon the bus-bars.

In general a station designed for a very low head requires for the same capacity a much larger floor area and more machines of smaller individual rating than is the case with the higher heads, say from 50 to 100 feet upward. In such plants concentration of the switchboard control is of great importance, for in cases of long and narrow stations provided with scattered or elongated switchboard facilities, experience has shown a high cost of switchboard attendance per unit of output, sometimes three men per shift being needed. Unless the main controlling panels, or better yet, the benchboard panels, are grouped close together, it is difficult for prompt and accurate adjustments to be made in times of emergency. Good regulation is also difficult to secure without close, compact-control panel arrangement. In this connection the practice of driving exciters from their respective generator shafts is open to criticism, for under such conditions the speed of the exciters changes with fluctuations of a momentary character in the load; this is reflected in decreased efficiency of voltage regulation and valuable time is lost in overcoming the effect of sudden drops in speed.

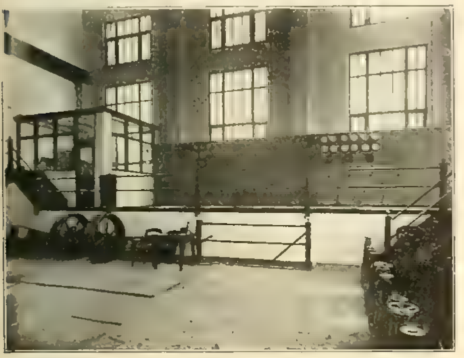
To secure the necessary co-operation between the attendants on the floor and the switchboard operator a positive system of signals is absolutely essential. There are still plants in service where the waterwheels drive the generators through gearing of some sort, and the inevitable noise which accompanies this operation precludes the use of audible signals for the most accurate and positive work. The same conditions are found in some of the latest high-speed steam-turbine installations.

It is not a matter of designing a new plant in many of these cases, but of making the best of the available equipment. It is often impossible to

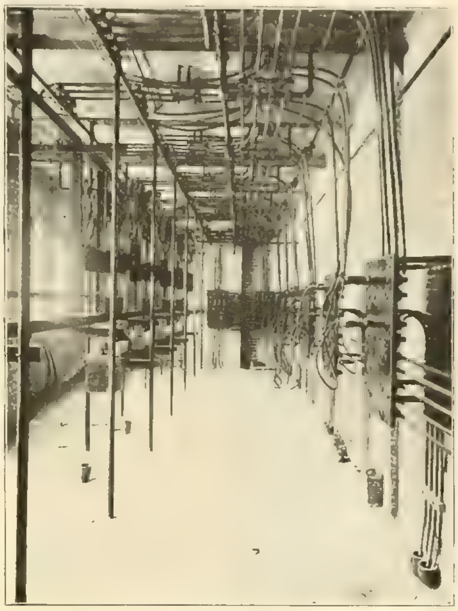
use a telephone or speaking tube in such instances, and even conversation with megaphones has its difficulties. Lamp signals of the transparency or illuminated sign type are the best solution of the problem. It costs little to make up these signals for any series of orders desired, and any effort made to avoid the need of memorizing different colors and their significance is well worth the little that it costs in time and money. One of the best installations of this kind thus far produced is in service at the Lachine Rapids plant near Montreal, Canada, which was designed by Mr. R. S. Kelsch, consulting engineer of the Montreal Light, Heat and Power Company.

At Lachine annunciators are mounted on the generator and exciter panels, each annunciator having six compartments with ground-glass covers, back of which are two five-candlepower 75-volt lamps connected in multiple, and on each piece of ground glass are printed the signals: "Stand-by"; "Load Off Quick"; "Stop"; "Start"; "Assistance Wanted," and "O. K." These lamps are operated from single-pole double-throw switches mounted on the bench-board operating table in the station, and a similar set of annunciators and switches is mounted at each turbine governor on the floor, the lamps here being in series with those on the main switchboard.

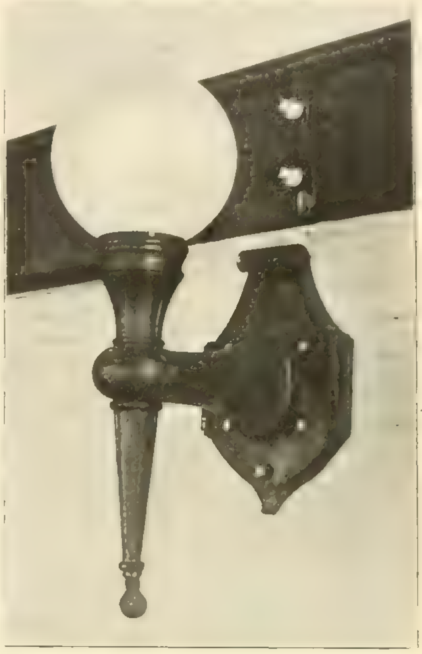
Thus it is possible for the wheel attendant and the switchboard operator to interchange with each other six different kinds of signals lettered on the ground glass. The lamps and signals are not visible except when they light up. Attention is called to the signals by electric bells. The 75-volt lamps are run two in series off from a 125-volt circuit and this insures very long life as well as sufficient



Switchboard Gallery.



High-tension Room.



Bracket Arc Lamp.

VIEWS IN THE NEW POWER HOUSE FOR THE SOUTH PARK SYSTEM IN CHICAGO.

illumination for the purpose. There are at all times two lamps in multiple.

In a paper before the Canadian Society of Civil Engineers on the Lachine Rapids plant Mr. Kelsch described the method of signaling as follows: "The switches at both ends are on the same, say the positive pole, and the lamps are out. The switchboard attendant wishing to signal switches over the cam switch corresponding to the signal to be given to the negative pole, and the lamps at both ends are lighted. The bells on both ends ring; the wheelman sees the signal, and to answer it, throws his switch also to the negative pole and the lamps at both ends are extinguished. The bell ceases to ring and the switchboard attendant is therefore notified that the signal has been seen and attended to." The switches are designed so that they cannot be left open, and hence the signals are always in operative condition.

One of the most important problems in the design of a switchboard for service in a hydro-electric plant is to provide sufficient flexibility without introducing undue complications and chances of error on the part of the station attendants. It is not the purpose of these notes to consider detailed wiring schemes, for these depend so much on purely local conditions that they must be solved for specific cases. At the same time the general relations of generators, bus-bars and switching apparatus are worth considering, particularly in the light of experience at the Lachine Rapids plant. The arrangement of this station is such that there are practically four different stations in one, each section being capable of entirely independent operation. This method is widely acceptable in power-plant work at the present time, and in both steam and electric plants there is no difficulty in arranging for multiple operation by splitting up the bus-bars into sections connected by the switches. By tying each set of generator bus-bars to a corresponding set of feeder bus-bars, in a station where there are a large number of feeders, any portion of the [illegible] at the other end of the gallery.

It is a great advantage to be able to cut any portion of the plant dead [illegible] periods of very light load for cleaning or repairs without danger of injuring the operating force. In plants where remote control is used on the tie, generator and feeder switches the use of pilot lamps of red and green colors should never be omitted in the secondary switch circuits at the bench-board. The arrangement of such switches in diagrammatic form with flat strips of copper between them representing dummy bus-bars is most helpful in the operation of a board. Too much emphasis cannot be laid upon the importance of freeing the switchboard operator's mind from the necessity of puzzling out connections in times of emergency. Even the chances of making mistakes should be automatically guarded against, particularly in synchronizing.

In plants where two or more sets of bus-bars are used, with only one synchronizer, the usual practice is to switch the synchronizer upon the bus-bar it is intended to synchronize with. This opens the way toward throwing a generator upon a wrong bus unless the plugging arrangements clearly indicate just what bus-bars are going together. A point of importance is to insure that a bus switch cannot be closed until the operator has looked at the voltmeter and synchronizer. With remote control this can be readily effected by including synchronizing plug contacts in the circuit of the auxiliary motors which close the oil switches, so that the oil switch cannot be closed until the plug is in place for the readings of the instruments.

Separate feeder and generator bus-bars in a sectionalized station make it possible to connect in instruments for measuring the total output, and the separation of feeder and generator panels avoids putting an entire section out of operation in case anything goes wrong with a single panel. In any plan separating the feeder and generator panels the generators of a section can still be operated if a feeder panel gets into trouble, and with bus junction switches if a generator goes out of service the feeder it was carrying can be operated from another section of the plant. While the cables and bus-bars may be so designed that a short-circuit on them is almost impossible, it is a wise precaution to include current transformers and overload relays in the circuits of the bus-junction oil switches. These can be adjusted to operate only in case of extraordinary overloads, and when such occur will cut off the section which is in trouble, often preventing a complete shut-down of the station. In large stations it is an advantage to sectionalize the exciter bus-bars also.

A Universal and International Exposition is to be held at Brussels, Belgium, during the year 1910, beginning in April and remaining open for at least six months.

Electric-light Rates Adjusted in Minneapolis.

[illegible] lasted several months, as readers of the Western Electrician are aware, from previous references to it. Following are the rates finally fixed:

Residence lighting—[illegible] per kilowatt-hour for the first 52 hours' use per month [illegible] cents per kilowatt-hour for all current in excess. Lamps or maintenance of lamps are not included in rates, but are subject to cash discount of 10 per cent. for prompt payment.

Commercial lighting—[illegible]

Retail power—Seven and one-half cents per kilowatt-hour for the first 52 hours' use per month of the customer's maximum demand; 2½ cents per kilowatt-hour for all current used in excess, less 10 per cent. discount for prompt payment.

Minimum rates—The company to receive not less than $1 per month per meter from lighting customers and $2 for horsepower demand, except for freight and passenger-elevator business, where the minimum charge will be $1.

Municipal lighting—Sixty-five dollars per lamp per year; settlement of unpaid bills at the rate of $70 per lamp per year from June 1, 1907, the $65 rate to apply from January 1, 1908.

Quantity discount for monthly bills for commercial lighting or retail power will be applied the same as under the old schedule.

English Punishment for Boiler Explosion.

Two British Board of Trade reports have been issued recently in connection with inquiries into boiler explosions at generating stations in London. The first one was at the works of the Poplar Borough Council and occurred to a water-tube boiler containing 630 tubes and took place in August last year. The fact was brought to light that one of the tubes, which in this particular class of boiler are curved somewhat, had become choked with scale and subsequent overheating caused the explosion. It is assumed in the report that the tube was missed in the cleaning by an oversight, and it is further put on record that the water softener had failed to do its duty.

In striking contrast to this is the judgment delivered at the end of the inquiry into the explosion of a thermal storage drum at the Greenwich works of the South Metropolitan Electric Light and Power Company a year ago. The commissioners in this case lay the blame upon the makers, whom they accuse of supplying a faulty end plate to the storage drum. The boilermakers are ordered to pay a substantial sum toward the costs of the inquiry, their manager to likewise contribute, while in smaller proportions the chief engineer to the central-station company and also the resident engineer have been ordered to pay sums for negligence in not attending to the drum when the fatal crack was first observed.

Details of a High-tension Pole Switch.

The recent great extension of electrical power transmission has brought with it many problems requiring the design of special apparatus to meet the new conditions. To keep the initial cost within moderate limits, outdoor switches are quite generally installed on the pole lines of high-tension systems in place of the more expensive oil switches. They are used for small sub-stations, for disconnecting lines from bus-bars, and especially for sectionalizing lines at branch points. A switch of this type has been designed and recently patented by Frank G. Baum of San Francisco, Cal.

This switch is intended to be inserted directly in the line wires at any point on a pole line and is ordinarily to be located at the top of the pole and operated by means of a rod or other device extending downward within reach from the ground. In the very high-voltage systems it is desirable that the switches be constructed to open each line at two or more points, preferably by means of a horizontal swinging switch element which normally forms a part of the line circuit Such an element must always be insulated to the same extent as the conductors and the switch must be strong and durable to withstand the action of the weather and any rough handling that operatives or workmen may subject it to.

The details of the switch are made clear by the accompanying drawings, of which Fig. 1 is a plan of the structure at the top of the poles supporting three high-voltage conductors, Fig. 2 is a section of this structure taken along line x—x of Fig. 1, and Fig. 3 is an end view thereof, omitting the auxiliary supporting insulator. These drawings show a triple-pole switch for a three-phase line; the construction of a double or single-pole switch is quite similar to this.

Upon the two upright poles is mounted a supporting framework for holding the insulators for the high-voltage conductors. Each row of insulators comprises three insulators forming part of the switch, and a fourth, which is an ordinary insulator used for supporting the conductor before it reaches the first switch insulator. The three insulators comprised in the switch are indicated by (b), (b′) and (b²). The terminal insulators (b′) and (b²) have metallic clamps (c) suitably secured to their upper surfaces and sustaining a pair of diverging clips (c′) arranged with their openings directed, in the one case, to the right, and in the other case, to the left. The middle insulator (b) also carries a metallic clamp (e), to which is secured a conducting switch arm (f) extending in opposite directions to each of the terminal insulators, and there fitted with blades or plates (f′) adapted to engage with the clips (c′). The insulators (b′, b²) are rigidly supported on the framework, but the insulator (b) is mounted [illegible] in a horizontal plane either to bring the blades (f′) into engagement with the clips (c′), or to sever this engagement.

By constructing the switch in this manner the space between the terminal insulators may be as great as desired, and although the current passes [illegible] insulator upon which it is supported, as are the metal parts of the circuit attached to the terminal insulators (b′, b²). The oscillating insulator may be moved in any desired way. Any suitable connections may be made with the crank arm (h) whereby the switch may be operated with perfect safety, whether it be located at the top of the pole or in any other place.

When a number of the switch units are mounted upon a single structure, it is desirable to provide means for actuating them all simultaneously. The drawings illustrate a mechanism for operating the three switch units in this manner. This mechanism consists of a connecting member or bar (i) pivotally attached to each of the crank arms (h). A thrust rod (j) takes hold of the connecting bar at some point (j′), and leads to one arm of a bell crank (k) suitably supported and pivoted on the frame. To the other end of the bell crank is connected an operating rod (l) leading downward within reach of the operator. By pulling or pushing this operating rod all three of the middle insulators of the switches will be rotated or oscillated at the same time, and thus the three lines simultaneously opened or closed.

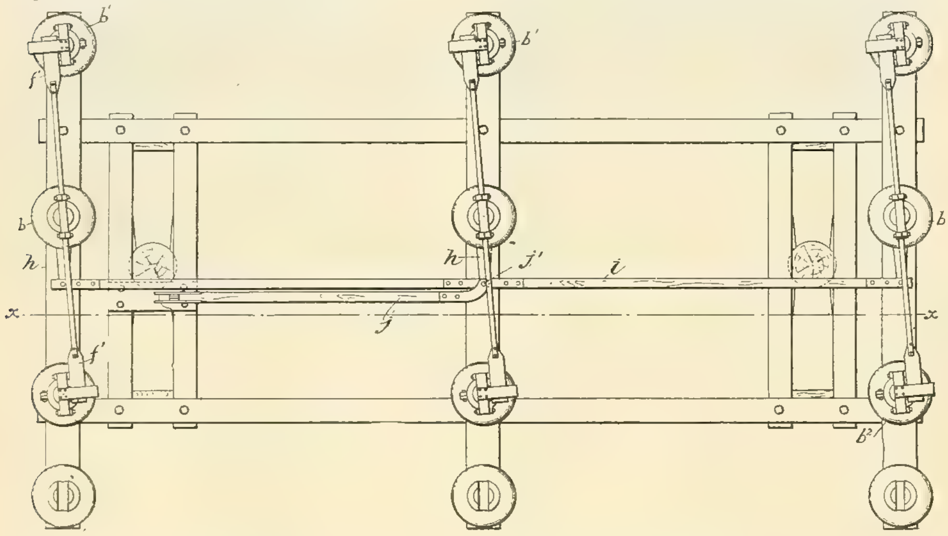
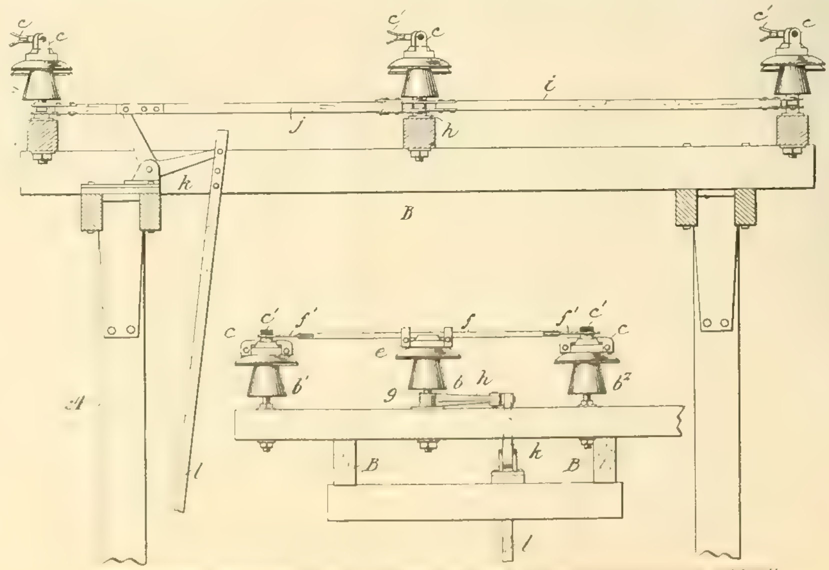


FIG. 1. DETAILS OF A HIGH-TENSION POLE SWITCH.

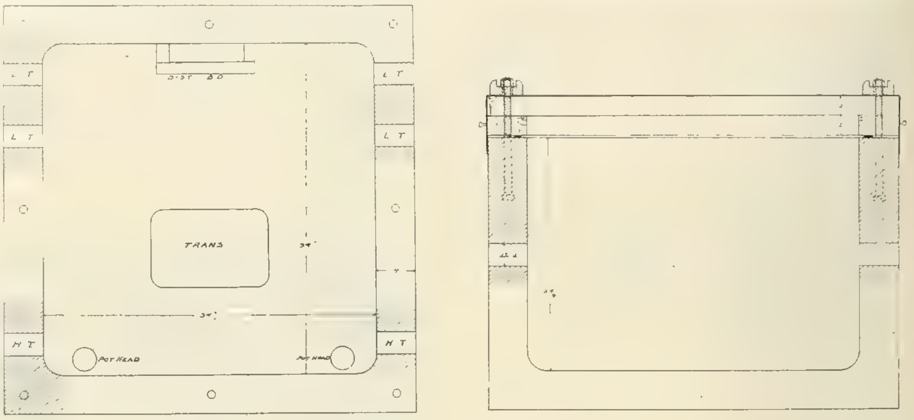


[illegible] OF A HIGH-TENSION POLE SWITCH.

It is evident that a switch of this nature can be made as heavy and of such a size as may be necessary to withstand the elements and other local conditions. As the insulators are of standard variety, a certain economy in construction is derived. When only a single break in the conducting path is desired, one-half the switch arm is omitted and a flexible conductor is substituted therefor.

An Inexpensive Underground Distributing System.

The village of Kenilworth, Ill., has recently put in at comparatively low cost an ingenious underground distributing system for electric-light and power supply to its residents. Kenilworth is one of the pretty North Shore suburbs of Chicago and is situated about 15½ miles north of the business district of the city. Being an exclusive residence village, with no alleys, it was deemed undesirable to mar the beauty of its streets with a pole line for electric-light wires. This kept the village from enjoying the benefits of electric light until last summer, when an underground system was decided on. Kenilworth has a population of about 700 living in some 115 houses in an area a little less than a square mile; consequently the expense of the system had to be kept down to a minimum.



PLAN AND CROSS-SECTION OF MANHOLE USED IN UNDERGROUND DISTRIBUTION IN KENILWORTH.

The system designed starts from the pole line of the North Shore Electric Company at the southeast corner of Kenilworth, where it borders the adjoining village of Wilmette. From this point all wires run underground right up to the houses of the consumers. The current is taken from these single-phase lines at 2,200 volts through two No. 8 main feeders running along Sheridan Road to Woodstock and Melrose avenues, respectively, that run southwesterly to the limits of the village. Along these feeders are located 14 manholes containing transformers, where the voltage is stepped down to 220 volts for secondary three-wire distribution. The secondary feeders are No. 6 wire, running along one block each way on the streets at right angles to those carrying the main feeders. At points where the load is large enough the secondary feeders are interconnected.

Specially designed armored cable is used throughout the installation to permit laying wires directly in the ground instead of using conduit construction. All the wire is Simplex, rubber covered, and pro-

tected successively by a lead sheath, a wrapping of jute, two layers of steel tape wound spirally in opposite directions and finally another layer of jute on the outside. It is laid in the parkway between the sidewalk and curb line and as close to the sidewalks as possible. It is embedded in sand about one foot below ground level and has no further protection beyond the adjoining concrete sidewalk foundation. In crossing streets the cables are likewise laid in sand with a row of bricks set on edge on each side and a layer of brick on top. These bricks are not cemented, however. The service leads to the houses are run in the same way close to the path from sidewalk to house. These service leads consist of No. 10 wire, some being two-wire, others three-wire, taps.

The manholes, as illustrated by the plan and cross-section shown herewith, are of concrete with four-inch walls and bottom. Owing to the fact that sewers lie so near to the surface of the streets, drainage to them from the manholes is practically out of the question. Therefore the manholes are made as shallow as possible and built two feet below ground and allowed to extend six inches above ground. Shrubs were planted around them to make them less conspicuous.

Since no drainage was provided for, the manholes are sealed in a practically hermetic manner. The holes in the sides where the high-tension and low-tension cables pass through are 2¼ inches in diameter. The cables were stripped to the lead sheath and passed through from the outside. The space around each cable was then calked up with lead wool, which welds itself to the sheath and forms a water-tight joint. The inner walls and bottom were painted with "Ironite" waterproof compound. The cover was made of treated wood with 2 by 4-inch border fitting over a rubber gasket. Over the cover was fastened a galvanized-iron sheet provided with a drip flange. Further to guard against dampness, a dish of deliquescent salt that readily absorbs moisture was placed in each manhole.

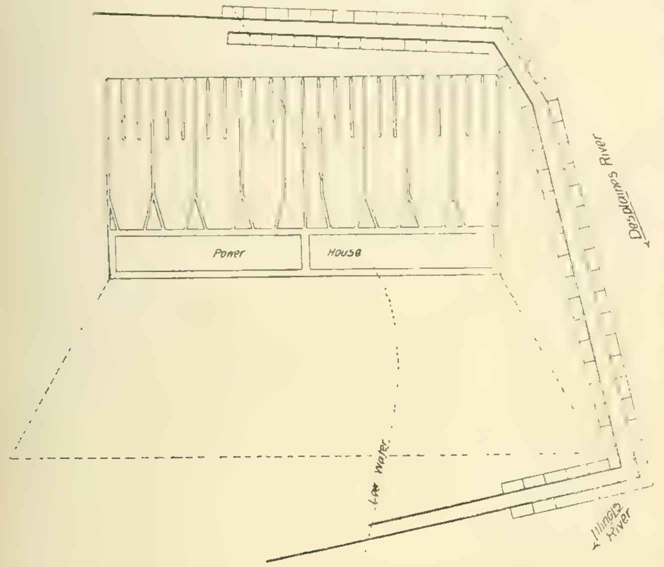
Besides the transformer each manhole contains two disconnecting pot-heads on the high-tension cables and distributing panel on the low-tension side. The transformers are of the regular General Electric pole type, with capacities ranging from one to five kilowatts. The total transformer capacity installed was 40 kilowatts.

The system was installed last September at a total cost of $12,000. The lengths of cable used are about 10,000 feet No. 8 primary two-wire cable, 20,000 feet No. 6 secondary three-wire cable and 3,000 feet No. 10 service cable, some of which is two-wire and some three-wire. The capacity of the system is 6,000 lights, about half of which are now wired to some 40 to 50 customers. The system tested out perfectly at the start and has given no trouble whatever. To aid in the location of any possible trouble, each block can be isolated on both the high-tension and low-tension cables. The system was put in by the Kenilworth Company under the direction of Mr. William D. Ball, electrical engineer. In view of the success of the installation the village is now considering placing the telephone wires underground and thus removing the only poles on the streets.

Excavation for Dresden Heights Hydroelectric Plant on Desplaines River.

[illegible] Company's projected hydro-electric plant at Dresden Heights, near Morris, Ill., were set forth. This plant is being constructed on the Desplaines River at the point where it unites with the Kankakee River to form the Illinois River. The volume of water in the Desplaines is furnished largely by the Chicago Drainage Canal, which connects Lake M[illegible] the Illinois with the Mississippi River, as everybody knows. Controversy has arisen over the plant, some Sanitary District and state officials contending that it will interfere with the deep waterway for navigation to connect Lake Michigan and the Mississippi River as a part of the Drainage Canal project. The Economy company (which has its main plant farther up on the Desplaines River at Joliet) declares, however, that its plans have been prepared to harmonize with any future federal deep-water work. The plant is intended to develop about 10,000 horsepower with a 17-foot head. Some details about the work of excavation will be of interest.

In the month of August, 1907, J. O. Heyworth, the general contractor, began to move his construction plant by 50-ton barges down the Illinois and Michigan Canal, hauled by a gasoline launch. In a period of three months' time the following work was done: A camp was built for the accommodation of about 200 men, a 7,000-yard, U-shaped levee, which may be called cofferdam No. 1, was thrown up, and 5,000 yards of rock was also excavated from the power-plant site and placed in the cribs of the cofferdam No. 2 beyond the levee in the river.



OUTLINE PLAN OF DRESDEN HEIGHTS POWER PLANT.

STEAM PUMPS HUNG IN SUMP IN A DIFFICULT PLACE IN DRESDEN HEIGHTS POWER-PLANT CONSTRUCTION.

An industrial railway enters the site of the excavation at the northeast corner in the form of a single track. It is fanned out into eight tracks on which dump cars carry out the excavated material, which is silt, glacial drift and sandstone underlying about nine feet. At the top of a 10 per cent. grade the single track runs level for about 30 feet, at which point a double-drum, double-cylinder hoisting engine is located, with the drums facing down the track. Two cables extend down into the excavation, and thus one hoisting engine, with one engineer, attends to the removal of the material and is capable of moving two trains of six cars up or down the grade at the same time. After the cars get on the level track, teams of horses haul them to the spoil bank.

One of the most interesting features of the work was the way the scraper excavating bucket was used both to run the levee around cofferdam No. 1 and also to assist in filling cribs in cofferdam No. 2. Seven thousand yards of dirt and 5,000 yards of rock were excavated in a little less than two months and placed either in the spoil bank or in the cofferdam. Thus excavated material from cofferdam No. 1 was used in construction of cofferdam No. 2 as well as making levee around cofferdam No. 1.

In the rock excavation four steam drills were used, and heavy blasts were employed during the [illegible] hardly completed. The U-shaped levee, however, [illegible] feet below the present level of the river. The con[illegible] son steam pump from A-frames, which have kept the excavation dry. During the drilling for blasting it frequently happened that subterranean springs were tapped, and upon the withdrawal of the drill little 1½-inch geysers would spurt out, further complicating the pumping problem. The accompanying photograph shows one of the pumps operating, with part of a strainer exposed above the surface of the water and taking air at every gulp.

It is said that there is to be considerable storage of water above the power plant, owing to the fact that the neck of land between the Desplaines and the Kankakee rivers will be turned into a reservoir by means of continuing the concrete dam now under process of construction, or in the form of 500,000-cubic-yard levee, reaching over toward the Kankakee River.

Electrical Conditions in La Crosse.

At La Crosse, Wis., the ordinance regulating the installation and maintenance of electrical wiring is being rigidly enforced, as far as the inspection of new wiring is concerned. Material and devices used in construction work are approved, but it is said that some inexperienced men are employed by local contractors. However, the standard for wiring generally has been greatly improved since a year ago, when the ordinance was adopted.

All of the isolated plants in town have been inspected and changes in the wiring ordered. Some of the work is now under way. The inspector plans to make the annual inspection of risks in the mercantile district soon, so that defective and possibly dangerous conditions in this locality may be abolished.

As readers of the Western Electrician are aware, the Railroad Commission of the state of Wisconsin has permitted the lighting company to advance its rates, in order that the plant may be placed upon a paying basis, and a few customers have resorted to the use of gasoline for illuminating purposes. Local electrical contractors are agents for these lighting systems. It is believed that this tendency to employ a dangerous substitute for electric light is temporary, as the service rates quoted are low in comparison with those prevailing in other cities.

Minneapolis-Superior Electric Railroad.

The electric interurban railway known as the Arrow Line, building between Minneapolis, Minn., and Superior, Wis., is said to possess some unique features in interurban practice. The maximum grade is 0.6 per cent., adapting it to heavy traffic and speed. The Farnham protected third-rail, the invention of the president of the road, is being used. There is a marked absence of curves, the route surveyed marking almost a straight line from the Twin Cities to the head of the lakes. The distance is 130 miles, and the great waterpowers at Duluth are thought to give assurance of abundant and cheap electric power.

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DATES AHEAD.

[illegible]

THERE SEEMS to be no good reason why the United States Senate should not ratify the Berlin radio-telegraphic convention, now before it. The United States was a party to the Berlin wireless conference, and while the representatives of this country did not succeed in making the code drawn up by the congress as wide and comprehensive as they should have liked, nevertheless the convention is obviously expressive of humanity and the spirit of progress, so far as it goes. The Marconi company is reported to be opposing the ratification of the agreement here as it did in England, but the convention was adopted, notwithstanding this opposition, by King Edward's government, and it is to be hoped that a similar course will be followed by the Senate.

AMONG the abounding natural resources with which the United States is blessed, few are more conspicuously valuable than the deposits of native copper in the Lake Superior district of Michigan. In the Keweenaw Peninsula of that state is found the one great native-copper district of the world. Here it is that the celebrated "Lake" copper, so well known in the electrical industries, is mined, and in 1906 the smelter production of the metal in this region amounted to 229,695,730 pounds, worth $30,000,000 or more. The native copper of the Lake Superior region occurs in masses ranging in size from minute particles to bodies hundreds of tons in weight, contained in certain beds of a thick series of basic lavas and in some of the intercalated sandstones and conglomerate beds. Curiously enough, the ores of the Lake Superior district are of low grade, Nature exhausting itself, apparently, in the superior quality of the native copper.

METHODS OF CHARGING are attracting renewed attention in England. It is asserted that consumers for power purposes are getting their current too cheaply at the expense of the lighting consumers. Following up the attack made upon this line in Parliament against the existing central-station companies in London, Mr. J. F. C. Snell, who was connected with last year's London County Council power bill, has prepared tables based upon varying load factors and a certain diversity factor based upon his experience at Sunderland and elsewhere. These tables indicate, theoretically, that practically all over the country electrical energy for power purposes is being supplied at rates too low to be consistent with sound finance. This argument is met with the answer that, above certain rates, industrial and competitive conditions in England preclude any power load being acquired, and that, in order to develop in this direction, power is sold at prices which will tempt the manufacturer to drive his works electrically. English station managers say that if they had all worked upon Mr. Snell's theoretical hypothesis, very few of them would have had a power load today.

ONE OF THE speakers at the recent memorial meeting of the American Institute of Electrical Engineers was Prof. E. L. Nichols of Cornell, whose topic was "Lord Kelvin as a Scientist." In Prof. Nichols' address occurred one passage of especial interest:

"To my mind his most striking characteristic was an unostentatious simplicity; the simplicity which one remembers in men such as Heinrich Hertz, and in Lorentz, and which happily we find so frequently in great men, that it may fairly be termed the typical simplicity of genius. With this simplicity was combined a certain practicality, the practicality of his race. I do not know, but I suspect that Kelvin would have regarded Niagara fully harnessed to the service of man a more beautiful and inspiring sight than the original unchained Niagara of the wilderness. I well remember that years ago, when the esthetically inclined protested against the unsightliness of overhead wires, he remarked that the time would come when the network of wires across the sky would be regarded a fit subject for the rhapsodies of the poets."

Lord Kelvin's sentiments regarding the beauty of [illegible] outweighing the beauty of the spectacle at Niagara are well known, but we fancy that the prediction attributed to him in relation to overhead wires and the poets will be something of a surprise to many of the great man's admirers. No doubt Lord Kelvin was speaking with rhetorical emphasis, but nevertheless it may be some gratification to the electrical pioneers in our American towns, when twitted of their unsightly overhead wires, to point their critics to Lord Kelvin's vision of the poets.

TUNNEL operation of railroad trains affords one of the most useful and benignant examples of electrical equipment. One of the first instances of heavy electric railroading was in the Baltimore and Ohio tunnel under Baltimore, and since then a number of tunnels have been equipped for electric-railway service, the most notable being the Simplon tunnel under the Alps, connecting Switzerland and Italy, and 12 miles long.

The latest application of electricity to railroad operation in tunnels is in the case of the Sarnia tunnel of the Grand Trunk Railroad, between Port Huron, Mich., and Sarnia, Ont., connecting the United States and Canada under the St. Clair River. Here the electrical service is about to be put into use, if it has not been already. The Sarnia tunnel is an old one, trains having been pulled through it previously by powerful steam locomotives specially provided for the purpose. Great improvement is expected to result from electrical operation, owing to greater facility in handling trains, and the Grand Trunk hopes to get a greater proportion of east-and-west traffic hitherto carried by American routes. Of still greater importance is the fact that the use of electricity will remove the ever-present danger of asphyxiation of men working on the trains. Since the opening of the tunnel a number of employes have been killed there by the noxious fumes of the locomotives, the most common form of accident resulting from the breaking of trains on the heavy grades, running the train hands back into the sulphurous gases. These fumes will all be done away with by the electric system.

Another important tunnel now building for electric train operation is that of the Michigan Central under the Detroit River. This new tunnel does not supersede an old one or a bridge, but will do away with the ferry crossing between Detroit and Windsor, which, in winter, when the ice is coming down the river, is often a cause of tedious delay.

HOME WEAVING is practically a lost art, in the United States at any rate, although not a few of our revered foremothers were adepts at the household loom as well as the spinning-wheel. But there is some possibility that the practice of home weaving may be revived in some parts of Germany by the recent invention of a new loom designed to be used in the home, although power-driven. Mr. Norton, the United States consul at Chemnitz, writes that the machine has attracted some attention in textile circles in that city. The new loom can be set up in any ordinary room, and is built of wood, except the driving shaft. It weighs about 4,500 pounds and about one-half horsepower is required to drive it. It costs only $50. The consul continues:

"This invention is of far-reaching importance for the household textile industries of this region. Formerly, especially in the nearby mountain villages, they were widely extended. Nearly every house had its loom or stocking frame or lace-pillow. Now, as in most countries, the work is concentrated in factories. It is hoped that the new loom, on account of its cheapness and the minimum of motive power required, will permit to some extent the retention of the practice of household industries. The widespread use of electricity throughout this section of Saxony is a helpful factor in this connection. It is not impossible that in various portions of the United States, where efforts are being made to revive and encourage home industries, the new device might find a welcome reception."

Perhaps this suggestion is worth more than passing attention. In rural or semi-rural communities, where cheap hydro-electric power is available, why would not the women of many households find it of advantage to use an electrically driven loom, if it is practicable, which costs no more than a good sewing-machine? This would be a return to old-fashioned methods, perhaps, but if the plan could enable the home operatives to make some money at odd times, while adding appreciably to the load on the power house, it might be worth considering.

How to Burn Illinois Coal Without Smoke.[1]

By L. P. Breckenridge.

It may perhaps be profitable to picture an ideal perfect combustion, and then inquire in what ways actual combustion falls short of the ideal. The given fuel, composed of carbon, various volatile hydro-carbon gases, and perhaps sulphur, is to be burned in air. Theoretically, each atom of the fuel finds and seizes upon the number of oxygen atoms with which it will combine. Each atom will meet with two oxygen atoms at a temperature sufficiently high for ignition. They will combine, and the resulting CO_2 will pass out of the furnace, carrying with it the heat arising from the combustion; likewise with the hydrogen and sulphur atoms. No more air will be delivered than is just sufficient to furnish the exact number of oxygen atoms, and no carbon or hydrogen atoms will pass out of the furnace without finding oxygen atoms with which they can combine.

Actual combustion deviates from ideal conditions in many respects. If only the theoretical amount of air is supplied, on account of the difficulty of properly mingling the fuel and air, some of the fuel atoms will not find oxygen atoms, and will escape uncombined. Or some of the carbon may burn to carbon monoxide instead of to carbon dioxide, and the CO will escape without further combustion. It is found in practice that, to insure complete combustion, an excess of air must be furnished. This excess is usually 50 per cent., and may reach 100 per cent.; i. e., while only 11.3 pounds of air are required for the complete combustion of one pound of carbon, it is usually necessary to furnish 18 to 24 pounds. Since the heat of combustion is distributed throughout the excess of air introduced into the furnace, as well as the products of combustion, the furnace temperature is lowered by the presence of the extra air.

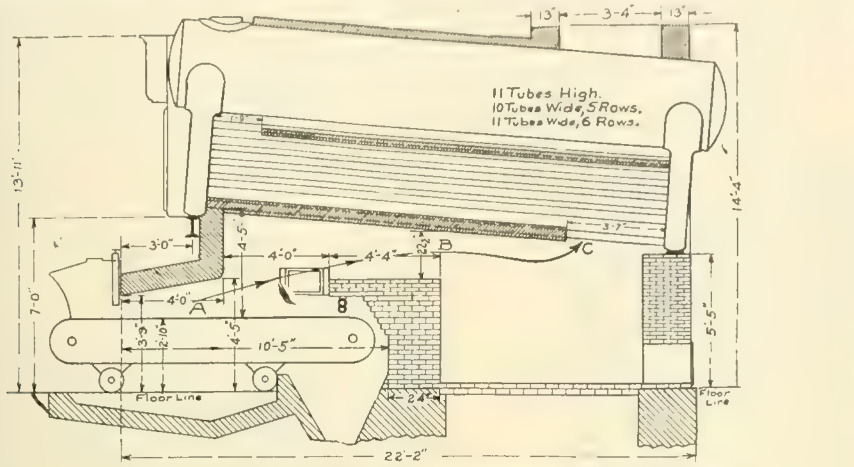
In another important particular, the actual state of affairs is likely to be quite different from the ideal combustion outlined above. Carbon and oxygen atoms will not unite unless a certain temperature, the ignition temperature, is reached. In parts of the furnace the temperature may fall below the ignition point because of the inrush of an excess of air or because of cold bounding surfaces. As a result, carbon particles, even in the presence of plenty of oxygen, will refuse to burn.

The opinion of the writer, doubtless held by most engineers, is that the boiler has very little to do with the smoke problem, except, perhaps, that some types of boilers lend themselves more easily to the necessary furnace construction, which is of the utmost importance when perfect combustion is desired.

When Illinois coal is being burned in any furnace it is essential that the volatile products of combustion should be uniformly distilled from the coal and mixed with sufficient air at a high temperature. To accomplish this, particularly to maintain a high temperature, the mingling air and products of combustion must be kept away from the tubes or plates of the boiler, which are comparatively cool, and which would therefore cool the gases before complete combustion had taken place. It is for the reason just mentioned that such forms of furnaces as shown in the cut are planned. Special forms of fire-clay tile are designed to be hung on the water tubes of boilers that are directly over the fire. The tiles form the roof of the furnace and prevent the hot gases, which are still not properly mixed, from coming in contact with the cooler tubes which are surrounded by the tiles.

The boiler set over a chain grate shown in the drawing is the boiler installed by the Engineering Experiment Station for fuel tests with Illinois coals. This boiler is exactly like the one used in the [illegible] government boilers were set with hand fired furnaces, evidently necessary where coals from many [illegible] setting shown in the cut is provided with an economizer [illegible] rates of combustion possible. This setting is [illegible] of operation which have thus far been applied to it. Over 100 trials of about 10 hours' duration of various kinds of Illinois coal have been made in this setting. In all of these trials the smoke record has been, "No smoke all day." This is the setting to which the writer has referred in several recent talks by saying that in this setting it has been impossible to make smoke.

Those who desire to grasp the simple yet fundamental principles of smokeless combustion for Illinois coals should thoughtfully consider just how this furnace fulfills the conditions of perfect combustion.



BOILER UNIT WITH WHICH IT IS SAID TO BE ALMOST IMPOSSIBLE TO MAKE SMOKE.

The fresh coal, fairly uniform in size, advances slowly from the hopper along on the grate toward the furnace, where the temperature is very high. The combustible volatile matter is continually being distilled from the coal more and more rapidly, but with much uniformity, while it is passing under the combustion arch. Some of the necessary air flows in through the coal in the hopper, more through the grate under the arch, but by far the most flows through the red-hot coals on that part of the grate beyond the arch. This air is thus heated and made ready for combining with the volatile products flowing from beneath the arch, and all together mix and roll along on the bottom of the tiles forming the roof of the furnace.

The bottom row of boiler tubes is covered with suitably formed tiles, which prevent the still actively mingling gases from being cooled by coming in contact with the tubes, and so the combustion processes go on until completed before reaching (C), a point before the gases pass in among the cooling tubes. The tiles in the adjoining rows touch each other, so that no gases pass between them. In such a furnace as this the smoke problem is settled somewhere between (B) and (C). When the total volume of combustible material distilled from the coal is quite large in a given interval of time, the flame length may reach to (C), while for smaller volumes the flame may end at (B). Thus it is that the flame length indicates the end of the combustion processes, and gives us valuable information concerning the proportions of smokeless furnaces.

It is important in the operation of this or any form of mechanical stoker that abundant opportunity be afforded for inspecting the condition of the fires and the progress of combustion. Appliances for continually indicating the composition of the escaping gases should be considered a necessity in all large and well-managed plants.

The character of the draft apparatus available with this setting made it possible to make sudden changes in the rate of combustion. The rate of travel of the chain grate was easily adjusted by a throttle governor on the independent steam engine in driving the grate. The rate of combustion could be calculated very closely from the thickness of the fuel bed and the rate of grate feed, by reference to the large number of tests already made with this unit. These special smoke tests were run on four different days, and on each day eight changes in condition of operation were made. The thicknesses of fire used were four, five, six and seven inches. The capacities varied from 60 to 150 per cent. of the rated capacity (210 horsepower) of the boiler. The results of these tests amply justify the conclusion that this type of furnace may be depended upon to operate even under adverse conditions without objectionable smoke, for out of a total of 32 tests in only six cases could [illegible] coals. A strong draft will make a large air supply possible, and allow thicker fires or finer coal to be used. The possibility of sufficient air makes [illegible] caused by a weak draft might cause the production [illegible] to drive boilers and furnaces a little harder. Boil[illegible] few years ago are now being forced to 1,400 and 1,600 horsepower. This means, of course, larger grate areas and a much higher rate of combustion per unit of grate area.

The method of introducing the coal into the furnace will in all cases have much to do with [illegible] smoke. When the coal is fed into the furnace mechanically, as it is when stokers are used, one of the most essential elements of successful smoke prevention has been met, namely, slow and uniform gas evolution. When coal is fed by hand into a hot furnace, six shovelfuls more or less at one time, this same element has been ruthlessly neglected. The gas evolution can neither be slow nor uniform. It is also very doubtful if the proper amount of air at the right temperature will be supplied. It is to assist in correcting such known violations of correct methods of coal supply to furnaces that certain devices have ben introduced which are intended to correct these initial mistakes. A steam jet is such a mixing device. When properly applied it does not let the volatile gases and air supply escape from the furnace until very intimately mixed. It has, however, two very serious objections, noise and large steam consumption.

Smoke Prevention with the Horizontal Fire-tube Boiler.

The horizontal fire-tube boiler is still much in use in the smaller units of from 50 to 150 horsepower. It was brought into prominence in the early days of American steam-boiler practice as the natural successor of the plain cylinder and flue boilers, all of which were externally fired. It soon became the standard type of boiler throughout manufacturing New England, where in many places it still retains its position on account of its cheapness and its economical operation with all grades of anthracite and many grades of bituminous coals, especially those containing a high fixed carbon content.

With the coals just mentioned the combustion takes place mostly on the grate or at a short distance above it. Many plants have been installed with this type of boiler, in which the grate has been placed not more than 14 to 16 inches beneath the boiler. These plants have burned anthracite coal successfully. With the introduction of the West Virginia bituminous coals containing small amounts of volatile combustible matter the grates were lowered under this type of boiler to 24 and 30 inches, with good effect. Still, with either coal, much the greater part of the heat was generated on or near the grate and the heat made available for transmission was largely radiant heat. The plates directly over the fire itself transmitted a correspondingly large part of the heat of the coal to the water in the boiler. The satisfactory performance of the fire-tube boiler with eastern coals, together with its availability, made it naturally the boiler to be adopted by manufacturers moving westward with the center of population. It is easily seen, however, that with Illinois coals carrying 30 to 40 per cent. of volatile combustible matter and burned at rates which produce flame lengths of from 5 to 20 feet, this type of boiler as usually set is by no means adapted for the smokeless consumption of this kind of fuel. There is, in fact, no better method of producing dense, black smoke with Illinois coal than to install a horizontal fire-tube boiler with the usual furnace, and hand-fire such a plant with run-of-mine coal. In such an outfit all the fundamental principles laid down elsewhere in this paper are disregarded. The method of introducing the coal directly into the hot furnace, in fine dust and large lumps, prevents slow or uniform distillation of the gases; the air supply through open doors, through holes in the fire, or through a fuel bed of varying thicknesses is neither correct in quantity nor is much of it properly heated; the mingling products of combustion come in contact with the cool surface of the plates of the boiler, reducing the temperature of the gases below the ignition temperature before combustion is completed.

Having in view these defects of the usual plan of operating the fire-tube boiler with Illinois coal, many ways suggest themselves by which these faults may be corrected. It is possible to burn Illinois coal without smoke with fire-tube boilers, but the furnace requires special treatment, and such settings are not common. The plans usually proposed are either low-set stokers or extended Dutch-oven furnaces. When hand-firing is adopted the wing-

1. Extracts from a bulletin issued from the Engineering Experiment Station of the University of Illinois, Urbana, Ill. The author is professor of mechanical engineering in the university.

1. The characteristic feature of these two settings is a tile roof furnace, originating in 1901 with W. L. Abbott, at the Harrison Street station of the Commonwealth Edison Company, Chicago.

wall furnace or other form of mixing baffles or piers is of great assistance. With any of these devices careful firing is very necessary for satisfactory results. The twin brick-arch furnace, which keeps the gases away from the boiler plates altogether, is an effective smoke preventive. Careful firing, with low rates of combustion (12 to 16 pounds) per square foot of grate, assisted by automatically controlled air supply, will often enable these settings to be run so as to escape the fines of city smoke inspectors, but they can hardly be compared as to smokelessness with such settings as are illustrated in this paper. Horizontal tubular boilers are often adopted on account of their cheapness, and when such is the case the addition of any special furnace constructions or any special devices to aid in smoke prevention, is seldom given any consideration. From what has been said it is doubtless evident why this type of boiler is so frequently found to be one of our worst smoke offenders.

How to Hand-fire Illinois Coals so as to Reduce the Production of Smoke

There are many small power-plant units that are hand-fired which smoke badly. The construction of many of these furnaces is such that it is almost impossible to operate the plant without smoke. Still, something might be done to reduce smoke if the fireman exercised more care in firing. Whatever can be done by the fireman in the way of properly introducing the fuel into the furnace is just so much gained, and it relieves the auxiliary mixing devices or baffles, if such exist, from just so much work later on. The best method of hand-firing for smokelessness is also the best method for attaining economy. There are three generally recognized methods of hand-firing—(a) the spreading, (b) the coking, and (c) the alternate. The first is satisfactory and generally used for anthracite; the second for coking coals, and the last for non-coking coals. It is the alternate method that is best suited to Illinois coals. This method is described as follows: The fuel-bed area is divided into equal parts, two, four, or six, depending on the size of the entire surface. The fresh coal is fired alternately on one-half of these areas at a time, at such intervals as may be necessary to hold the steam pressure. Depending on the rate of driving, these intervals will vary from one to five minutes. For small areas first one-half the surface of the fuel bed is covered, and then perhaps three minutes later the other half. This method allows much of the air supply to come through the bright fuel bed, and thus become heated and suitable for mixing with the highly volatile content which is being rapidly driven from the freshly fired coal on the other side. Just because fresh fuel has been spread over one part of the fuel bed, the air most needed at that moment cannot as easily flow through it, and another part of the fuel bed should be left free for its passage at that time. When the fuel-bed area is very large, some checker-board system of firing may be adopted, which, when alternately fired and left free for air passage, will result in a large reduction in the amount of smoke produced by the too common method of spreading the coal over the entire surface at each firing. It must not be forgotten that a large supply of warm air is needed immediately after fresh fuel is spread over a part or all of the fuel bed; this is best supplied as just explained, but it may be advantageous to provide for still more air by leaving the fire doors open slightly just after each firing. There are several devices on the market which provide for an air supply over the fire, which are turned on with the opening or closing of the fire door, and which can be arranged to close at the end of any desired time, depending upon the rate of driving and frequency of firing found desirable. The firing of small amounts of coal at frequent intervals produces less smoke than firing large amounts at longer intervals. The latter method, however, usually proves less tiresome to the fireman, and is [illegible] frequently adopted.

[illegible] Between the Boiler and the Grates

[illegible] horizontal tubular boiler, [illegible] the boiler to the [illegible] 24 inches. At this distance the flame from Illinois coals will sweep [illegible] the boiler, and [illegible] smoke will result. Still it must be borne in mind that a [illegible] from the burning of the fixed-carbon part of these coals is [illegible] radiant heat, and for this purpose the grate should be near the boiler. While it is necessary in prevent- [illegible]

tube boiler. The small unit hardly warrants an automatic stoker. Desire for a cheap plant prevents any special form of furnace, and so it is that this kind of a setting frequently proves to be a troublesome smoker.

The Preparation of Coal for Smokeless Burning.

When the coal fed into a furnace is fairly uniform in size it is much easier to burn it without smoke than when it is of different sizes. In all the settings described in this article as smokeless the coal burned has been of such uniformity as to meet this requirement. The standard commercial sizes are all that are required, such as Nos. 1, 2, 3, 4, or 5. Take, for instance, the chain-grate stoker; the very principle of its operation—complete consumption of the coal while it travels the length of the furnace—makes it very evident that if small pieces of coal are just consumed, the very large pieces will not be consumed.

The washing of coal, which removes a considerable part of the ash and sulphur, has proved very advantageous to many plants, especially where capacity has been an important consideration. The washing itself, however, does not make coal burn without smoke.

Powdered fuel has been used with much success in places where the coal has not been too high in volatile-combustible content, and where the cost of the coal ordinarily used exceeded five or six dollars a ton. Powdered fuel can be burned without smoke, and it can be burned with excellent economy. It cannot, however, be cheaply reduced to a powder.

Students' Competition at the Electrical Show.

Six prizes were awarded by the Electrical Trades Exposition Company for electrical devices invented by students and amateurs and entered in the prize contest at the recent Chicago Electrical Show. There were five divisions under which devices and designs could be entered, viz. (1) electric light; (2) electric power; (3) electric heat; (4) transmission of intelligence; (5) electrochemical and electrotherapeutic. The judges were Messrs. C. H. Thordarson, F. L. Perry and W. H. Butler.

Following are the names of the prize winners:

H. L. Transtrom, 75 McLean Avenue (International Correspondence Schools), $20; 2,200-volt transformer for wireless telegraphy, and a high-frequency Tesla coil.

Byron De Forrest, 1115 North Clark Street, (Alcott School), $12; alternating-current electrolytic rectifier.

Lynn Waynick, 335 Park Avenue (Lewis Institute), $6; telegraph relay.

A. Boetter, 2521 Indiana Avenue (American Correspondence School), $4; burglar alarm.

Walter I. Wilcox, 4244 Langley Avenue, $4; original primary coil.

A. R. Perlow, 587 West Congress Street (Lewis Institute), $4; induction coil.

It is intended to make the student competition one of the most interesting features of next year's show.

Nine-hour Law for Railway Telegraphers.

On March 4th the nine-hour law for railway telegraph operators will go into effect. Besides serving as a measure of relief to the operators, the new law is expected to benefit the public and make travel safer. In day and night offices operators will be required to work no more than nine hours out of any 24. Where offices are open only during the day the companies cannot require the men to work more than 13 hours in succession, except in case of wrecks or other emergencies. Experienced operators say that the new law will not work hardship to the railroads, inasmuch as in some states a straight eight-hour law is complied with for all operators. It is said that there are plenty of operators to fill what extra positions the new law may create.

LEGAL NOTES.

Judge Holland, in the United States Circuit Court for the Eastern District of Pennsylvania, has entered a decree for a perpetual injunction restraining Eugene A. and George A. Rumsey from "further infringing" various claims of certain Shallenberger patents relating to induction wattmeters. The Westinghouse Electric and Manufacturing Company is the complainant.

In the case of the Westinghouse Electric and Manufacturing Company against the Condit Electrical Manufacturing Company, in the United States Circuit Court for the Southern District of New York, Judge Ray has decided that the defendant infringed claims 2 and 5 of patent No. 633,772, issued on September 26, 1899, to Gilbert Wright and Christian Aalborg for an "Automatic Circuit-Breaker." The patent has been the subject of [illegible] litigation and the case is spoken of as the "edgewise circuit-breaker case."

Electrical Exports for December and for the Year 1907.

Electrical exports from the United States in the month of December, 1907, reached a total value of $1,353,512, compared with $1,463,501 for December, 1906. Goods classified as electrical appliances show a marked falling off in the amount exported in December as compared with the corresponding month of 1906, but electrical machinery shows a substantial gain. A comparison of the figures follows: Electrical appliances—December, 1907, $515,701; December, 1906, $827,646. Electrical machinery—December, 1907, $837,811; December, 1906, $635,855.

Exports for the Year 1907.

The total value of electrical exports from the United States for the calendar year 1907 was $17,460,775, the greatest on record. In a review of electrical exports from the United States for the year 1907 printed in the New Years issue of the Western Electrician, the value of such exports, with figures for the month of December estimated, was given as $17,477,263. Official figures for December now at hand show that the estimate was but $16,488 too high.

For the last five years the value of electrical exports was as follows: 1907, $17,460,775; 1906, $16,655,510; 1905, $13,057,677; 1904, $11,039,758; 1903, $9,856,047.

The following tables show the destination and value of electrical appliances and machinery exported from the United States in the calendar years 1906 and 1907. It will be noted that in electrical appliances (which includes telegraph and telephone instruments) there was a decrease, while electrical machinery shows an increase.

Electrical Appliances.

Exported to—	1906.	1907.
United Kingdom	$ 2,194,085	$ 890,676
Belgium	195,288	145,759
France	58,910	78,205
Germany	310,073	352,791
Other Europe	178,425	138,078
British North America	1,158,824	1,380,926
Central American States and British Honduras	178,226	246,458
Mexico	999,141	753,936
Cuba	557,217	398,769
Other West Indies and Bermuda	39,170	60,137
Argentina	347,949	202,637
Brazil	774,217	1,237,691
Other South America	487,000	729,645
Japan	259,836	558,888
British Australasia	188,207	173,803
Philippine Islands	201,084	115,820
British Africa	69,369	71,881
Other countries	183,736	189,445
Total	$ 8,380,757	$7,725,545

Electrical Machinery.

Exported to—	1906.	1907.
United Kingdom	$ 1,219,392	$ 1,131,711
France	276,750	848,350
Germany	101,192	98,389
Other Europe	463,332	369,430
British North America	1,943,983	1,543,450
Central American States and British Honduras	47,603	97,365
Mexico	1,049,097	1,551,562
Cuba	437,327	74,625
Other West Indies and Bermuda	7,167	19,493
Argentina	168,256	210,657
Brazil	530,494	979,730
Other South America	147,881	187,729
Chinese Empire	24,071	59,647
British East Indies	221,662	254,160
Hongkong	18,985	10,095
Japan	960,146	1,411,229
British Australasia	369,550	527,561
Philippine Islands	65,064	88,212
Other Asia and Oceania	35,300	117,492
British Africa	181,950	95,661
All other Africa	5,551	58,682
Total, machinery	$ 8,274,753	$ 9,735,230
Total, appliances	8,380,757	7,725,545
Grand total	$16,655,510	$17,460,775

Municipal Bookkeeping in Westmount, Canada.

The Montreal (Canada) Gazette in its issue of January 17th prints an excellent editorial bearing on the methods of accounting as employed in the conduct of the municipal electric-light plant and destructor at Westmount. In a pamphlet containing "the facts about the plant" a profit of $174.55 is figured over operating and fixed charges for the year ended December 31st. Basing its argument on figures taken from the pamphlet and on seemingly indisputable evidence, the Gazette clearly shows that instead of a profit of $174.55 there was in reality a deficit of several thousand dollars.

Looking into the future the pamphlet predicts a profit of $20,000 for the plant in 1908. Here again the Montreal paper points out a probable serious deficit. "The contention in these columns has always been," says the Gazette, "that an electric-light plant in the meager field represented by Westmount could not be made self sustaining at the rates charged. The town today is paying its electric-light department $1,500 more per year for its street lighting than the value of the service and a fair commercial price warrants, and there was a deficit last year of about $3,000."

Large Commutating-pole Railway Generators in Boston

Among the comparatively recent improvements made in the design of [illegible] probably none has done more [illegible] advance in the art than the employment of commutating poles. While commutating [illegible] of moderate capacity have been in [illegible] eration for some time past, it is only recently that the feature has been applied to large [illegible] nected, engine-driven generators operating under the severe service conditions generally met with in street-railway work.

The two 2,700-kilowatt commutating-pole railway generators recently installed in the Charlestown and Harvard power stations of the Boston Elevated Railway Company by the General Electric Company present some interesting features in connection with the design, installation and operation of this type of railway generator.

The first of these generators was put in commercial service on October 10th last, exactly eight months from receipt of order and 21 days in advance of the date specified for delivery. [illegible] said to be the quickest delivery on record for an engine-driven unit of this size. The second machine, although completely installed and ready for operation before the middle of November, was not placed in service until several days later, owing to non-completion of other work in progress of erection in the station.

These generators are direct-connected to McIntosh & Seymour 4,100-horsepower vertical cross-compound engines and are designed for 575 volts at a speed of 90 revolutions per minute, but are capable of wide voltage range at all loads. Although the largest commutating-pole railway generators ever built, at the same time they are of smaller dimensions and occupy less floor space than any machines of same output and speed previously constructed. It is interesting to note that the armature diameter of these machines is approximately 4½ feet less than the armature diameter of the non-commutating-pole generators of the same output just installed in the Lincoln Wharf station of the Boston Elevated Company.

The generators are guaranteed to deliver 2,700 kilowatts (4,700 amperes at 575 volts) continuously with a temperature rise not to exceed 35° C. in any part above the surrounding air, also 50 per cent. overload, or 4,050 kilowatts (7,050 amperes at 575 volts) for two hours following the normal run, temperature rise not to exceed 55° C., and to withstand a momentary overload of 100 per cent., or 5,400 kilowatts (9,400 amperes at 575 volts) without injury.

That these guarantees have been fully met has been clearly demonstrated since the machines were put in service. Their operation under the severe conditions imposed by a fluctuating railway load has been entirely satisfactory, and tests taken show a temperature rise that is within the guarantee by a very large margin.

The practically sparkless commutation secured under all conditions of load by conservative design and use of commutating poles reduces wear of commutator and brushes to a minimum, which is an additional source of economy obtained with this type of generator.

No change whatever in the brush setting has to be made from no load to momentary overload condition of 100 per cent., and the circuit-breaker can be tripped under any condition of load between these limits without appreciable disturbance at the brushes. In fact, the provision for shifting brushes is almost superfluous on this type of machine, as with the brushes once adjusted for best commutation it is never necessary to alter their position.

This desirable feature can be best appreciated by station attendants, more or less accustomed, in times of excessive load or trouble, to the exercise of constant vigilance with respect to the brush-setting on the ordinary type of generator, to prevent flashing.

Considerable doubt was expressed as to the possibility of obtaining successful parallel operation of [illegible] paralleling these machines with others in the stations where they were installed.

The magnet frame is of cast-iron, rectangular in shape, made in six sections, securely bolted together, and of the box-section type, forming a rigid [illegible] their heavy field coils. The main poles are rectangular cast-steel, with laminated pole faces, and the commutating poles are laminated throughout. Field coils are compound-wound.

The armature core, formed of steel punchings, is rigidly held to a cast-iron spider of substantial proportions by means of numerous dovetails. Effective cooling of the armature is procured by numerous ventilating ducts throughout the core and also by a novel construction of the end flanges, which allows the end conductors to be well separated, and permits a free and natural flow of air between them. The armature winding is of the multiple-drum type, composed of formed coils of bar copper, effectively insulated, and interchangeable on the same armature. The coils are held [illegible] the end windings are kept in position by patented sectional binding bands, easily removed or replaced.

The commutator bars are of hard-drawn copper of such dimensions as to provide ample wearing depth and liberal creepage distances. The spider, made of cast-iron, is rigidly bolted to the armature spider, and the clamping rings are of the best cast-steel. An interesting feature of the commutator construction is the precaution taken to prevent a possible short-circuit from studs or bars to clamping rings. Where the clamping rings extend beyond the commutator bars, they are thoroughly insulated with mica, and, in addition, extra insulation is molded over the extreme edge of ring and carried well down underneath, where it is securely fastened, thus making it almost impossible for grounding at this point.

The brush rigging is of the latest type, employing cast brackets of substantial dimensions, to which individual brush holders of excellent design are bolted. The resulting construction is strong, rigid and entirely free from movement or vibration, thus obviating the necessity of employing supporting tie-rings passing from stud to stud. Alternate sets of brushes are so placed on the stud brackets that they are staggered around the commutator. By this means the brushes do not track, thus promoting even and uniform wear of the commutator without the use of auxiliary means.

The present normal capacity of the Boston Elevated system is a little over 52,000 kilowatts, all of which is furnished by direct-current machines.

TWO VIEWS OF 2,700-KILOWATT COMMUTATING-POLE GENERATOR IN CHARLESTOWN POWER STATION OF BOSTON ELEVATED RAILWAY.

Another Municipal Plant Running Behind.

A Sheboygan (Wis.) newspaper says that the city of Algoma, Wis., now finds that the municipal light and water plant there is running behind, and is appealing to its citizens to come to the aid of the institution. For the year 1907 the city paid for water and light the sum of $3,658, while private persons and corporations paid $4,763.63, approximately. The cost of running the plant, labor, fuel, minor repairs and incidentals, is about $20 per day, or $7,300 a year. Thus, it is shown that there is but $1,121.63 to pay the $1,500 interest on the bonded indebtedness of $30,000. Besides, the intake pipe must be taken up and relaid, which [illegible] and light.

Government Ownership of Telegraphs a Failure.

[illegible] taken as a criterion. The Dominion minister of [illegible] of Commons that the telegraph system in question [illegible] were $136,188, and there has been no expenditure on capital account. According to reports received the line is in a bad condition, and a number of complaints have been received from business men at Fort Essington, Prince Rupert and Port Simpson. The main line of this system extends from Ashcroft, a station on the Canadian Pacific Railroad, about 200 miles east of Vancouver, to Dawson City. The towns of Fort Essington, Prince Rupert and Port Simpson are served by a branch which leaves the main line at Hazelton, and it is of this branch that complaint is made. It is stated that the line between Hazelton and Prince Rupert was down from October 21st to November 30th except for a few periods of one or two hours each. Complaints go to show that the men engaged on repair work are too few and inefficient.

Mr. Tesla Makes Further Disclosures.

Nikola Tesla, who has been making some rather remarkable assertions of late in letters printed in the New York Times, publishes another communication under date of January 26th. This is a part of it:

"I read in your issue of today that, according to Lieutenant-Colonel Chales, director of military telegraphs of France, a wireless message 'should theoretically go around the world.' If you will take the trouble of perusing my French patent, No. 354,791, you will find that this has long since ceased to be a theory, for that document, while bearing the date of April, 1905, describes experiments which I made in the fall of 1899, and one of which was to pass currents of 100 amperes around the globe, a mere breadth in view of its immensity, but more than necessary to affect a sensitive receiver. You will also notice that in those tests I used 'undamped' oscillations, one of my earliest improvements, which you seem to find pleasure in attributing to other electricians. These facts are mentioned incidentally, merely with the desire of informing you correctly.

"What I wish to bring to your attention relates to certain provisions of the last wireless conference which are now being considered by the United States Senate. Some of the rules were undoubtedly proper and applicable to 'radio-telegraphy' by electromagnetic or Hertzian rays, in view of the impossibility of preventing interference and because many different forms of apparatus were employed. But since that time the Hertz waves have been abandoned by the more advanced experts and a uniform system adopted which permits the simultaneous transmission of any desired number of wireless messages without interference and with a precision and accuracy equal to, if not greater than, that practicable with cables."

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

LIV.—Electric Welding.

It is well known that if two pieces of steel or iron are heated to a creamy-white heat they become soft, so that when placed in contact they will stick together. Welding consists of joining two pieces of metal which have been thus heated by means of placing them together and either hammering them or putting them under special pressure until they form one single piece. When welding metals by heating them in a fire, great care must be taken in heating the parts to the exact welding temperature. If they are not sufficiently heated there will be a scale of oxide on the surface of the metal which will prevent their union. If they are overheated the metal will be burned, which is indicated by showers of sparks coming from the fire.

Until recent years iron and steel were practically the only metals to which welding was commercially applied, but with the advent of electric welding it became possible to weld nearly all kinds of metals and alloys on account of the heating being under perfect control. Electric welding consists of passing a large current through the portion of the metal to be mended, until it attains a welding heat, and then bringing the heated portions together under pressure until they are firmly united. The amount of current required for making the welds depends upon the location of the part to be heated and the character of the metal. The electrical resistance of these parts when carrying a large current tends to heat them up in the same way as an ordinary copper conductor is heated when carrying more than its normal capacity.

The most advantageous features of the electrical weld are the rapidity and accuracy with which it can be made, the uniformity of the work and the localization of the heat to the parts to be united. Electric welding has become a very important part of many industries, and new applications of it are steadily being made. The simplest electric welders consist essentially of transformers whose primaries are wound for the ordinary alternating-current voltages furnished from central stations. The secondaries are wound with very heavy copper, having usually only one or two turns, so that the secondary current is a very heavy current at low voltage, usually three or four volts.

The pieces to be welded are held in clamps, which are connected to the terminals of the secondary winding.

One important application of electric welding which has already been briefly mentioned consists of track welding, or uniting the ends of railway-track rails to form a continuous length of rail and thus avoiding bonding and joint troubles. Track welding is done after the overhead construction is completed, so that the 500-volt trolley current is available. The actual welding current is always alternating current, on account of the ease with which it can be transformed to a very low voltage desirable for this work, and a track welding outfit therefore contains a rotary converter for changing the 500-volt direct current into alternating current. This alternating current is then carried to a special transformer, such as described above, where it is reduced to a working potential of three or four volts. The low-tension terminals of this transformer are connected to massive clamping blocks, between which the parts to be welded are clamped. These clamps are cooled by water, which is circulated through them, so that there is no danger of the clamps becoming welded to the part of the joint which comes into contact with them.

The joint is made by butting the two ends of the rails together and welding a block on both sides of the rail across the joint. The low-tension current is then passed between the clamps through the two blocks and rail ends until the metal about the joint is raised to a welding heat. The pressure on the clamp then unites the blocks and rail ends intimately, producing a true weld. As the surface of the joint is liable to be somewhat distorted during the process of welding, a grinding attachment is carried upon the welding outfit by [illegible]

advantages for locally heating parts for bending, shaping, annealing, etc., make its use very broad. In one or the other of these functions, the welding machine is used in making nearly all of the metal parts in bicycle manufacture. It is also very largely used in carriage factories for welding tires, fifth wheels, steps, dash frames, etc. It is also used for fastening the ends of the central wire in making solid rubber tires. Aside from these larger applications, it is used extensively for welding umbrella rods, typewriter bars and the finest sizes of wire. From these varied examples of the work performed by an electric welder, it will be seen that there is practically no limit to the delicacy with which the finest work may be produced. A number of electric welders are used for performing welding operation continuously and automatically as fast as the material to be welded is fed into them. Among machines of this character may be mentioned those for producing pipes and tubes of various diameters. The material is fed into the welding machine in a continuous strip and is bent between rolls, and the edges which come together are butt-welded. The heat is so localized that only a small beading of metal appears along the joint. While butt-welding of pipe is most common, lap-welding, in which the welded edges overlap, is coming largely into use.

The manufacture of wire fencing is now done to a considerable extent by means of welding machines. Parallel rows of wire are fed through the machine from a number of reels, depending in number upon the mesh of the fencing. Short pieces of wire corresponding to the height of the fence are placed across the continuous wires at intervals and are almost instantly welded at each crossing point of the wires. The operation is continuous, a machine turning out many thousand feet of fence wire per day.

The operation of the various welding machines is more or less automatic, depending on the class of work they are performing. A track welding machine requires all the operations to be done by hand. In other machines the operation of clamping the work is manually performed, whi'e the heat is turned on and og automatically. In still other machines the entire operation is automatic, as in the fence-wire and chain-welding machines, and these only require an operator to feed in the necessary amount of matrial to be worked.

There are a large number of other applications of electric welding which would make too long a list to mention, but enough have been described to indicate the very important part electric welding plays in numerous lines of manufacture.

[To be continued.]

QUESTIONS AND ANSWERS.

Running of Cables to a Telephone Distributing Frame.

E. N. C., Honolulu, Hawaii: What is the standard or proper way to form out cables on the horizontal side of distributing frames used by the Bell telephone companies? The racks here are 13 strips high and 13 blocks long; the cables are woolen with 200 pairs each. Should they feed in from the end of rack or should they come up between the uprights?

Answer.

The standard method is to bring up a cable at each vertical and to tape it against the corner of the angle iron support. The method of bringing the cables in from one end may be used where necessary, but the standard method is to be preferred because it is simpler, gives better support to the cable and leaves more room on the frame.

Raising Dynamo Voltage.

A. L. J., Antrim, La.: We have a 20-kilowatt dynamo that is marked 167 amperes at 115 volts. Our circuits take only 110 amperes at this voltage. Can we carry 125 volts with perfect safety? The machine is a new compound-wound dynamo.

Answer.

The machine will probably safely stand the added 10 volts, but it is a little doubtful whether the field strength can be increased enough to give 125 volts at nearly full load, for the load current will very likely increase with higher voltage. If the engine can keep up the speed with the increased load, the machine will probably run warmer than usual and its commutator especially should be watched for heating and sparking. The voltage should be increased slowly and its effect on the system as well as on the machine observed.

The First Electric Railways in America.

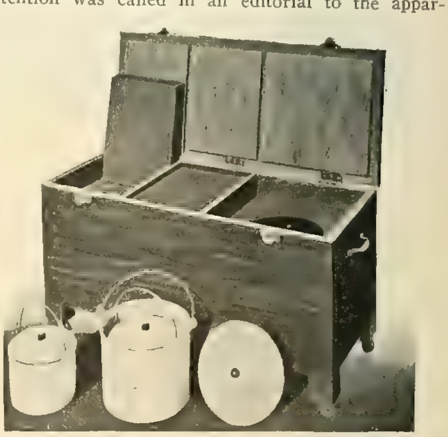
E. H. H., Kayford, W. Va.: Kindly advise me when and where the first electric railway was operated in America. Also whether San Francisco did not have an electric car line some time before the one in Richmond, Va., was installed.

Answer.

The first electric railway in America that can be said to have been operated along lines now standard and that required comparatively little experimental work and alteration to make it successful as a railway system was opened for traffic in Richmond, Va., in the early part of February, 1888. Quite a number of electric cars had been operated before this in this country, but they were more or less experimental in nature and did not have the ultimate success that the Richmond road achieved. Probably the first experimental car was one built in the winter of 1880-81 in Stockbridge, Mass. Others followed at expositions in Chicago and Toronto in 1883 and 1884. In the following years a number of electric car lines were started, the most successful being in Appleton, Wis. (1886); Scranton, Pa.; Los Angeles, Cal.; Lima, Ohio, and others in 1887. None of these early lines, however, got out of the experimental stage so as to resemble the modern electric railway as quickly and completely as the Richmond road. San Francisco did not have electric cars earlier than this. For further information on this matter see in the Western Electrician of September 28th last the articles by B. J. Arnold, p. 232, and A. A. Stiles, p. 250.

Electric Cooking by the "Fireless" Method.

In the Western Electrician of December 14th last attention was called in an editorial to the apparent possibility of combining the advantages of electric cooking and the "fireless cooker." To quote the language of that editorial:



Electric Cooking by the "Fireless" Method.

"As is well known, these 'fireless stoves' are appliances insulated to retain the initial heat of the cooking utensil and its contents. After the operation of cooking is fairly begun on an ordinary stove or range the kettle or what not can be removed to the 'fireless stove' and there enclosed in such a manner that the cooking process is finished in the course of time by the heat already imparted, without the addition of further heat. Now why could not these 'fireless stoves' be used with great advantage in electric cooking, resulting in a great saving of current? Only enough electric heat would be required to get the boiling or baking well started. The current could then be shut off, allowing the retained heat to do the rest."

It is interesting to note that this is exactly what is done in the "Autotherm," illustrated herewith, a device exhibited at the Chicago Electrical Show of last month by W. S. Heger, Jr., of Milwaukee, but of which the writer of the editorial had no knowledge a month before. The idea, of course, is to combine the conceded excellences of electric cooking with the economy of the "fireless cooker."

The operation of the cooker is as follows: The food to be cooked is merely heated thoroughly on the electric stove, which is then cut out of circuit. Then the food is put into the "Autotherm" and left for a number of hours, during which it is deliciously cooked without further application of heat or attention. For example: Soup prepared electrically is a highly nutritious and acceptable article

of food, of very little cost if it were not for the cooking expense. In the old way of cooking the necessity of long boiling requires quite an amount of current. If the "Autotherm" is used it is only necessary to boil the soup for about 10 to 15 minutes, then to put it into the "Autotherm," and further expense for current and labor ceases. Oatmeal should cook at least an hour, while far longer cooking greatly improves it. For cooking in the "Autotherm" it is just brought to a boil on the electric stove and put into the "Autotherm" over night. In the morning it is steaming hot and well cooked.

The largest current consumer among the electric-cooking appurtenances is the oven, which, it has been computed, takes 25 per cent. of the total amount of current used. This is due largely to the fact that to roast meats the oven must be run at a high heat for from two to three hours. If after the meat has been well browned, which takes from 20 to 30 minutes, it is put into the "Autotherm" it cooks much better than if it were finished in the oven, and the item of greatest expense in electric cooking is cut down about 70 per cent. One might go on showing the saving in each case, but it is sufficient to say a saving of 50 to 90 per cent. is effected in the case of every article cooked in this way.

The following table of comparative cost which has just been compiled by E. W. Lloyd, general contract agent of the Commonwealth Edison Company, Chicago, serves well to illustrate the saving. The cost of current is figured at 5 cents per kilowatt-hour:

Article.	Time Required if Cooked Entirely on Electric Apparatus.	Cost.	Time Necessary to Cook on Elec. App. if Finished in Autotherm.	Cost.	Savin	Size of Utensil Used.
Baked Beans	6 hrs.	18c	2 min.	1c	17c	2 qt.
Most fibrous vegetables	1 "	4½c	5 "	1½c	3c	2 "
Stewed chicken	2 "	8c	10 "	1½c	6½c	2 "
Corned beef	2½ "	12½c	15 "	2c	10½c	4 "
Dried fruits	1½ "	2c	5 "	1⅛c	⅞c	1 "
Ham	4 "	22½c	30 "	5c	17½c	8 "
Pot roast	2 "	7½c	15 "	3c	4½c	4 "
Roast beef, lamb or pork	2½ "	30c	45 "	10c	20c	*8 lbs

*Weight of Meat.

Foods which may be cooked in this way include all boiled and steamed articles, all roasts and foods which are baked long and slowly (the browning of which may be done before or after the cooking in the "Autotherm"). With the exception of bread or cakes the articles which cannot be cooked in this way are of a class which take but a few minutes to cook, so no particular saving would result from cooking in the "Autotherm" if it were possible.

Forest Preservation and the Electrical Industry.

On January 10th the board of directors of the American Institute of Electrical Engineers adopted the following self-explanatory resolutions:

Whereas, The American Institute of Electrical Engineers recognizes that waterpowers are of great and rapidly increasing importance to the community at large, and particularly to the engineering interests of the country; and,

Whereas, The value of waterpowers is determined in great measure by regularity of flow of streams, which regularity is seriously impaired by the removal of forest cover at the headwaters, with the resulting diminution in the natural storage capacity of the watersheds, this impairment frequently being permanent because of the impossibility of reforestation, owing to the destruction of essential elements of the soil by fire and its loss by erosion; therefore,

Resolved, That it is the opinion of the American Institute of Electrical Engineers that the attention of the national and state governments should be called to the importance of taking such immediate action as may be necessary to protect the headwaters of important streams from deforestation, and to secure, through the introduction of scientific forestry and the elimination of forest fires, the perpetuation of a timber supply; and further

Resolved, That the committee on forest preservation be instructed to communicate these resolutions to all members of Congress, and to the governors of all the states.

The Home Show.

Space is being taken for the Home Show which will be held at the Grand Central Palace, New York, from May 2d to 9th, inclusive. Containing "everything for the home," the exhibition will appeal as directly, if not more directly, to women as to men. From real-estate men, architects, builders, inventors of heating and ventilating apparatus, to the furnisher and decorator of the completed home, the list of possible exhibitors is necessarily a long one. Occasionally the housewife finds something at once useful and novel in the department store, but her information in regard to home furnishing from drawing room to kitchen must be kept up to the minute by an irregular visit to such stores on bargain days. The opportunity is given by the Home Show to see the last word on such subject. Applications for space should be made to the Home Exhibit Company, 12 Broadway, New York.

Electrical Aspect of Moving-picture Theaters.

By George Rice.

Ten years ago the average electrical man was inclined to ridicule the moving-picture business, so far as it concerned the electrical business. Today the moving-picture show business has assumed large proportions in the electrical field, and there are men who are devoting their entire time to the electrical departments of it.

Formerly the moving-picture machines were run in a few theaters for vaudeville programmes. There were some scattering machines here and there, and it was seldom that the electrician was called upon to do anything in connection with them. There are now about 5,000 five-cent theaters listed in this country, all running with moving-picture machines, and all making money, apparently.

The five-cent moving-picture theater craze began four years ago. Two, three, four and oftentimes a dozen different five-cent moving-picture-machine houses were opened in cities and towns of fair size. In the large cities the number was proportionately larger. All seem to have flourished.

With the beginning of the opening of the first of the five-cent theaters with pictures, the new

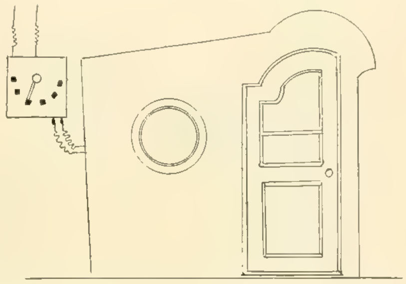


FIG. 1. BOOTH FOR MOVING-PICTURE MACHINE.

work of the electrician developed. And it has been developing ever since, until now it is worthy of notice, for the reason that most of the machines are operated by electric current, and there is more or less electrical work to be done every day in connection therewith.

Furthermore, the business promises to expand to greater limits. It is discovered that the moving-picture theaters have developed a new set of audiences. People who never attended theaters before go now. And these people never tire of going. They go alone and with their families.

A man rents a little store, room or hall. He goes to the local central-station company and simply mentions the words, "Electrical current wanted for a moving-picture outfit." The superintendent of the plant realizes that a profitable customer is going to use some current, and arrangements are made.

A machine is bought or rented. Films are arranged for. An operator is hired, and some chairs or benches are put in, and the show begins that night. Watch the man! In two months he increases the seats and oftentimes rents a larger building. He makes money. Sometimes he decorates his establishment elaborately. And the electrical people get a part of it. It is worth while for the electrical fraternity to study the moving-picture machines and their demand for current.

In fact, a man ought to be something of an electrician to be able to handle the electric-light moving-picture machine. Some of the electrical companies own moving-picture theaters. The profits should be good. Ordinarily the rental of the room or hall on the public street is about $40 a week; wages of manager, about $25; wages of operator, $20; doorman, $15; general utility man, $12; rent of film, $40; printing, etc., $20. There are no expensive actors and actresses to pay every week—no orchestra or scenery. About $200 a week will cover a modest outfit, including rental of the projecting machine. Several shows are given daily. On a holiday enough money is often received to pay the entire week's expenses.

The electrician is getting wise. He is called upon frequently to install systems. He is consulted at other times. It is usually an electrician who is called upon to install the machine. He must be sure to be familiar with the fire underwriters' regulations [illegible] be ... ted to the [illegible] those booths ... [illegible]

Fig. 1 shows a [illegible] tern the booth [illegible] of the hall so that [illegible] forward to the [illegible] The electrician [illegible] range the interior of the booth, and Fig. 2 is a sketch of such a place with the fittings.

FIG. 2. INTERIOR OF BOOTH FOR MOVING-PICTURE MACHINE.

In addition to the middle bench for supporting the machine, there ought to be a stand for the tools, fuse wires, carbons and electrical devices required for immediate service during a show. The electrician has to remind the new proprietor of many things. There ought to be pigeon-holes for various parts of the electrical outfit, so that, in case something breaks or burns out, it will be possible to place the hands upon a new part. The film should be kept secured in a film box.

Fire is the worst foe. A wet blanket in a pail of water can be used to smother out almost any fire at the beginning, and such a pail should be handy with the blanket in it.

The electrician will find that it is necessary to give the operator lessons in the arc lamp, even though the operator may be experienced. This will be due to the fact that the electrical current and conditions vary in different towns. Direct current is usually preferred, but many of the towns are equipped with an electrical plant producing only alternating current. Some of the arc-lamp carbons are arranged at 90 degrees, as at (A), Fig. 3. Others are placed as shown at (B), and still

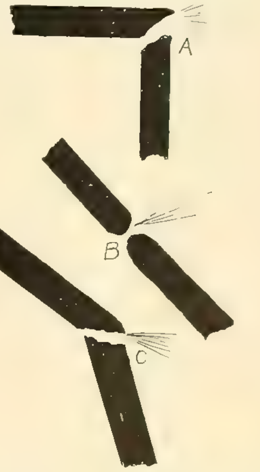


FIG. 3. ADJUSTMENT OF ARC-LAMP CARBONS FOR MOVING-PICTURE MACHINE.

others as at (C). It is necessary to get the crater right, and when this is done, there will be no trouble. I usually hold the tips about a quarter of an inch apart. If too much space is permitted the arc will be too long, and the light may go out. But all of these little things become easy after experimenting.

Hydro-electric Power for Merrill, Wis., Mills.

The paper mill in Merrill, Wis., is now being operated by electricity generated at Grandfather Falls on the Prairie River. Development of the falls was begun in August, 1906, after it became apparent that the flow at the Dells of the Prairie River was not sufficient to generate enough power to meet the needs of the mill. The Grandfather Falls company was then formed and later bought out the Merrill paper-manufacturing plant.

The dam is built of solid masonry and is 70 feet high, 700 feet long, with a base 35 feet in thickness, and five feet at the top. The power house at the falls is 44 by 44 feet and 23 feet high. It

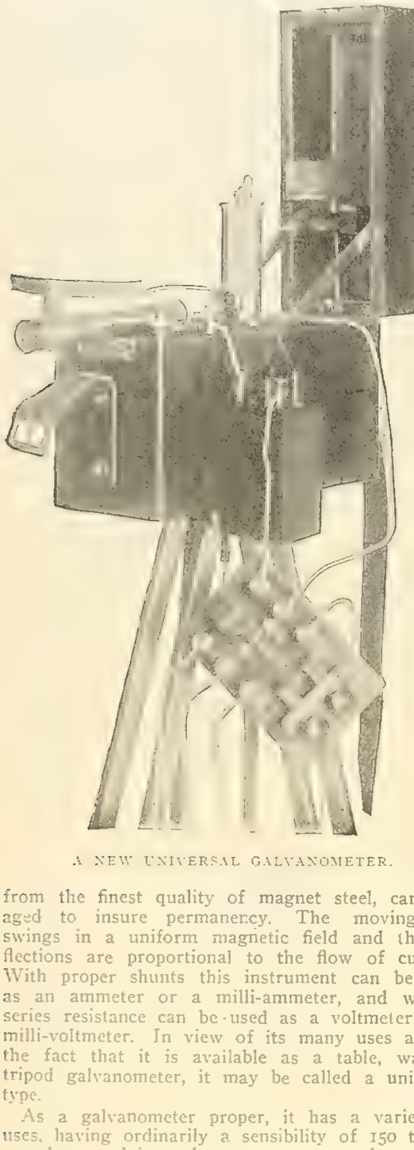
has [illegible] generator of 1,400 kilowatts, with the necessary auxiliary apparatus. Other flumes have been built, ready to receive additional power to the amount of 3,700 kilowatts.

Electricity is transmitted to the Merrill paper mill, a distance of 12 miles, over heavy transmission wires. The electrical power runs the three grinders, the wood room, the tail end of the pulp mill and the beater line at the mill.

At the new village of Grandfather there are about 15 men employed. Dwelling houses are being built and the little town is being lighted by electricity.

A New Universal Galvanometer.

With the advantages of the pivoted form the added sensibility of a suspended instrument is obtained by the Queen universal galvanometer, just produced. The permanent magnets are made



A NEW UNIVERSAL GALVANOMETER.

from the finest quality of magnet steel, carefully aged to insure permanency. The moving coil swings in a uniform magnetic field and the deflections are proportional to the flow of current. With proper shunts this instrument can be used as an ammeter or a milli-ammeter, and with a series resistance can be used as a voltmeter or a milli-voltmeter. In view of its many uses and of the fact that it is available as a table, wall or tripod galvanometer, it may be called a universal type.

As a galvanometer proper, it has a variety of uses, having ordinarily a sensibility of 150 to 500 megohms, and is made up to 1,000 megohms sensibility. The coils are rectangular in form and swing over a soft-iron core having radial faces. The moving system is suspended by phosphor-bronze strips secured to abutments terminating at the ends of two steel rods that also hold the soft-iron core over which slides the clamping device for transportation. A three-eighths-inch plain mirror is mounted just above the coil. The upper abutment is provided with two milled heads, one for locking the system and the other to adjust zero. The [illegible] provided with a three-fourths-inch circular window.

The entire system can be lifted from the tube by the removal of two small screws. The tubes with system are interchangeable. This will enable the user to have tubes of different sensibilities.

The containing cases are made of hardwood and provided with a leather carrying strap. The permanent magnet is securely bolted in the case, thereby insuring extra stability.

[illegible] that form a receptacle for the tube and system. On either side of the telescope is provided a mill-head screw for leveling when used as a table galvanometer. There is also provided a brass plate secured to the lid of the instrument, so that it can [illegible] tapped to receive the screw from a tripod for street work.

With this instrument is a 100,000-ohm coil wound with a wire having a negligible temperature coefficient mounted in a neat case with suitable terminals. There is also an Ayrton shunt, with all necessary binding posts and two battery-reversing keys. These instruments all fit in the box very compactly, and the entire dimensions over all are 6½ inches high, 8½ inches long and 3½ inches wide, weighing 5½ pounds. This universal galvanometer is manufactured by Queen & Co., Philadelphia.

"Linolite," a New System of Lighting.

The marked improvements in incandescent lamps brought about from time to time have none of them made much of a change in the shape of the lamps. The new system of lighting recently devised, and previously mentioned in the Western Electrician as the "Linolite" system, employs a long tubular lamp in which the filament reaches from end to end, as shown in Fig. 1. As the lamps are connected end to end, they form a continuous line of light, hence the name "Linolite." The source of light being continuous, the illumination is uniformly distributed, and alternate bright and dark spots are eliminated.

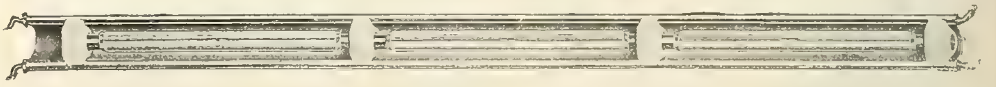


FIG. 1. "LINOLITE" SYSTEM OF LIGHTING.

The lamps are arranged in a semicircular reflector, which is made up in any lengths required up to and including 10 feet. The position of the lamp relative to the reflector is such that the filament is located uniformly throughout its length in the focus of the reflector, and thus a maximum of reflecting efficiency is obtained. Tests are said to have shown that the illumination secured from Linolite is much greater than that from an ordinary bulb lamp.

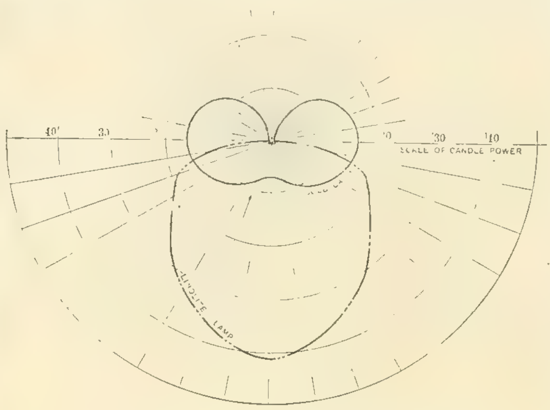


FIG. 2. DISTRIBUTION OF LUMINOUS INTENSITY OF LINOLITE AND ORDINARY BULB LAMP

The Linolite system requires but small space. The entire reflector is only 2¼ inches wide by one inch deep over all, so that it can be placed in show windows, showcases, etc., back of the window frames or fillets, in such manner that the fixture will be invisible, or practically so, and the source of light screened entirely from the eye of the spectator.

Fig. 2 shows the distribution of luminous intensity of Linolite as compared with the ordinary 16-candlepower lamp in its end-on position, both having the same size and length of filament and consuming the same current. This curve, says the manufacturer of the new system, is the result of a certified test made by the City and Guilds of London Institute, London, England. The block curve shows the candlepower in any direction of the bulb lamp, while the dotted curve shows the corresponding values of the candlepower of Linolite. The illumination given by the bulb lamp immediately in front is shown to be seven to eight candlepower, while that of Linolite is over 40 candlepower, and the illumination from Linolite is in every direction in front of the fixture considerably greater.

Linolite is particularly adapted for lighting show windows, showcases, pictures, signs, desks, etc.; also for theatrical stage lighting, and the outlining of buildings for display purposes. An important application of it is in the illumination of room interiors by reflected light, in which case Linolite is placed above the cornices near the ceiling, from which the light is reflected. Linolite is manufactured by the H. W. Johns-Manville Company of New York.

Denmark [illegible] tory after May 4, 1912.

Electric Flatirons and Transformer Capacity.

[From the Question Box of the National Electric Light Association.]

Have central-station men who have used a transformer of one-quarter the capacity of the connected load for lighting in residence districts found it necessary to install larger transformers, due to the use of electric irons?

ANSWERS.

Peninsular Electric Light Company, Detroit: We do not expect that electric irons will increase the peak load. The peak load in any residence district comes just before supper time. It would be exceptional to have the family ironing in progress at that hour. We find there is a difference in the ratio of demand to connected load in districts built up with new residences in comparison with districts where the residences were wired 10 or 15 years ago. In the older districts the rule that the demand is about one-fourth of the connected number of lights seems to hold good. In the new districts the demand is only about one-fifth of the connected lights. We believe that this is due to the common installation of lights in closets, basements and other places of intermittent use in new residences, and also to the much more free installation of wall switches, so that customers do not hesitate to wire extra lights to be used only occasionally. If the inquirer has a new residence district and has transformers of one-fourth the connected load, we do not think he need worry about the effect of flatirons. We assume, of course, that his secondaries are tied together.

L. L Elden, Boston Edison Company: Does not apply to this company, as our smallest transformer is one kilowatt. We allow five to ten lamps for the maximum demand for each residence on networks, and proportion the transformer capacity accordingly, so that the use of a number of flatirons causes no trouble from transformer capacity. Where individual residences are connected to separate transformers there is always sufficient capacity for flatirons. We have never changed a transformer on account of the use of flatirons.

Centralia (Ill.) Gas and Electric Company: Has not been our experience. But your question suggests the advisability of your following our practice: viz., use demand meters on the primary side of your transformers once in a while to arrive at the maximum demand. The results will bring you more than one surprise, and you will be satisfied that the instrument has paid for itself in the first month's use.

H. A. Holdrege: We have found it entirely impossible to get along with transformers of one-quarter the capacity of the connected load, and find it necessary in all cases to install transformers of at least one-third that capacity, and in many cases one-half. This is regardless of the use of flatirons.

Elevated Roads Show Gains.

The South Side and the Metropolitan Elevated railroads in Chicago show gains in their annual reports. The South Side company reports gross earnings of $2,105,193 for the year 1907, compared with $1,788,975 in 1906. The total operating expenses were $1,459,745, leaving net earnings of $645,447. The net earnings were equal to 4.25 per cent. on the outstanding capital stock. Besides normal increase in operating expense there were some extraordinary outlays for the improvement of the structure and operating conditions. These unusual expenditures were chargeable to the operating account. The increased gross receipts were due partly to the enhanced population in the territory traversed by the road, partly to the opening of five new stations on the Englewood extension and to the opening to traffic of the new Kenwood branch, on which there are seven stations. There was carried a total of 40,438,620 passengers, or an average of 110,791 daily.

The Metropolitan Company reports gross earnings for the year 1907 of $2,878,000, an increase of $240,000 over the preceding year. Net earnings were $1,435,000, an increase of $87,500. After deducting all interest and rental charges the balance of earnings amounted to 4.5 per cent. on the preferred stock outstanding. During the year 2¼ per cent. in dividends was paid on the preferred issue and the year's surplus was $195,857, making a total surplus of $1,320,291. The proportion of total operating expenses to gross earnings was 50.11 per cent. During the year the road carried 54,280,888 passengers, an average of 148,715 a day, and an increase of [illegible] per cent. over the traffic of the preceding year. The daily average number of passengers in 1906 was 136,361.

Mr. Kellogg Wins Victory in Kellogg Company Litigation.

An important decision in the telephone industry was given on February [illegible] by Judge Windes of the Circuit Court, in Chicago, when he directed that the control of the Kellogg Switchboard and Supply Company by the American Telephone and Telegraph Company, known as the Bell company, be set aside. The decision decrees the return of [illegible] shares of stock in the Kellogg concern to its original owners. The monetary value of the stock is said to be about $1,200,000. The question of more importance is the control of the company, which was formerly a leader in the manufacture of apparatus for independent telephone companies. The litigation is of several years' standing. Judge Windes' decision closely follows the opinion of the Supreme Court, which remanded the suit to the Circuit Court.

In the year 1902 Milo G. Kellogg, the organizer of the Kellogg Company, went to California because of ill health, but before leaving Chicago gave a power of attorney to his brother-in-law, Wallace De Wolf. In the fore part of 1903 he returned and, it is declared, learned that in the meantime De Wolf had transferred 3,334 shares of Kellogg's stock to the American Te'ephone and Telegraph Company. At the same time, it was averred, Mr. De Wolf transferred his own shares to the control of the Bell company.

Mr. Kellogg disapproved of his representative's action and sought to have the transfer set aside. At the same time the minority stockholders, owning 485 shares, brought suit to compel the return of the Kellogg stock held by the American company, alleging that it was against public policy to allow one corporation to ho'd stock in another that was a competitor. The transfer of the stock, it was charged, amounted to a violation of the Sherman anti-trust law.

Automatic Telephone Men Organize.

During the recent Independent telephone convention in Chicago the National Automatic Telephone Association was organized by representatives from the 60 automatic telephone exchanges in the country. The members are managers, superintendents, wire chiefs and others actively in charge of automatic systems, and the organization is to enable the discussion of automatic problems and topics of mutual interest. The first officers elected were: President, J. H. Ainsworth, general manager of the Home Telephone Company of Dayton, Ohio, and secretary-treasurer, F. J. Hanna, superintendent of the same company.

GENERAL TELEPHONE NEWS

The Cerderville Telephone Company has been incorporated by H. Z. Owen and others of Hinton, Okla.

The Decatur County Mutual Telephone Company has purchased the Leon Telephone Company for $3,500 and will make improvements on plant at Leon, Iowa.

The Hawkeye Telephone Company proposes erecting a new building at Perry, Iowa, for its headquarters. Extensive improvements in the entire local system will also be made.

The Tri-state Telephone Company has finally completed arrangements for entrance to Rochester, Minn., having contracted with the Rochester Telephone Company to handle the business.

The La Crosse Interurban Telephone Company of La Crosse, Wis., has purchased the telephone lines and all the other property of the Vernon County Telephone Company for about $13,000.

The Tri-state Telephone Company, locally known as the Twin City, according to its annual report filed with the state auditor at St. Paul, shows gross earnings of $936,236, and on this the company paid the state a three per cent. tax of $27,087 for the year 1907.

The farmers south and west of Thief River Falls, Minn., have organized what is known as the Farmers' Mutual Telephone Company. The new line will cover an area of considerable extent and will be connected with the local telephone exchange of Thief River Falls. Minn.

The monthly statement of the Chicago Telephone Company shows that the net gain in the number of instruments installed in January was 3,075, of which 2,830 were in the city and 245 were in the country. On January 31st the company had in service 205,756 telephones, of which 158,909 were city and 46,847 were country lines.

The citizens of Bloomington, Ind., are making a determined fight against an order to increase rates 25 per cent. by the Home Telephone Company in that city. A mass meeting was held by the citizens to consider the order, resulting in a demand for an examination of the company's books for convincing evidence that such increase of rates is justified. In case the request is denied, 300 resident subscribers and 70 business subscribers have pledged themselves to discontinue the service.

CORRESPONDENCE.

Continental Europe.

[illegible] central station which the city contains. Laid out [illegible] 100 feet. In order to supply the water for the condensers there is a large conduit laid to the Willebroeck Canal, which lies in the vicinity of [illegible] are four of the main alternator groups erected. These are 3,000-kilowatt direct-coupled sets of the three-phase type and they deliver 5,000 volts. Besides the principal machines the plant contains two rotary converters and an engine group which gives the exciting current as well as the current for the pump motors and for charging the storage batteries. The latter are run in parallel upon the bars of the exciter and are used to supply the lamps and motors in the plant. The outfit also includes a booster set which is used with the storage batteries.

A concession was obtained not long since for an electric railway running from Budapest through a number of suburban localities and ending at Gödöller, a distance of 30 miles The city terminus of the road will be erected not far from the station of the Hungarian state railway. It is proposed to use both locomotives and motor cars on the new line, which will probably be run at a high voltage.

Specimens of high-grade steel for construction work were to be seen at the recent Paris Automobile Show, these being manufactured by the Girod electro-metallurgical process in the works which this company is operating in the Loire region of France. Another plant operated by the Girod firm at Ugine is running very successfully at present, and will have a capacity of 30,000 horsepower soon. A part of this current will be used for the production of steel, and it is expected to turn out from 30 to 40 tons a day. The metal will be rolled, forged or cast within the works, and there is a very complete set of machines erected for the purpose. A number of new plants for producing steel on the Kjellin system are also being constructed in different parts of Europe. The "Electro-steel" company, which controls the rights for the process, has now built three electric-furnace plants. One of these is located near Liège, in Belgium, while the second is erecting in Germany and the third in Italy. The Belgian plant has one electric furnace of 200 kilowatts for a one-ton flow of metal, the second has 500 kilowatts for a five-ton flow, and the third plant 330 kilowatts for 1.6 tons.

It is expected that a hydraulic plant will be built in the Baden region of Germany which will rank among the largest in Europe. Power is to obtained from the Murg River, which is an affluent of the Rhine, and the turbine house will be erected at Forbach. According to the present plans, the outfit which is to be installed in the plant will include five single and eight double turbines, or 13 groups in all, and these will have a total capacity of 50,000 horsepower. The plant will be operated on the three-phase, 5,000-volt system, using step-up transformers to give 50,000 volts on the line.

Among the new enterprises which have been recently undertaken in Austria I may note a new narrow-gauge electric railroad opened for traffic not long ago between Untervirgl and Virglwarte. In addition the minister of railroads has given the concession for a standard-gauge electric railway to a Vienna syndicate. It will run from the city at a point near the railroad station and will proceed through the suburban region as far as the Raxalpe plateau. Another concession has been granted to one of the leading companies for a line which will lie in the region of Vienna. It will have some high grades over a part of the route, and in the latter case the rack-rail system will be used, otherwise the road will be of the usual kind. The line starts from the town of Baden and runs through the Priessnitz valley, ending at Mödling.

A. DE C.

Great Britain.

London, January 25.—When "tube" and underground electric railways were first contemplated in London and schemes were before Parliament, one of the first results of the ingenuity of opposing counsel was to dilate upon the horrors of the possibility of a fire in a tunnel. This was promptly met by the assurance that all the rolling stock would be rendered fireproof and that nothing more than a charring of the wood could take place. A few weeks ago something happened to the motor of a District Railway train in a station, which resulted in the compartment next to it being filled with pungent smoke. Nobody seems to be aware of the true facts, but a lively correspondence took place in the Times, and it was assuming such serious proportions that the Board of Trade deemed it wise to enter the lists with an announcement. This was to the effect that the car in question had been examined before any repair work had [illegible] Below floor level, the metal pipe carrying the elec- [illegible] mediately above the pipe and junction box was charred in places, but the charring nowhere ex- [illegible] burning is attributed to the failure of the insulation of the electric lighting wires, owing to damp, the heating of the wires resulting in the liquefaction of a small plug of bitumen. An explosion of bitumen gas followed, causing smoke and fumes. The communication from the Board of Trade, which is signed by the electrical adviser, concludes with the expression of opinion that the apprehension of danger which has been expressed by writers in the daily papers is not justified by the facts. The main danger in any such cases of fire will be from panic.

The officials responsible for the draft regulations issued last summer by the Home Office to be observed by all using electric power have at last arranged for a conference of all concerned with a view to arriving at the opinions of the opposition and of endeavoring to assimilate their views. The inquiry will be begun early in March and will undoubtedly continue for some time.

A report by a special commissioner to the Board of Trade dealing with trade in Canada has just been issued and serves to emphasize what remarkably small dimensions British trade with this home colony amounts to, so far as the electrical industry is concerned. The last available statistics show that the electrical apparatus imported from Great Britain amounted only to $81,000, whereas the United States sent in goods to the value of $3,460,000. These figures are for the year 1906. The report goes into detail as to the causes for this state of affairs, and, apart from the great advantage which the United States has in its geographical position, it is pointed out that no effort is made to cater for the real needs of the market by British firms, and that to a large extent the blame is their own.

A short time ago I mentioned the circumstances surrounding the prosecution of the Underground Electric Railways Company of London by the Chelsea Borough Council for permitting black smoke to issue from the chimneys of its generating station. Briefly, the Borough Council was driven to the prosecution in question by the County Council, under a threat that it would be treated as a defaulting authority under the Public Health Act. Being unsuccessful, the Borough Council was mulcted in heavy costs, and feeling naturally somewhat hurt, it applied to the County Council for financial assistance in the matter of the costs. After some delay, the County Council blandly answers that it has no power to make the contribution suggested.

G.

Eastern Canada.

Ottawa, February 1.—The Independent telephone movement, launched in the Niagara district of the province of Ontario a year ago, has proved a decided success. The annual meeting of the Niagara District Company was held recently, when it was shown by the statement of finances that the receipts were about twice as much as the expenditures.

At the annual meeting of the Sherbrooke Power, Light and Heat Company it was decided to sell the stock of the company to the city of Sherbrooke at any time before July 2d at $85 for every $100 share, the city to assume the bonded debentures. The deal amounts to about $240,000. This will end the agitation which has been in progress for the last six years for municipal ownership. A bylaw will be submitted to the ratepayers to authorize the purchase and issue debentures, which, if carried, will put an end to the city developing the Westbury power.

In the waterpowers of Ontario and Quebec, Canada possesses an asset at least equal to any other natural asset of the two provinces. Owing to lack of coalfields, these provinces have to go far to the east and west for coal to be used in lighting, heat or power production. This portion of the Dominion has a substitute in the waterpower of the country by which electricity could be generated at one-quarter the cost at which it is generated by coal. It is also a perpetual power and a permanent asset, which in Ontario amount to 7,500,000 of an estimated horsepower, with probably as much more in the province of Quebec. Niagara alone furnishes 430,000 horsepower, which, it has been calculated, 4,000,000 tons of coal would be required to produce.

It is understood that in the course of a few days the Marconi Wireless Telegraph Company of Canada will announce that it is prepared to accept messages in Montreal for transmission to Great Britain at the rate of 15 cents a word, and that then correspondents in London will accept messages to Canada at the same rate.

The town of Port Arthur, Ont., has completed arrangements with the Kaministiquia Power Company of Montreal for the supply of power to be

used for lighting and the operation of the street-railway service. The Kamnistiquia company is meeting with considerable success in connection with its new hydro-electric development, situated at Kakabeka Falls, about 20 miles from Fort William. This company's plant has been in operation a little over one year and is now a financial success. This is considered rather remarkable in view of the fact that when the plant was started there was not very much business in sight. The town of Port Arthur owns and operates its water and electric power plant, but the civic authorities have found it advisable to purchase some power from the Kaministiquia company, as the demand for power has exceeded the capacity of the civic water-power plant. W.

New England.

Boston, February 1.—The National Motor Boat and Engine Show at Mechanics Building this week, under the management of Chester I. Campbell, was the center of attraction for experts and laymen who are interested in aquatic sport. The exhibit has been a display of a most varied character, among the exhibitors being a number of builders of electric launches and more powerful boats as well as electric devices for use on board pleasure craft.

It is stated that prospects are good for an appropriation by Congress at this session of $300,000 approximately to complete the work undertaken in 1905 of consolidating the power plants at the Boston Navy Yard into one great plant. Already $175,000 has been spent on new machinery and a suitable building has been erected at a cost of $167,000. Installed in the big power house to date are one 500-kilowatt, one 750-kilowatt and one 1,000-kilowatt turbines and a set of boilers of 2,000-horsepower capacity. The new funds will be utilized when available for another set of boilers of equal capacity and air compressors with a capacity for 6,000 cubic feet per minute.

The New England Telephone and Telegraph company puts in effect today a new night toll-rate arrangement. Heretofore the night toll from 6 p. m. to 6 a. m. has been half the day rate. Now the half rate is in effect only from 10 p. m. to 4 a. m.

Post-graduate students in electrical engineering at Worcester have organized the Worcester Polytechnic Institute Graduate Engineering Company, doing a general consulting engineering business in practice, with the members of the electrical engineering department as clients, and passing upon problems such as they would be called upon to solve in an actual consulting engineering office. The electrical engineering department has just received from W. T. Goddard, graduate of 1903, eight 200,000-volt porcelain insulating bushings for use in the engineering department's equipment. B.

New York.

New York city, February 1.—One of the notable points in connection with the beginning of electric-railway service in the new subway from Borough Hall, Brooklyn, into Manhattan is the decline in ferry traffic. The proposed new ferry houses for the Thirty-fourth Street ferry probably never will be built. The two new steel ferry boats have been taken out of service as a result of the falling off. It is probable that the Pennsylvania Tunnel, the Blackwells Island Bridge and the Belmont Subway will practically put the ferry out of business.

A plan presented by the Civic Federation to President Roosevelt would, if carried out, create a national or international reservation bordering the Niagara River from the rapids to the end of the gorge below the Falls as a means of preserving the scenic beauty of Niagara. With the plan carried out, the river would be lined on either side by a grove of trees and all power plants and factories moved to the background. The plan contemplates the renewal of the Burton act for a period of 10 years. This act limits the amount of electricity which may be generated by a diversion of the waters of the river.

Students of the School of Automobile Engineers are running an automobile in West Fifty-sixth Street, using denatured alcohol as fuel. Few changes in standard equipment have been made. [illegible] that the carburetor is placed on top of the engine instead of near the bottom of the cylinders. This is said to facilitate the flow of [illegible] the determination of the relative values [illegible] gasoline as a fuel has yet been [illegible]. It has been found, however, that slightly higher power is obtained from alcohol, but to secure the best results it is admitted by the school instructors that a higher compression is [illegible] the engine is started, even when cold, [illegible] the injection of gasoline.

[illegible] Rochester Club. Officials of the Rochester Fire Underwriters' Association and the Rochester Rail- [illegible]

quet. Among the delegates from this city were E. A. Keefer, A. A. Nimms, James R. Strong and A. J. Martin.

The New York Electrical Society will hold its next meeting on board the steamship Lusitania of the Cunard line on February 5th at 8 p. m.

Men representing the steel and iron-ore interests of the country met in this city on Thursday, the purpose being, it is said, to reach some decision in the trade in regard to the advisability of reducing the prices of steel products.

The Public Service Commission has ordered the Interborough Company to begin the operation of 22 additional trains on the Third Avenue Elevated Railroad before February 10th. The order was based on a number of hearings held by Commissioner Eustis.

The funding of the floating debt of the Interborough Rapid Transit Company, which operates the Subway and the Manhattan Elevated system, will be the first step in the reorganization of the traction properties of the city. The prospects are for an issue of about $30,000,000 bonds to take up the $25,000,000 Interborough notes outstanding and certain other indebtedness of the companies in that system proper. Next the Interborough-Metropolitan company, the holding corporation for all the tratcion properties, will have its financial readjustment to do. W.

Southeastern States.

Charlotte, N. C., February 1.—The revival of business is attested to in Atlanta by the fact that local capitalists have purchased during the past 30 days over $100,000 worth of the stock of the Georgia Railway and Electric Company.

The town of Spartanburg has granted to the Electric Power and Manufacturing Company practically all privileges requested, as to stringing transmission wires into the town, and the company is making rapid progress on the work, expecting to have power ready for delivery within less than 80 days. The power house is located on Broad River, 16 miles away. Some of the towers for the copper wires are being placed 1,000 feet apart, some 500 feet, the distance being regulated by various conditions.

The Southern Power Company, Charlotte, N. C., has just completed its transmission lines to Newton, N. C., where a sub-station has been built, and power will be supplied the Newton Hosiery Mills, the Catawba Cotton Mills and other manufactories. The Ridgeway mills, being completed, will also utilize the electric power afforded.

The Agricultural and Mechanical College, Raleigh, N. C., is installing a modern electric plant for light, heat and power to the various college buildings. The plant will also be used to demonstrate applied electricity to the classes in the institution.

At Radford, Va., J. L. Vaughan, president of the local water company, has purchased the electric power plant of J. H. Grayson, with other property, amounting to $30,000. The plant furnishes light for Radford and Christiansburg. An electric line will be built from Christiansburg to Cambria.

The Whitney Reduction Company is extending its transmission lines in all directions from Salisbury, N. C., and will carry power to High Point, 40 miles distant, by July 1st, building one direct line, and one via Salisbury (the home office of the company), Lexington and Thomasville, in order to insure current at all times.

Recent heavy rains completely destroyed the cofferdam at the electric-power development at Bluitt's Falls, on the Great Peedee River, near Rockingham, N. C. The damage is estimated at approximately $25,000. L.

Ohio.

Toledo, February 1.—The annual report of the Columbus Railway and Lighting Company for the year 1907 shows that after charging off operating expenses, taxes, rentals, interests and dividends, renewals and depreciation the surplus is only a fraction less than four per cent. of the capital stock of $5,000,000. This is an increase over 1906, when the earnings were 2.47 per cent. on capital stock. Preliminary work is under way at Findlay, which will result in the construction of an interurban depot for the electric roads entering the town. The station will occupy the corner room in the Niles Building on Main and East Sandusky streets. The Toledo Urban and Interurban, the Western Ohio and the Toledo, Fostoria and Findlay lines will share the expense.

The previously mentioned scheme to double track the Lake Shore Electric Railway from Toledo to Cleveland was resurrected last week, when it was learned that two representatives of the Lake Shore Electric were securing renewals of options for private right-of-way between Freemont and Genoa. This right-of-way is for the purpose of an air line track that will shorten the distance between Freemont and Toledo 13 miles.

The Westinghouse Electric and Manufacturing Company in Columbus has changed its office from the ninth floor to the fifth floor of the Columbus Savings and Trust Building.

The Mogadore Stoneware Company of Mogadore, Ohio, which was recently incorporated with a capital stock of $15,000, will install an electric-light plant and furnish light for the town.

At a meeting of the Wooster and Mansfield Electric Railway Company, held recently, the following-named officers were chosen: President, B. L. Chase; vice-president, David Collier; secretary, D. H. Graven; treasurer, J. C. Chesrown. Announcement was made that there is now a good prospect of financing the road by a London bond house. S.

Indiana.

Indianapolis, February 1.—The Cincinnati, Madison and Western Traction Company has been incorporated by J. E. Greeley, Samuel D. Miller and other capitalists of Indianapolis to build a number of short electric-railway lines from Scottsburg, Ind., to surrounding towns and cities, the longest to include Cincinnati.

A corps of surveyors is doing preliminary work for the construction of a dam and power plant in White River, near Decker. It is understood that the Murdock-Marshall traction syndicate is back of the enterprise, since the plans for the concrete dam call for the construction of a bridge in connection with the abutments thereof, to be used by the Evansville and Terre Haute electric line when constructed.

The Grand Central Traction Company completed the survey of its right-of-way through Warwick County during the past week and set the grade stakes for the roadbed. This road will extend from Evansville through Millersburg, Holland, French Lick and thence to Indianapolis by the way of Bloomington. J. H. Hutchinson, constructing engineer, says that work will begin on the road February 15th at several localities along the route and pushed to rapid completion. Mr. Hutchinson is an English engineer and was called from a construction work in South America to take charge of the construction of this road.

The Chicago, South Bend and Northern Indiana Railway, known as the Murdock system, which connects South Bend, Elkhart, Mishawaka and Goshen, is now being operated by electric power secured from the Hen Island plant owned and controlled by the Indiana and Michigan Electric Company. The Hen Island dam and power plant, representing an expenditure of $1,500,000, has been the source of extensive litigation for a number of years, but now promises to be of great value in the matter of electric generation for large territory in Northern Indiana.

The directors of the Vincennes Traction and Light Company have decided to issue $100,000 six per cent. preferred stock in order to secure money for improvements. The company proposes to build an extension to the new factory district in South Vincennes and to double all the electric-railway tracks in the city. New rolling stock will be purchased and the power plant enlarged and equipped with some modern machinery. A short interurban line will be constructed by the company from Vincennes to Bicknell during the early part of the year.

Encouraged by the recent adverse decision in Pennsylvania relative to two-cent rate law the Louisville, New Albany and Corydon Railroad Company has brought suit in the Federal Court, Indianapolis, to test the constitutionality of the Indiana two-cent rate law.

The Retail Merchants' Association of Indiana, in annual convention at Terre Haute, adopted a resolution providing for the control of interurban railroad lines by the State Railroad Commission relative to freight regulation from the inception of such roads. The present law does not give the commission any jurisdiction over interurban lines relative to freight regulation until after the freight business equals 33⅓ per cent. of their receipts.

The Terre Haute, Indianapolis and Eastern Traction Company has been awarded a contract to light the city of Vermillion, taking current from the feeders of the new branch line between Terre Haute and Paris.

The property, both real and personal, including poles, wiring system and franchise, of the Spencer Electric Light Company of Spencer, Ind., will be sold by E. R. Braden, receiver of the company. The bids for the plant will be opened on February 21st.

The Town Board of Miller has granted a franchise to T. E. Bell of Hammond to construct and operate an electric and gas plant for a period of 25 years. S. S.

Illinois.

Peoria, February 1.—The new ice plant of the Taylorville Utilities Company is completed. The plant will have a capacity of 25 tons a day and will be operated 24 hours a day. The company expects soon to add an electric-light plant.

Michael Beyer, administrator of the estate of Henry Beyer, has filed suit against the Peoria, Bloomington and Champaign Traction Company for $10,000 for the death of Henry Beyer. The accident which caused the death of Mr. Beyer happened last summer. Mr. Beyer was president of

the Morton Electric Light and Power Company and after shutting off the current from his wires started to repair his lines, and in so doing he received a shock from the trolley wire that caused his death.

At a conference between a City Council committee and the representatives of the Peoria Railway Company General Manager Nelson told the committee that to put the feed wires of the railway company underground would cost the railway company $60,000. The company asked for permission to run the wires up a street not traveled by its tracks but which makes the feeder line shorter.

The Troy and Suburban Railway Company has filed notice with the secretary of state that the company has been dissolved, as has also the Edwardsville and Granite City Company of Edwardsville.

The Illinois Traction Company, beginning Monday, will carry the mail from this city to the city of Morton.

The citizens of Taylorville held an enthusiastic meeting in the interests of the St. Louis, Terre Haute and Quincy Traction Company that proposes to build an electric line from East St. Louis to Terre Haute. The company will probably be able to secure through the help of the Chamber of Commerce the entire right-of-way through Christian County free of cost.

The Eudelic Electric Company of Chicago has been incorporated with a capital of $12,000 to conduct an electric-supply business. The incorporators are J. H. Thompson, E. McLiernan and C. Lindenberger.

The Madison County Light and Power Company of Edwardsville has been granted an amendment allowing it own and operate street railways.

V. N.

Northwestern States.

Minneapolis, February 1.—The Public Service Company of Fond du Lac, Wis., has been incorporated with a capital stock of $25,000. It will do general electric work outside of that city.

Minneapolis is using its garbage-incinerating plant for the generation of electricity to light the workhouse and crematory, and also for the operation of machinery.

The new hydro-electric plant on Hennepin Island, Minneapolis, has been leased to the Twin City Rapid Transit Company. It will generate 20,000 horsepower to assist the present power system of the company, on the east side, in driving its street cars.

A Fargo committee held conference with Manager Pennington of the "Soo" Railroad to consider the co-operation of the Northwestern Interurban Railway Company with the Soo company for a line from Fargo, N. D., and Moorhead, Minn., to Detroit, Minn. The railroad expressed entire willingness to work in conjunction with the electric line.

An electric railroad will be built from Dickinson, N. D., to Scranton, or Bowman, N. D., to connect with the Milwaukee and the Northern Pacific steam roads. The line will be known as the Dickinson and Southern Railway.

R.

Western Canada.

Winnipeg, February 1.—That the City Council has shelved the civic power scheme at Winnipeg is evident by the actions of that body during the last few weeks. Practically all the engineers have been discharged with the exception of Cecil B. Smith, the power expert, and W. M. Scott, but the Board of Control has decided that Mr. Smith must go. Under the terms of his contract he must receive either six months' notice or six months' salary, amounting to $2,500. Citizens of Winnipeg generally look upon this as the death knell of civic power.

A proposition is on foot to build an electric railway between Arkona and Sarnia, Ontario, a distance of 35 miles. Power will be obtained from the Rock Glen Power Company, which has a plant near Arkona, on the Ausable River.

Alberta, following the example set by Manitoba, is alive with an agitation to purchase the Bell Telephone Company's lines in that province. However, the government will profit by the experience of Manitoba, and unless the Bell people are willing to accept a reasonable price the province will go ahead and complete its system to compete with the Bell people.

L. Bruce Hodge, manager of the British Columbia Telephone Company's office at Greenwood, B. C., has been transferred to the office at North Vancouver.

There is now pending in the Exchequer Court of Canada an action entitled "The King, on the information of the Attorney General of Canada, vs. the Burrard Power Company of Vancouver, B. C.," wherein the validity of the defendant's large water privilege of 25,000 inches out of Lillooet River and lake and tributaries is called in question on the ground that the rights of the federal government in the railway belt have been infringed.

A movement is on foot at Edmonton, Alberta, to have the price of electric light supplied by the municipal plant again reduced. During 1907 the [illegible]

Pacific Slope.

San Francisco, [illegible] 000,000.

Patrick Calhoun, president of the United Railroads of San Francisco, has returned from New York, where he completed the arrangements for securing $5,000,000 which the company needed for the contemplated restoring and improving of its lines in this city. About $2,000,000 of this amount has already been received in San Francisco. Following the return of Mr. Calhoun, the company paid taxes to the amount of $325,000 into the city treasury. The funds secured in the East will be sufficient to take up the company's floating debt here and to build a power plant for the operation of the company's entire system as well as the reconstruction of tracks and the general betterment of the system.

Electric and financial interests are considerably interested in the outcome of the efforts of John J. Eagan and others, who are at the head of a movement to secure a charter amendment which will permit an individual or corporation to operate street cars over 31 consecutive blocks of a rival corporation's tracks instead of 10 blocks, as at present. Mr. Eagan filed a petition this week asking the election commissioners to place the desired amendment on the ballots at the next general election. This petition contained the necessary 12,000 signatures and, unless legal obstacles are interposed, the question will be voted on next November. Mr. Eagan states that he expects to operate cars on 247 miles of the city's streets.

The Southern Pacific Railroad Company is proceeding with its plans for power development in Southern Oregon. The company now has an engineering party at work on the upper Mackenzie River some distance from Foley Springs. Cabins are being built for the use of the force, which will begin work in the spring on the canal for one of the power sites recently filed on by the company.

The Pacific Coast Power Company (Stone & Webster syndicate), which owns the Tacoma and Seattle (Wash.) street-railway systems, as well as the interurban line connecting the two cities, has bought the properties of the Seattle-Tacoma Power Company, including the Snoqualmie Falls power plant, water rights at Lake Tapps and along White River and the lands along the latter stream. The Pacific Coast Power Company will now build a 100,000-horsepower hydro-electric plant on the shore of Lake Tapps, 10 miles from Tacoma. The waters of White River will be diverted at Buckley, 30 miles from the power-plant site, and carried into Lake Tapps. Another canal will carry a large head of water to the edge of a bluff, where a 1,100-foot fall can be secured. The power developed will be used commercially in Seattle and Tacoma and in the operation of the electric-railway enterprises controlled by the Stone & Webster syndicate.

An election to determine the question of voting bonds to the amount of $7,000 for the purchase of the electric-light plant in Elsinore, Cal., will be held on March 23d.

An election has been called at Pasadena, Cal., for February 20th to vote on the question of issuing bonds to the amount of $50,000, a portion of the proceeds of which will be used in the construction of an electric-light distributing system and a portion for street purposes.

James A. Coke of Maui, Hawaii, is now in Washington, D. C., endeavoring to secure congressional approval of a franchise for an electric-power plant on the Island of Maui, which is designed to furnish current to the towns of Lahaina and Kahului and to a number of plantations.

The Mount Hood Railway Company has begun the operation of its first generator at its plant at Bull run, near Gresham, Ore. This will furnish power for the operation of saw mills, planers, mixers, drills and lights for the construction work of the remainder of the power plant and of the proposed railroad. The company has a fall of 680 feet in the waters of Deer Creek for the generating of power.

The Hanford and Lemoore Interurban Railway Company has been incorporated at Hanford, Cal., with a capital stock of $1,000,000. A modern electric road about 17 miles in length is to be constructed. Inquiries have been made for securing a supply of electric power from one of the existing hydro-electric plants, but it is more than possible that the company will install its own electric generating plant at some point near the line of the road.

An electric-lighting plant has been installed in the new 17-story Humboldt Savings Bank Building on Market Street, San Francisco. A General Electric generator with a capacity of 100 kilowatts is direct-connected to a Curtis steam turbine. The plant is in charge of Mr. Lindsay, who was for- [illegible] partment.

[illegible] Humboldt Bank Building will eventually obtain [illegible] reach the new buildings.

A.

PERSONAL.

J. C. Hubinger of Keokuk, Iowa, the founder of the Twin City Independent telephone system, is dead. He was 55 years of age.

Mr. William A. Buttrick, formerly superintendent of the Columbus Railroad Company of Columbus, Ga., is now connected with the Pawtucket Electric Company of Pawtucket, R. I.

Mr. Marsden J. Perry, for 20 years president and general manager of the Narragansett Electric Lighting Company of Providence, R. I., resigned at the annual meeting held on January 27th.

General Manager J. S. Speer of the Speer Carbon Company passed through Chicago last week, homeward bound to St. Marys, Pa. Mr. Speer had been west on a two-week trip inspecting a large gold-mining property in which he is interested.

Mr. John M. Roach, long identified with the management of the Chicago Union Traction Company properties, has been chosen president of the Chicago Railways Company, which takes over the Union Traction and its underlying companies. Henry A. Blair was made chairman of the executive committee.

Mr. A. V. Shaver, for five years connected with the electrical inspection department of the Underwriters' Inspection Bureau at Cleveland, has been chosen as general inspector of the Brooklyn Rapid Transit Company. He will look after the fire-protection end of the business from the viewpoint of electrical inspection.

To fill the vacancy caused by the resignation of Mr. Thomas J. Bechtel of the Grand Rapids-Muskegon Power Company, Mr. B. H. Vandermaas, who has been in the employment of the Grand Rapids (Mich.) Edison Company for a number of years, is now looking after the duties formerly performed by Mr. Bechtel.

Mr. C. S. Knight, Jr., manager of the electrical department of the American Steel and Wire Company, Chicago, has been confined to his home for two weeks by an attack of grip. Mr. Knight left for California on February 5th for a month's rest and recuperation, and his many friends earnestly hope that the trip will fully restore his health.

At the annual meeting of the Southern New England Telephone Company in New Haven, Conn., on January 28th, John W. Alling was elected president, to succeed the late Morris F. Tyler, who was for nearly 25 years at the head of the company. James T. Moran succeeds James English as vice-president, the latter declining a re-election.

Emerson H. Brush, vice-president of the Kellogg Switchboard and Supply Company, died at a hospital in Chicago on February 2d, after an illness of several weeks from heart trouble. Mr. Brush was born in Brooklyn, N. Y., in 1852. He came to Chicago in 1888 and for a time was engaged in mercantile pursuits. Aside from his connection with the Kellogg company, he was engaged in the real-estate business.

Mr. James J. Lambrecht, president of the Northwestern Interurban Railway Company, who had been suffering from appendicitis for six weeks, successfully underwent an operation at St. John's hospital in Fargo, N. D., on January 25th, and is said to be doing well. Mr. Lambrecht has been connected with the promotion and construction of the interurban electric railway between Fargo, N. D., and Detroit, Minn.

Mr. W. J. Barker, general superintendent of the Denver Gas and Electric Company, returned to Denver recently from a trip to New York. He is quoted in the Denver Times as having heard many flattering remarks about Denver from New York people who have large investments in electrical and other enterprises in the western city. Business in the East, Mr. Barker says, is rapidly assuming normal proportions.

An influential meeting was held in Belfast, Ireland, under the presidency of the lord mayor on January 21st to inaugurate a movement to establish a fitting memorial to Lord Kelvin. Mr. Balfour, Mr. Chamberlain and other prominent men sent letters expressing their sympathy with the object of the meeting. It was decided to erect a statue, and over $4,000 was subscribed as the be-

giving of a fund for that purpose. Lord Kelvin was born in Belfast.

Mr. Frank McMaster, formerly of the Electrical Appliance Company of Chicago and the Chicago office of the Fort Wayne Electric Works, has accepted the position of sales manager of the supply department at Duluth of the Northern Electrical Company of Duluth and Minneapolis. Mr. McMaster is an electrical man of wide practical experience and of extensive acquaintance. He is highly esteemed by a large number of friends, who will wish him the best of success in his new connection.

Brigadier-General Anthony Heger, U. S. A., retired, died January 24th, at his home in New York city. General Heger was born in Austria 80 years ago. He took his degree as a physician at the University of Pennsylvania. He entered the regular army as an assistant surgeon in 1856, and at the close of the Civil War was brevetted lieutenant-colonel. He was made assistant surgeon-general in 1891, and retired from the service the following year. General Heger gave much of his time to the study of mathematics, and was the author of several text-books. He leaves a widow and two sons—William S. Heger of the Allis-Chalmers Company, Milwaukee, Wis., and Dr. Anthony Heger, of New York city.

Daniel Shafer, for many years one of the best-known salesmen and engineers in the South, succumbed to a sudden attack of pneumonia at the Nashville Hotel, Nashville, Tenn., on January 24th. Mr. Shafer, who was 47 years of age, had been associated for the last three years with Allis-Chalmers Company, being sales engineer of the steam-turbine department at the time of his death. Formerly he was associated with the Hooven, Owens & Rentschler Company of Hamilton, Ohio, and he was well known throughout the South as an expert on the power equipment of cotton mills. Mr. Shafer was possessed of a striking personality. He was gifted to a remarkable degree with the faculty of making friends. His home was in Wheeling, W. Va., where he is survived by his mother.

Mr. A. L. Searles, manager of the Grand Rapids (Mich.) office of the Fort Wayne Electric Works, was tendered an informal dinner on Tuesday, January 28th, by some of his Grand Rapids friends. Among those present were Mayor Ellis, State Senator Fyfe, S. A. Freshney, manager of the Board of Public Works, and George Judd, all of Grand Rapids; F. S. Hunting of Fort Wayne, George Westover of Cadillac, Mich., A. L. Pond and W. S. Goll of Chicago. The dinner was given in honor of Mr. Searles' birthday, and proved a very enjoyable affair. An extraordinary feature of the occasion is the well-authenticated report that, in order to attend this dinner, Mr. Searles cut a very important business engagement, which lost him a contract for electrical apparatus amounting to between $50,000 and $60,000.

Mr. Bernard C. Groh has been appointed manager of the Chicago office of the American Conduit Company. Mr. Groh has earned for himself a well-deserved reputation as an authority on scientific conduit construction. He began his telephone experience with the Michigan Telephone Company at Detroit, and was connected with the equipment department of the Erie system under C. L. Boyce, when that company was at its best. Mr. Groh entered the Independent telephone field as superintendent of equipment of the Interstate Telephone and Telegraph Company of Trenton, N. J., in 1901, and later became chief engineer of that company. He remained with the Interstate company during its heavy construction period of 1902-1904, when Trenton, Atlantic City and other cities of the state were rebuilt and the connecting toll lines constructed. Mr. Groh went with the American Telephone and Telegraph Company in 1904 and became conduit engineer under Dr. Hammond V. Hayes at Boston.

Mr. Charles C. Baird has been appointed western sales representative of the McRoy Clay Works, to take the position recently vacated by Mr. E. F. Kirkpatrick. Commencing life in the business department of the B. F. Goodrich Company of Akron, Ohio, Mr. Baird soon went to the Akron works of the H. B. Camp Company; he has been with this latter company about nine years. About two [illegible] Brooklyn on conduit work of the Public Service [illegible] quite extensively on the underground service of the Brooklyn Heights railway. For several years Mr. Baird has been engaged almost exclusively on [illegible]

ELECTRIC LIGHTING.

The town of Johnson, Neb., is considering the advisability of putting in an electric-light system.

The Stanberry (Mo.) Electric Light Company will install some new machinery, including a generator.

The Board of Supervisors has decided to install an electric-light plant in the County Building at Flint, Mich.

A. C. Randolph of the Randolph Ice and Packing Company of Palacios, Tex., is figuring on erecting an electric-light plant in that place.

The Railroad Commission has dismissed the complaint of the city of Sheboygan against the Sheboygan Light, Power and Railway Company, alleging inadequate service and facilities.

By a vote of 45 to 35, voters of the village of Cashton, Wis., carried the proposition to bond the village for $15,000 for the construction of a municipal lighting plant. An old mill property will be purchased and fitted up as a power plant.

Maus Bros., of Lafayette, Ohio, are installing an electric-light plant in that town. They will also supply the village of Harrod, nine miles distant, and have made a rate for residences at $12.50 a year for four lights and 25 cents per month for each additional light.

The State Board of Agriculture of Indiana proposes to install an electric-light plant on the State Fair grounds. Charles Downing of the board says that such a plant would offer many advantages, among them the possibility of many forms of amusement at night.

The village of Utica, Mich., has granted a franchise for an electric-light plant and waterworks to Charles A. Ward, and has contracted for 15 arc lights for street lighting at $60 each per annum. Additional lamps are to be $50 per annum. The arcs are to burn from dusk until midnight.

The new electric-light plant installed by the city of Bloomington, under the supervision of A. T. Maltby, engineer, of Chicago, has been completed and the plant is now in operation and furnishing light for the city. The contract for the erection of this plant was let in August, 1907, and has been completed in five months at a cost of $40,000. Mr. Maltby is highly praised by Bloomington citizens for his rapid and good work.

The city of Fairview, Okla., has a commercial league composed of citizens and business men which is open to any proposition for any enterprise that will benefit the city. It is said that the league offers a very attractive inducement for the location of an electric-light plant. Persons desiring a new location, a good farm or a location for a new business in a thriving city and healthy location, are invited by the league to visit Fairview.

A movement is on foot among business men of Ogden occupying quarters along Washington Avenue, in the principal business block in the city, to install an independent heating and lighting plant to supply their places of business in this block. The merchants say that the rate of the Utah Light and Railway Company is too high and they expect to effect a reduction in the cost of heating and lighting of their places. Each merchant will subscribe for stock in the concern.

A dispatch from Fairmount, Ind., in the Indianapolis Star says that the people of Fairmount are hoping that a contract can be made between the Central Indiana Lighting Company and the Council for the street lighting, as the town has been in darkness for the last six years owing to an unfortunate deal entered into by a former Council and later repudiated by the town on the plea of being above the constitutional two per cent. limit of indebtedness at the time the contract was made.

Sealed proposals, in triplicate, will be received at Fort Des Moines, Iowa, until February 24, 1908, for furnishing and installing electric wiring, electric-light fixtures, etc., complete, in one double set captain's quarters, and two double sets lieutenant's quarters, to be constructed at Fort Des Moines, Iowa. Information will be furnished on application. Envelopes containing proposals should be indorsed, "Proposals for Electric Wiring Officers' Quarters," and addressed Captain John J. Boniface, constructing quartermaster.

Notices have been sent out by E. Keisewetter, secretary of the Columbus (Ohio) Edison Company, for a special stockholders' meeting to be held on March 2d, for the purpose of voting on the proposed increase of the capital stock to $500,000 preferred and $300,000 common. Enclosed with the notices is a letter of explanation, which contains the following: "The portion of the increase in the capital stock which is not needed at this time to liquidate the claim held by the Columbus Railway and Lighting Company against this company, will be placed in the treasury and devoted exclusively to extensions, betterments and permanent improvements."

The Central Indiana Lighting Company, formed last year to take over the light plants in a number of Indiana cities, intends to connect a chain of cities with high-tension transmission lines. Among the cities which it expects to light are Alexandria, Columbus, Fairmount and Jonesboro. A large central generating plant will be located probably at Anderson and the current transmitted over high-tension lines to sub-stations in the different cities. Existing direct-current plants will be abandoned for the alternating-current service. Superintendent Jeffries of the company has quoted a price of $20 a year for 32-candlepower incandescent lights in Fairmount.

ELECTRIC RAILWAYS.

The Waterloo, Cedar Falls and Northern Railway Company has just completed its modern car barns in Waterloo, Iowa. The building is 70 by 200 feet in dimensions, 35 feet high, and built of brick and reinforced concrete. Eight tracks enter the building.

The Detroit and Adrian Traction Company has asked for renewals of options on the right-of-way from Detroit to Adrian. All franchises have been secured and arrangements made to proceed with the letting of contracts as soon as financial conditions improve.

It is said that universal transfers on all surface lines of Chicago is to be one of the early results of the reorganization of the Union Traction interests into the Chicago Railways Company. Funds for the rehabilitation of the North and West Side lines to the amount of $12,000,000 are to be furnished, it is said, by N. W. Harris & Co. and the National City Bank. Additional funds necessary for further reconstruction will be forthcoming.

Receivers of the Chicago and Milwaukee Electric Railroad Company have been making an inspection of the properties and affairs of the company and are planning to complete the line into Milwaukee. For this purpose probably $300,000 will be expended, for which receivers' certificates will be issued. The receivers as finally determined upon are W. I. Osborne of Chicago, D. B. Hanna of Toronto and H. A. Haugan of the State Bank of Chicago. Charles G. Dawes has withdrawn as trustee of the properties, and the trusteeship has been merged into the receivership. George M. Seward is the receiver for A. C Frost & Co., bankers. Mr. Frost is president of the railway company.

SOCIETIES AND SCHOOLS.

The annual dinner of the American Institute of Electrical Engineers will be given at the Waldorf-Astoria Hotel, New York city, on February 19th. It will be known as the Public Service Dinner, and the speakers, yet to be announced, will treat of the relations of the community and the public-utility corporations.

The first meeting of the Gas Power Section of the American Society of Mechanical Engineers will be held Tuesday evening, February 11th, in the Engineers Building at 29 West Thirty-ninth Street, New York. The subjects under discussion will be "Experimental Gas Turbines in France" (with lantern slides), "A Simple Continuous Gas Calorimeter" and "A Gas Engine and Producer Guarantee." Other subjects relating to the question of gas power will also be discussed.

The twelfth annual meeting of the Northwestern Cedarmen's Association was held at the Grand Pacific Hotel in Chicago last month. Resolutions were adopted favoring the establishment of a timber-testing laboratory at the Minnesota Agricultural College and also asking Congress to have a stumpage census of the country taken. These officers were elected: President, A. T. Naugle; vice-president, L. R. Martin; treasurer, W. B. Thomas; directors, P. W. Raber for one year, J. E. Gerich for two years, and W. T. Watkins for two years. The Chicago members entertained the out-of-town members at a banquet.

At its regular meeting in Colorado Springs on January 25th about 75 members of the Colorado Polytechnic Society enjoyed an instructive lecture by Mr. R. McF. Doble on the subject of hydro-electric power transmission and its development. With the aid of lantern slides Mr. Doble described the work accomplished by various power companies in California and Washington, and went at length into a description of the works of the Central Colorado Power Company. He also discussed the power plant at Guanajuato, Mexico. At the next meeting of the society on February 22d Mr. T. E. Countryman will talk on "The Drainage Tunnel and Its Influence on the Cripple Creek District."

The February meeting of the New York Section of the Illuminating Engineering Society will be held Thursday evening, February 13th, at the Engineers' Building, 33 West Thirty-ninth Street. Mr. George Leland Hunter will present a paper on "Light and Color in Decoration," accompanying

the presentation with lantern [illegible] colors. This paper marks the first attempt in the history of the society to lay proper emphasis upon the importance of considering [illegible] in determining upon the character of [illegible] installation and the distribution of the light. Mr. Hunter is recognized as an authority on tapestries and decoration and approaches the discussion from the viewpoint of the decorator.

AUTOMOBILES.

The Studebaker Automobile Company of South Bend, Ind., recently delivered to the Bourne-Fuller Company of Cleveland, Ohio, two electric trucks of three and one-half and five-ton capacity, respectively, for transportation of iron and steel. These trucks are interesting, in that they were probably the first electric trucks built with special reference to the convenient handling of steel and iron bars, sheets and strips. The driver's seat is moved to the extreme left of the vehicle, and in this way extra provision is made for the overhang in front of extra lengths of iron or steel, and this construction allows for the convenient handling of much longer pieces than can ordinarily be handled by horse-drawn vehicles. Another interesting feature of these trucks is that they are equipped with tires of wood, instead of rubber. The trucks are equipped with broad platforms of ample dimensions and the bed is partially lined with sheet steel to prevent wear.

PUBLICATIONS.

The D. Van Nostrand Company of 23 Murray Street, New York, publisher of electrical books, is presenting to its friends a useful calendar giving metric conversion tables in shape ready for convenient reference.

The Weber Gas Engine Company of Kansas City has just published its brochure No. 55, which is for general distribution to those interested. The brochure contains some interesting information and illustrations of this well-developed prime mover.

The Robert Instrument Company of 56 Shelby Street, Detroit, has issued a new and attractive catalogue of its electrical measuring instruments. Pocket meters, battery-testing instruments and electroplaters' voltmeters are among the types described.

The Murray Iron Works Company of Burlington, Iowa, has issued an interesting and unique pamphlet entitled "Nomenclature of Murray Corliss Engines." In it the different types of engines and some of their parts are well illustrated. The feature of the pamphlet is a series of detail drawings of the engines and parts, in which every part is clearly designated by its proper name.

Catalogue No. 14 of electric wiring supplies manufactured by the H. T. Paiste Company of Philadelphia contains 208 pages, listing a large and practical line of the most modern and serviceable wiring supplies. All who have to do with electric wiring will appreciate this new catalogue. Price list No. 9, just issued, applies to catalogue No. 14. This company's product is well known and covers a large variety of sockets, receptacles, switches, cut-outs, panel boards, bushings, rosettes and many other Paiste specialties.

"Lifting Magnets and Recent Improvements in Them" is the title of a little booklet just issued by the Cutler-Hammer Clutch Company, maker of lifting magnets and magnetic clutches. This little booklet, which is printed in the form of a miniature magazine, traces briefly the development of the lifting magnet, illustrates the different kinds of magnets used for handling pig-iron, metal plates and other classes of material and explains by an easily understood analogy how the magnetic "lines of force" support weights ranging from and to 10 tons. Copies may be had free by addressing the Cutler-Hammer Clutch Company, Milwaukee.

A map just issued by the Bureau of Statistics, Department of Commerce and Labor, Washington, D. C., entitled "Principal Transportation Routes of the World," shows the chief railway lines and water routes of the entire world, the distances from port to port across all oceans and seas, and carries with it a marginal table showing the distances from New York, New Orleans, San Francisco and Port Townsend to each of the principal ports of the world, and from many of the other cities of the United States to those four initial coast ports, thus enabling the citizen of all the principal cities of the country to determine the exact distance from his door or railway station to the docks of any of the principal commercial ports of the world.

Reliable and efficient starting devices are necessary for the satisfactory operation of all motor installations. In bulletin No. 4559 the General Electric Company, Schenectady, N. Y., describes lines of motor-starting rheostats and panels for direct current. The rheostats contain an improved enclosed-type resistance unit consisting of a low-temperature co-efficient resistance wire wound on a strong tube that is not brittle. The unit is [illegible] voltage release and those with both no-voltage and [illegible] illustrated and described, as [illegible] In order to facilitate the installation of motor-starting devices the General Electric Company has perfected a line of motor-starting panels. The bulletin shows [illegible] different types of starting rheostats are used.

TELEGRAPH.

Senator La Follette has introduced a bill in Congress at Washington placing all telegraph companies under control of the Interstate Commerce Commission to regulate the interstate transmission of messages and make the tolls equitable. The bill also prohibits all government employes from accepting and using telegraph franks.

MISCELLANEOUS.

Eugene Maret, a French engineer, has, according to newspaper report, established an electric furnace with which he says he will be able to manufacture several pounds of sapphires daily. These artificial stones will be harder than the natural gems, it is said, and can be graded to any shade desired. The raw material used is said to be Roman alum and chromic acid.

The Great Falls coal field, situated along the base of the Rocky Mountain front range in north-central Montana, has provided a part of the coal product of the state since 1876, when a small mine was opened at Belt and coal shipped overland to Fort Benton, a town near the head of navigation on the Missouri. Since 1880, when the first systematic record of coal production in Montana was kept, the field has produced 12,702,465 short tons, or approximately 56 per cent. of the total output of the state.

Part of the overhead tramway extending a mile and a half over Lake Michigan at Seventy-third Street, Chicago, was wrecked a few days ago by a tremendous crush of ice. Some of the 30-foot steel towers which carry the tramway cables to a temporary crib were forced down by the ice. The tramway is an interesting piece of engineering, designed to facilitate the building of the new lake and land tunnel. It was designed by George W. Jackson and was described and illustrated in a previous issue of the Western Electrician.

The Alaska-Yukon-Pacific Exposition will be held at Seattle, Wash., opening on June 1st and closing on October 15, 1909. Work on the grounds and buildings of the exposition is well under way, it is said, and the management is determined to have everything in readiness by opening day. The Auditorium, Palace of Fine Arts and Machinery Hall will be permanent structures, built of buff brick with terra-cotta trimmings. The grounds are located on the property of the Washington University, a state institution, and after the exposition is over the permanent buildings and those substantially built will be taken over by the college to be used for educational purposes. The purpose of the exposition is to exploit Alaska and Yukon and the countries bordering on the Pacific Ocean.

More lumber was cut in the United States last year than in any other year in its history. It is safe to say that the present annual lumber cut of the United States approximates 40,000,000,000 feet, and that the total mill value of the lumber, lath and shingles each year produced is not less than $700,000,000. Since 1899 the cut of white pine has fallen off more than 40 per cent., while that of white oak has fallen off more than 36 per cent. Today yellow pine leads all other woods in amount cut, while Douglas fir comes second. Washington is now the leading lumber-producing state. The highest priced native woods are walnut, hickory and ash, and the cheapest are larch and white fir.

TRADE NEWS.

The annual meeting of the Western Electric Company, Chicago, is scheduled to be held on February 6th.

Marvin McLain is engaging in the electric-construction business in Lake City, Minn., under the firm name of Lake City Plumbing, Heating and Lighting Company.

During the six months from July to December, 1907, inclusive, the electrical exports of the United States to Germany amounted in value to $187,884. For the corresponding period of 1906 the amount was $230,866.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until February 24th, for lamp brackets for the Federal Building in Chicago, in accordance with drawing and specification, copies [illegible] architect.

[illegible] W. F. Biggs Company, which will do the work in the city. The incorporators of the new company [illegible]

The Electrical Supply and Construction Company of Columbus, Ohio, which, since its organization [illegible] Gay Street, is now preparing to remove to the Schumacher Building, corner of Gay and Third streets. The new location is two full-width storerooms, with entrances on both streets. A large basement gives good facilities for workmen. Mark Simonton, the president and general manager, was the organizer of the company. In the new rooms a full and complete line of fixtures will be carried.

It is learned that the Westinghouse Lamp Company, manufacturer of incandescent electric lamps, and one of the constituent companies of the Westinghouse Electric and Manufacturing Company, has obtained the signatures of 99 per cent. in amount of the creditors to the readjustment plan permitting a discharge of the receivership. The receivers have found the company's financial condition to be entirely sound, the assets being approximately five times as great as the liabilities. The formalities connected with the application to the court for a discharge of the receivers are now under way, and it is expected that the company will be returned to its shareholders by March 1st. The business of the company has continued without interruption during the receivership. The officials of the company are expecting to have the new plant at Bloomfield, N. J., in operation before the end of the summer. It will have a capacity of over 15,000,000 lamps yearly.

BUSINESS.

The Arnold Company, 181 La Salle Street, Chicago, is building general repair shops and a reinforced concrete storehouse for the New Orleans Great Northern Railroad Company at Bogalusa, La.

"Use Holophane in your home," says the Holophane Company, 227-229 Fulton Street, New York, "and you will be just as enthusiastic about it as we are." Central-station men should practice what they preach.

The American Electrical Heater Company of Detroit, Mich., is putting out the new American electric toaster, designed and particularly adapted for use on the breakfast table or for use in connection with an afternoon tea, an evening rarebit or for making toast for the invalid. It toasts bread in two or three minutes, taking current from any lamp socket.

The new type "OB" governor, recently brought out by Allis-Chalmers Company, which attracted attention at the 1907 street-railway convention in Atlantic City, is being installed on many of the principal traction lines of the country, including the Manhattan Elevated Railway; Milwaukee Northern Railway; Indianapolis, Crawfordsville and Western Railway; Connecticut Companies; Massachusetts Electric Company and others. This governor is of the pneumatic type, light, compact, substantial and positive in its action. It can be placed in any position, either inside or under the car, and it will operate equally well on either alternating or direct current.

The Chicago Glove and Mitten Company, 170 North Halsted Street, Chicago, has recently issued a new catalogue describing its product. Among the full line of gloves which this company makes is one particularly adapted to the needs of linemen and other electrical workers. Mr. Wiltshire, proprietor of the company, says that he has supplied the needs of electrical men for many years and that his product has given entire satisfaction. The glove which this company makes for electrical workers is tanned by a special process which is said to make it fireproof; it will not shrink nor harden by the effects of water and heat. The company does a large business with electrical men.

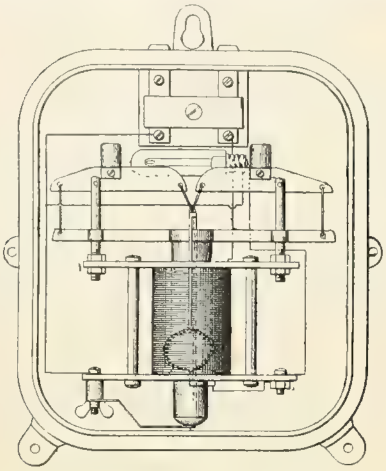
Mill-type motors manufactured by the General Electric Company, Schenectady, N. Y., to meet the demand of the constantly increasing business done in electric-driven rolling mills, etc., are described in bulletin No. 4562, recently issued by the company. These motors are manufactured for direct and also for alternating-current circuits and are designated MD and MI motors, respectively. They are built in sizes from 30 to 150 horsepower, and the direct-current motors, while generally rated at 220 volts, can be supplied for 500 volts with a slight variation from standard speed. The MI alternating-current motors are wound for either 220 or 440 volts, 25 cycles, three-phase. The motors are totally inclosed, dustproof and are intended for use on heavy and intermittent loads.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 28, 1908.

877,460. Egg-candling Machine. Samuel E. Davis, Elgin, Ill. Application filed November 8, 1907.

Incandescent lamps are placed below a transparent screen over which an opaque horizontal conveyor moves. This has apertures just fitting the eggs. As the conveyor moves over the light screen the eggs are rolled over the latter so as to expose them entirely to the light.



No. 877,705.—CURRENT CONTROLLER.

877,501. Electric Alarm Attachment for Clocks. Charles Goldsmith, Denver, Colo., assignor of one-fifth to Cesare Finelli, Denver, Colo. Application filed January 15, 1907.

A rotating cylinder has electrical contacts adjacent to it. A pointer is mounted so as to be movable circumferentially upon the periphery of the cylinder, and capable of engaging the contacts, which have alarm signals connected to them.

877,510. Trolley-ear Clencher. Ernest O. Marsh, Seattle, Wash. Application filed September 27, 1906.

A casing has the sides of its upper edges formed as clamps to engage the sides of the ear astride of the wire and hold the same rigidly. A movable clencher supported and guided by the casing has a concave upper edge. Toggle-levers are pivoted on the casing and clencher. These are operated so as to move the clencher upward against the edges of the ear held by the clamp and to close or crimp the same closely around the wire.

877,537. Method of Electrolyzing Salts. Jasper Whiting, Niagara Falls, N. Y. Application filed April 24, 1906. Renewed June 21, 1907.

Current is passed through the electrolyte to a body of molten metal underneath, which acts as the cathode. This metal is withdrawn to be purified, and then again used as cathode in a practically continuous process.

877,555. Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed March 25, 1905.

This method of transmission consists in locally producing at a transmitting station short code dot signals, simultaneously transmitting to a receiving station a long signal whose length is determined by the number of dots and locally converting at the receiver the long signal into the same number of dots locally produced at the transmitting station.

877,558. Self-lubricating Trolley-wheel. Hiram G. Farr, Melrose Highlands, Mass. Application filed December 24, 1906.

The wheel has a lubricating chamber communicating with its bore. A bushing fits the bore and has radial openings connecting with its inner wall and the supporting pin. Felt or similar absorbent material is placed in the openings and depressions.

877,576. Series-parallel Polarity-changing Switch. Edwin S. Lincoln, Brookline, Mass. Application filed February 11, 1907.

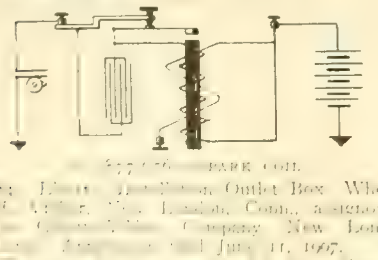
A triple-pole double-throw switch is intended to connect two sources to a line; in one position the two sources being in parallel, and in the other in series.

877,645. Kaleidoscope. John R. Hare, Baltimore, Md. Application filed February 15, 1907.

In combination with the mirror-holder are a number of object boxes having electric lights swung therein, means for conducting current to the lights, and means for automatically revolving the object boxes.

877,656. Spark-coil. August R. Luschka, Chicago, Ill., assignor to the Motor Specialty Manufacturing Company, Chicago, Ill. Application filed October 29, 1906. Renewed June 22, 1907.

The secondary coil is formed with high and low tension [illegible], and a condenser of an annular shape [illegible] the [illegible] tension section. (See cut.)



No. 877,656.—SPARK COIL.

[illegible] Outlet Box. Wheeler [illegible], New London, Conn., assignor to [illegible] Company, New London, [illegible] filed June 11, 1907.

[illegible] tically during wiring.

877,705. Electric-current Controller. Albert E. Dion and Charles W. Ball, Ottawa, Ontario, Canada. Application filed November 19, 1906.

A solenoid in the main circuit has a hollow armature in which a plunger contact rod is raised so as to break the main circuit when the current becomes excessive. When this happens, a shunt circuit with resistance is thrown across the line. (See cut.)

877,711. Instrument for Indicating Speeds, Distances Covered and the Like. Eugene V. Gratze, Leytonstone, England. Application filed October 16, 1906.

An annular stationary magnet is provided with a revolving core positioned between its poles, a metallic casing adapted to embrace the core and extending beyond both sides thereof, spring means for controlling the rotation of the casing, indicating means operated by the casing, and means for rotating the core.

877,727. Telephone Exchange. Nils E. Norstrom, Chicago, Ill., assignor of one-third to John Anderson, Salina, Kan.; one-third to M. E. Richardson, Sterling, Kan., and one-third to John H. Martin and H. Keating. Application filed October 4, 1901.

A continuous party line wire is provided with branches extending to the different local stations. A discontinuous line is made up of sections extending from station to station. Means are provided for connecting the sections into a continuous line, also additional means for connecting the telephone sets of selected stations to the two continuous lines, and a selecting device located at the central station and arranged to be set so that upon its operation it will cause a desired combination of operations at the different local stations.

877,739. Means for Obtaining Thin Liquid Dross in Electric Furnaces for Metallurgical Purposes. Hermann Röchling and Wilhelm Rodenhauser, Völklingen-on-the-Saar, Germany. Application filed September 7, 1906.

This furnace has smelting channels and damlike ridges arranged in the hearth, so that the electric current heating the metal bath is forced to pass through the layer of dross floating above the metal bath.

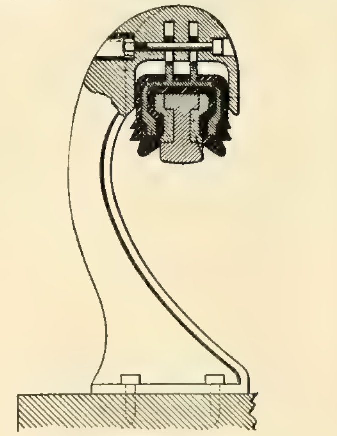
877,784. Shade for Incandescent Lamps. Edward B. Lewis, Pacific Grove, Cal. Application filed August 27, 1906.

The shade holder has a shell with a number of attaching parts extending outwardly from one edge. The shade has a number of independent sections attached to these parts.

877,790. Automatic Electric Switch. Mike Mintz, Rock Island, Ill. Application filed May 15, 1906.

Variations of fluid pressure on a diaphragm cause a rod connected with it to move a bell-crank that engages the forked end of a pivoted arm weighted at its upper end. This arm in its movement strikes against one of two stops on an oscillating contact member so as to cause the latter to suddenly drop into or be withdrawn from a mercury cup.

877,804. Insulator for Heavy Conductors. Louis Steinberger, New York, N. Y. Application filed April 17, 1907.



No. 877,804.—INSULATOR FOR THIRD RAIL.

This insulator for an inverted and protected third rail consists of a saddle-shaped portion engaging the rail, and in which is embedded a metallic strengthening member of the same contour. The latter has two flanges extending upward into the head of the supporting bracket. (See cut.)

877,817. Insulated Compromise Rail-joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed March 22, 1907.

The joint has separate disconnected base sections respectively for the dissimilar rails, these sections having a stepped relation and each affording one rail end a support on both sides of the meeting point of the rail ends. The rail ends are insulated from each other by wooden blocks.

877,821. Perforating Machine; 877,822, Printing Telegraph, and 877,823, Perforator. John C. Barclay, New York, N. Y. Applications filed May 2, 1906; January 11, 1907, and July 22, 1907, respectively.

A printing telegraph system and two forms of paper-perforating machines used in connection therewith are described. Both the transmitting and receiving machines have a sunflower selecting mechanism.

877,843. Electric Heater. Edmund F. Hoskin, Evanston, Ill., assignor to the Hoskins Company, Chicago, Ill. Application filed September 19, 1907.

An electric soldering iron has a coiled insulated resistance wire on a stem and a metal heat-transmitting head cast about the stem and wire in intimate contact with the insulation thereon.

877,844. Trolley. August W. Huhsman, Staunton, Ill. Application filed May 25, 1907.

On each side of the wheel is a T-shaped arm having its upper end outwardly curved and provided with a roller overhanging the trolley-wheel.

877,857. Telegraph Switch. Lewis H. Parcels, Hiawatha, Kan., assignor of one-half to John H. Koger, Willis, Kan. Application filed August 5, 1907.

A series of contact strips is connected to a number of local sounder circuits. A resonator sounder circuit is also connected to the switch, which has two semi-circular plates insulated from each other and arranged so that their edges will contact with the strips as the switch is rotated.

877,861. Portable Tire Inflater. John W. Radu, Rochester, N. Y., assignor of one-half to Paul C. Wild, Rochester, N. Y. Application filed July 13, 1907.

An electric motor is geared to an air compressor. Both are mounted on the same base and housed in as a compact set that can be carried by hand.

877,877. Wire-retrieving Attachment for Trolley-wheels. William C. Althen, Columbus, Ohio, assignor of one-sixth to William F. Miesse, one-sixth to William N. Gearhart, one-sixth to Benjamin F. Hirt, and one-fourth to John T. Dunnick, Columbus, Ohio. Application filed March 22, 1907.

The retrieving yoke is pivoted close to the wheel, so that its arms are normally below the wire. The trolley rope is so attached that when it is pulled the retriever arms are swung above the wire.

877,880. Outlet Box. Harry Becker, Baltimore, Md. Application filed February 1, 1907.

The box consists of a cylindrical casing, an annular flange extending from the inner walls thereof, a ring screwed into the end of the casing, and an insulating bushing held between the flange and ring so as to swivel freely.

877,887. Controller Regulator. Cyrus P. Ebersole, Keokuk, Iowa, assignor to the Electric Service Supplies Company, Philadelphia, Pa. Application filed September 1, 1904.

A number of movable stop-pins are mounted in the top of the controller. A pawl moving with the controller handle engages these pins one after another. A manually operated device releases the pins so as to permit the handle to advance.

877,889. Storage Battery. William Gardiner, Chicago, Ill., assignor to the Commercial Storage Battery Company, Chicago, Ill. Application filed May 2, 1905.

The grid for this storage battery plate has triangular horizontal ribs set with apex outward and a series of oppositely disposed vertical strengthening bars with inwardly flaring lugs or teeth.

REISSUE.

12,744. Electric Motor Controller Regulator. Paul A. Weyand, Maywood, Ill., assignor to the Electric Service Supplies Company, Camden, N. J. Application filed March 18, 1907. Original No. 810,240 dated January 16, 1906.

The controller has a revolving cover. A pawl within this is deflected by a series of studs so as to engage a number of ratchet teeth in succession and thus to permit an intermittent movement of the handle only.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 3, 1908:

445,542. Secondary Battery. H. T. Cheswright, Carcassonne, France.
445,546. Electric Arc Lamp. J. W. Easton, New York City.
445,549. Mast Arm for Electric Lights. G. Fitch, Sharpsburg, Pa.
445,564. Automatic Circuit Closing Device for Railroad Signals. I. W. Loy and R. O'Toole, Mechanicstown, Md.
445,623 and 445,624. Electric Motor. F. J. Batten, New York, N. Y.
445,634. Contact Device for Electric Railways. E. M. Bentley, New York, N. Y.
445,654. Regulator for Electrically Propelled Vehicles. S. H. Short, Cleveland, O.
445,674. Electric Railway. R. M. Hunter, Philadelphia, Pa.
445,716. Automatic Switch for Autographic Telegraphs. H. Etheridge, Pittsburg, Pa.
445,727. Electric Gas-lighting Apparatus. H. H. Cutler, Newton, Mass.
445,728. Electric Gas Lighter. H. H. Cutler, Newton, Mass.
445,741. Electric Motor Switch. F. A. Weller, Boston, Mass.
445,751. Electric Wire Connector. J. W. Hoffman, Pullman, Ill.
445,752. Electric Switch. J. W. Hoffman, Chicago, Ill.
445,773. Electrical Station Indicator. E. S. Ely, Chicago, Ill.
445,796. Electrical Visual Indicator. F. W. Cole, Newton, Mass.
445,797. Repeater. F. W. Cole, Newton, Mass.
445,798. Successive Non interference Signal Box. F. W. Cole, Newton, Mass.
445,800, 445,801 and 445,802. Successive Non interference Signal Box. F. W. Cole, Newton, Mass.
445,822. Electric Cut out. G. A. Scott, New York, N. Y.
445,872. Electrode for Secondary Batteries. S. H. Barrett, Springfield, Mass.
445,906. Dynamo electric Machine. C. J. Schwatze, Brooklyn, N. Y.
445,907. Starting Device for Electric Motors. E. P. Sharp, Boston, Mass.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Electric Elevators in the Chicago Board of Trade Building.

The popularity of the modern electric elevator for passenger service in high office buildings is well illustrated by the installation in the Board of Trade Building in Chicago. This popularity is especially noteworthy in this case, in that it is shared by the passengers, the operatives and the owners of the bulding. The reasons for this are the excellent service rendered and the low cost of operation and maintenance. The requirements of the service in this building are very severe, in that the traffic is not only heavy throughout business hours, but exceptionally so while the Exchange is in session, for large numbers of brokers have to be carried with the utmost speed from the Exchange floor to their respective offices; a competent elevator authority has pronounced the service to be the most severe of any in this country. Added to these features is the novel construction of the elevator mechanism, making the installation a noteworthy one and well deserving consideration.

When the building was constructed in 1883-4 four hydraulic elevators, operating at 500 feet per minute, were installed. The service these gave was insufficient, so these machines were replaced in the early part of 1897 by electric elevators of the screw-type, and an additional electric elevator, No. 5, of the drum type, was installed to run from the main to the Exchange floor only. Even with this addition the service was inadequate, and in the summer of 1902 another elevator was decided. For this purpose a Mabbs elevator was chosen. This was the first installation of the electric elevator invented and patented in 1900, by Mr. John W. Mabbs, chief engineer of the building. This machine, No. 6, has been in continuous service over five years and has given such good results that early in 1905 a petition was signed by all the tenants in the building requesting the directors of the Board of Trade to replace the older elevators by those of the Mabbs type. After prolonged comparative tests the directors voted to make the change desired. Two of these Mabbs elevators were put in service at the beginning of 1906 and the other two about three months later. All the elevators are operated from the direct-current, 110-volt generating plant installed in the basement of the building.

The general arrangement of the Mabbs elevator machinery is shown in Fig. 4, which is a perspective prepared from the working drawings. The principle of this elevator is that the machine constitutes the counterbalance of the car and is the only counterweight. The cable and sheave rigging is arranged so that the machine is geared two to one; i. e., when the driving machine runs up half the height of the building the car is lowered from the top to bottom, and vice versa. The cables attached to the car run over a sheave in the attic over the hatchway, then down and around a sheave at the top of the A-frame and over the driving motor and are fastened to an I-beam about midway of the height of the building. The driving machine runs between and is geared to two cast-iron columns which form the sides of a separate hatchway for the machine. This may or may not adjoin the shaft in which the car runs; in this particular installation the two shafts are separated by 35 feet in one instance.

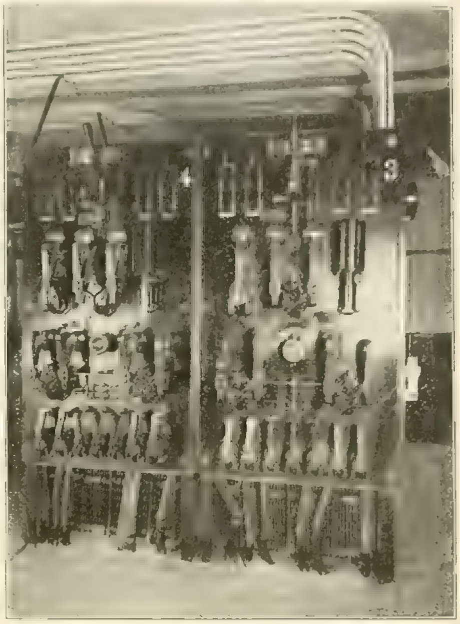


Fig. 1. Two of the Controller Panels.

The driving motor (A) has a vertical shaft, as can be seen in the detailed drawing of the machine, Fig. 5. Upon this shaft are mounted, in order, the brake pulley (K), upper bearing (N), commutator (C), armature (B), coupling (T), worm (D), and roller thrust bearing (Q). The armature is rigidly keyed to the shaft and connected by means of the coupling to the worm, which is really a sleeve on the shaft; this arrangement permits smoothing up the commutator without operating the gearing. The worm drives two worm wheels (E) keyed to the horizontal shafts (F). On each end of each of these shafts is a pinion. These engage the four racks mounted on the face of the vertical cast-iron columns, as shown in Figs. 2, 3 and 4.

Figs. 2 and 3 show the four elevator machines last installed. In Fig. 2 these are at the bottom of [illegible] of movement of the [illegible] taken from the [illegible] machines at or near the bottom. In this view are also shown the [illegible] the fields, brake solenoids and slack-cable devices to the controller panels and the trolley conductors on the inside of the columns that supply current to the armatures. These trolleys are mounted on porcelain blocks on the inner face of one column of each set. The trolley brushes are mounted in a self-adjusting holder. Eight of them constitute a set; they are shown at (O) in Fig. 5. Each brush has over one square inch of contact surface, and after more than five years of service no burned spots show on the trolley.

The motors for these machines were specially designed and built by the Northern Electric Manufacturing Company of Madison, Wis. In the first machine the motor was armature-controlled; the last four are almost entirely controlled through the field circuits. The fields have four poles on which are three distinct windings, a light series field used only in starting, the main shunt field which is always connected while the motor is running, and an auxiliary shunt winding which is gradually cut out in accelerating the machine. With the shunt field alone excited the maximum speed of the armature is attained, which is between 900 and 1,600 revolutions per minute. The commutator is made of extra length to give large contact surface and sparkless commutation.

The motor is effectively enclosed and the gearing below it is entirely encased. This gear case (W) is filled with oil to nearly the center of the horizontal shafts. The oil does not have to be replaced oftener than once in 2½ years. It affords not only efficient lubrication but insures noiseless running of the gears. The pinions and racks are lubricated with grease. These make less noise in operation than the humming of the commutator. All the gearing is machine cut. All gears are steel except the worm wheels, which have phosphor-bronze rims. The wear on the gears has been insignificant.

Over the motor are mounted the A-shaped truss frames (H) carrying the sheave (I) on the shaft (J). In the oil pan below this sheave is an effective slack-cable device, shown in Fig. 5. The roller (p) is mounted clear of the sheave, so that if any cable is loosened it will strike the roller, and through it move the arm (q) so as to close a circuit at (r) that immediately trips the main circuit-breaker. Below this device and on top of the armature shaft is the automatic brake, comprising a pulley (K), which is engaged by brake shoes applied by the spring (M). While the machine is running, these shoes are held out of contact with the brake pulley by the solenoid (L). Whenever the current is cut off by the operator

Fig. 2. View Showing Four Machines in the Basement.

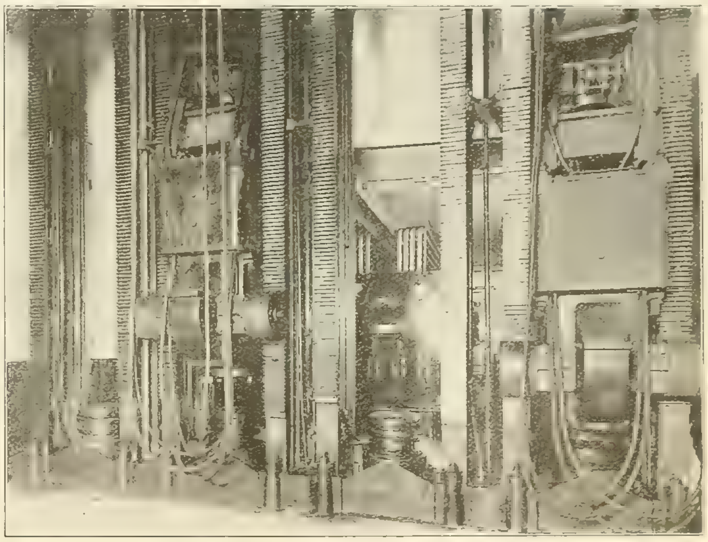


Fig. 3. View from Other Side, With Two Machines Raised.

ELECTRIC ELEVATORS IN THE CHICAGO BOARD OF TRADE BUILDING.

or by the sudden opening of the circuit-breaker, the brake is therefore automatically applied.

At the top and bottom of the motor hatchway are placed powerful buffers to limit the motion of the machine and thereby positively to prevent pulling the car too high or dropping it too low. The upper buffers are two in number and engage the shaft (J) on either side of the sheave (I). As shown in Fig. 5, the cylinder (a) is forced over the piston (c), thus forming a pneumatic cushion or dash-pot which will stop the motion of the machine when moving at its maximum speed, with full power, should all other automatic safeguards fail. The spring (b) on the outside of the cylinder returns the latter to normal position and also adds to the buffer action. The lower buffers, shown in Figs. 2 and 3, are built on similar lines.

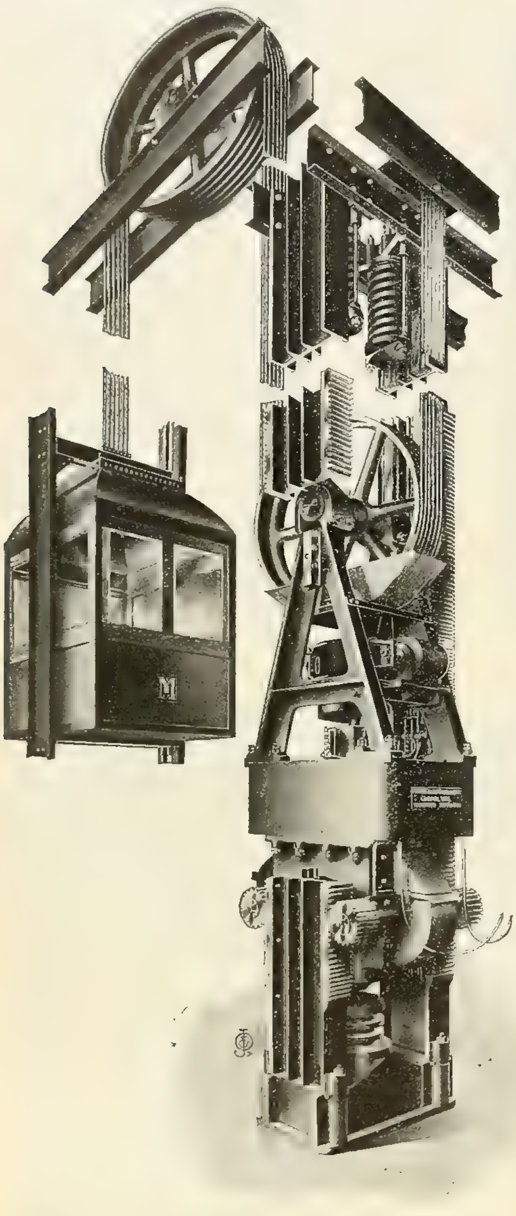


Fig. 2. General Arrangement of the Mabbs Elevator.

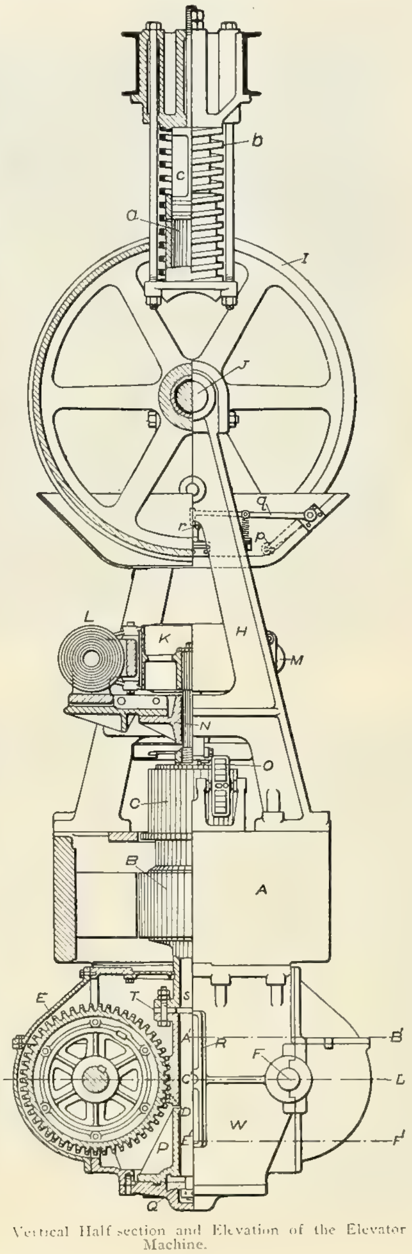


Fig. 5. Vertical Half-section and Elevation of the Elevator Machine.

ELECTRIC ELEVATORS IN THE BOARD OF TRADE BUILDING.

A modified form of these buffers has been introduced on No. 6 machine. It uses oil instead of air and has been found still more effective and entirely free from recoil.

Each elevator is provided with a controller panel such as the two shown in Fig. 1. A view of the main panel is shown through the open hatchway for No. 2 machine in Fig. 3. These controllers were made by the J. L. Schureman Company of Chicago. Operating connections are made entirely by electromagnetic switches that are interconnected to give a definite sequence of action, producing [illegible] and similar stopping of the machine. Speed control is through adjustment of the auxiliary shunt field. In stopping the machine current is cut off from the armature and [illegible] through a bank of resistances, which action itself has considerable braking effect. The brake is then applied, as already described, and the machine quickly stopped without appreciable jar.

[illegible] placed at the upper and lower limits of travel of the machine, which slow down the motor, cut off its armature current and set the brake in case of negligence of the operator. If the machine should go beyond this point, a limit switch would trip the main circuit-breaker, cutting off all current from the controller and machine. If even this safeguard should fail, the buffers already referred to would form a final positive mechanical stop. The worm gearing is a preventive against the car starting to move without the application of motive power. A push-button placed in each car enables the operator to trip the main circuit-breaker instantly in case of derangement of his control switch or other abnormal action of the machinery.

The cars are six feet square inside, an unusually large size for office-building elevators. The character of the service, already alluded to, is made more clear by a test made on the first Mabbs elevator when doing regular business and running express with stops at five floors out of the nine in the building, the height of car travel being 130 feet. The car made 547 round trips in 540 minutes. In its five years of operation this elevator has had over 25,000 miles of car travel. Careful records of current consumption extended over four years showed an average of 3.44 kilowatt-hours per car-mile. The four machines shown in Fig. 2, operating locally under still more severe conditions, showed an average of 3.5 kilowatt-hours per car-mile during a period of 76 weeks. These figures show excellent efficiencies under the conditions prevailing. The average corresponding figure of the older type of elevators, as formerly installed, was 5.35 kilowatt-hours per car-mile at slower speed. It is fair to say, however, that the older elevators were of an obsolete type, not now installed.

Maintenance expense of these elevators is also less than with the machines formerly used. The services of one electrician engaged principally on elevator repair work have been dispensed with. Aside from this, the repair bills for the four old machines used to run about $2,500 a year. Repairs on the new machines for the last year amounted to $333, of which 38 per cent. was on controllers, less than 27 per cent. on the machines proper and the remaining 35 per cent. on gates, signals, cars, etc.

The primary aim in the design of the Mabbs elevators was safety. This, it is asserted, has been attained to a greater degree than with any other elevator built. Incidentally, economy of operation and of maintenance have been realized as well as smoothness and rapidity of service. These machines have a running speed of 540 to 600 feet a minute. For very high buildings, for which these elevators are said to be particularly adapted, this speed could be readily increased 30 per cent. or even more.

Motor Speed Control by Multivoltage System.

Where a very wide range of speeds at practically full motor capacity is necessary in machine driving by direct-current motors, the multi-voltage system is doubtless the best suited for the service. In a number of these systems, however, the strain upon the motor and the gearing connecting the motor and machine is severe when different voltages are applied at the armature terminals. To bring about more gradual speed changes has usually been done by either increasing the number of voltages or by inserting resistances in the armature as well as field circuits. Both of these expedients increase the complexity of the system, and the insertion of armature resistance cuts down the efficiency of the set.

To overcome both these objectionable features, a multi-voltage system has been invented by William H. Powell of Norwood, Ohio. It was recently patented and assigned to the Allis-Chalmers-Bullock interests. The system is quite simple, and embodies the principle of speed control by variation of the field strength in the steps between the different voltages. This principle, briefly stated, is that the greater the field strength the slower the speed, and vice versa. This is true whether the field excitation be supplied by a shunt or series field winding, and in this particular system both are used.

In this system automatic means are provided for controlling the insertion and cutting out of an auxiliary field winding. On each increase in potential at the terminals of the motor, which is normally a shunt motor, the auxiliary field winding is inserted in the circuit, so that the motor will not suddenly come up to the speed corresponding to that voltage. In the form herein illustrated and described, the auxiliary field winding is inserted in series with the armature winding. This series winding is afterward automatically short-circuited or removed from the armature circuit, and a predetermined interval of time is caused to elapse before this winding is cut out, this being of sufficient duration to allow the motor to speed up to some extent. Upon cutting out the series field winding a further increase of speed occurs, which brings the armature to the speed of the next running step.

In the accompanying diagram a portion of a multi-voltage distributing system is shown at (1), (2) and (3), which is connected by a switch (A) to the three-wire mains (4), (5) and (6) for supplying the motor with current at voltages which differ from each other. For example, between the mains (4) and (5) there may be 90 volts, between mains (5) and (6), 160 volts, and between mains (4) and (6), 250 volts.

The armature of the motor, the speed of which is to be varied, is indicated at (7) and its main field winding (8) is connected in series with a variable field resistance (9). This main field winding and its resistance are connected across the mains (4) and (6) by conductors (10) and (11) so as to receive the full voltage of the system. The auxiliary field winding is shown at (12). This winding is connected to contact fingers by conductors (13) and (14), and these fingers are adapted to be engaged by suitable contact segments on the controller drum in such a manner that the winding will be connected in series with the motor armature for a short space of time on a change of voltage at the armature terminals.

A switch (15) having contacts connected respectively to conductors (13) and (14) short-circuits the auxiliary winding when the switch is closed. The bridging member of this switch is attached to the soft-iron core of the solenoid (19). To the lower extension of the bridging member

of the switch is connected a plunger (20) which works in the cylinder (21), forming a dash pot. The plunger is provided with one or more openings (22) and carries a loosely fitting disk or ring (23) which normally closes the openings. The cylinder is provided with one or more openings (24) located at suitable distances from its closed top and bottom.

When current passes through the coil the switch is raised with a comparatively slow movement, as the air passes to the bottom of the plunger only by leakage around the same. Just before the switch is closed, however, the plunger passes beyond the holes (24), permitting a free flow of air below it, and the switch is then closed with a sudden movement. When no current passes in the coil, the switch quickly falls, due either to the force of gravity or spring pressure against the movable part, as preferred, the air from the plunger passing freely through the holes (22), the disk or ring being then raised from its seat.

The parts above described are interconnected and also connected to the controller fingers (1^a, 1^b, 1^c . . . 1^o) as shown. The controller cylinder or drum is provided with a large number of contacts (25), which control the connections to the armature. The controller cylinder is also provided with a metallic drum (26) suitably notched and recessed, forming contacts which control the resistance in circuit with the main field winding. As the cylinder is revolved from the off position designated (o), the controller fingers take the successive positions indicated by the dot and dash lines (2^a, 2^b, 2^c, . . . 2^l) for forward rotation and the positions (3^a, 3^b, 3^c, . . . 3^i) for backward rotation of the motor. In tracing the circuits, switch (15) will be considered to be closed, as such is its ultimate position. Should the switch be open, the current will flow through the leads (13) and (14) and the series field winding instead of going through the switch.

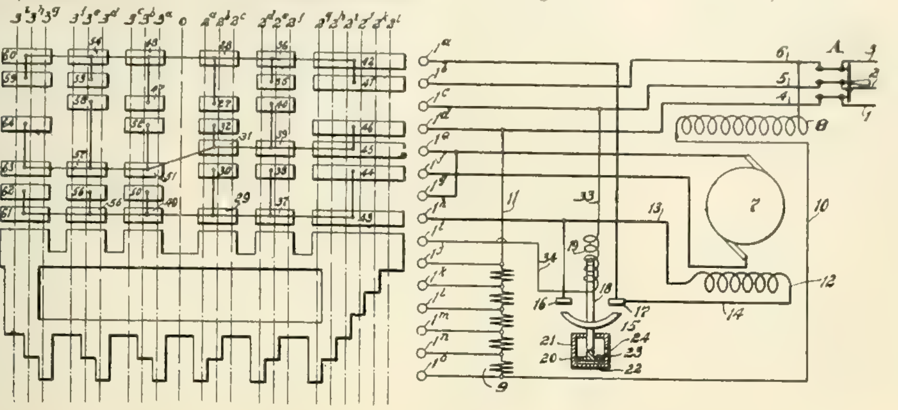
For position (2^a) the path of the current is as follows: From main (5), contact finger (1^c), contacts (27) and (28), finger (1^a), switch (15), finger (1^h), contacts (29) and (30), finger (1^f), motor armature, finger (1^e), contacts (31) and (32), finger (1^d), to main (4), thus subjecting the armature to the lowest voltage of the system across the mains (4), (5). For this position, the field connections are from main (6) to main field, conductor (10), finger (1°), drum (26), finger (1^j), conductor (11), to main (4), thus subjecting the field to the full voltage of the system, with all the resistance cut out. Connection is also made through the solenoid coil as follows: Main (5), conductor (33), solenoid coil, conductor (34), contact finger (1^i), drum (26), contact finger (1^j), conductor (11), main (4). The coil is therefore subjected to the voltage across the mains (5) and (4), and the switch is caused to close.

For the position (2^b), finger (1°) is cut out of contact with the lower drum and one section of the variable resistance is inserted in the main field circuit of the motor, the field current passing from the main field winding through a section of the resistance to contact finger (1^n) and then to the drum. No other changes take place, and by thus weakening the main field of the motor an increased speed is obtained. In the same way for position (2^c) a still further weakening of the field takes place by inserting another section of the resistance in the field circuit, and in this position current passes from the field through two sections of the resistance to finger (1^m) and to drum (26).

For position (2^d) the armature connections are from main (6), to contact finger (1^b), contacts (35) and (36), finger (1^a), switch (15), finger (1^h), contacts (37) and (38), finger (1^f), motor armature, finger (1^e), contacts (39) and (40), finger (1^c), to main (5). The motor armature is therefore subjected to the voltage across the mains (6) and (5), which is greater than the voltage across the mains (5) and (4), across which the motor armature was connected in previous positions. The field connections and those of the solenoid coil are the same for this position as for position (2^a), and the speed of the motor is increased by the increase in voltage applied to the armature. For positions (2^e) and (2^f) the only changes that take place are the weakening of the field by cutting in sections of resistance in positions (2^b and 2^c).

For position (2^g) the connections for the armature are from main (6), finger (1^b), contacts (41) and (42), finger (1^a), switch (15), finger (1^h), contacts (43 and (44), finger (1^f), motor armature, finger (1^e), contacts (45) and (46), finger (1^d), to main (4). The motor armature is therefore subjected to the greatest voltage of the system. The field connections and those of coil are the same for position (2^g) as for positions (2^a) and (2^d), the resistance being cut out, and increased speed is obtained by the increase in the voltage applied to the terminals of the motor armature.

For positions (2^h, 2^i, 2^j, 2^k and 2^l) the connections remain the same, except that sections of resistance are successively cut into the circuit of the field winding until it is all in circuit, in this manner successively weakening the field for increases in speed from positions (2^g) to maximum at (2^l).



MOTOR SPEED CONTROL BY MULTIVOLTAGE SYSTEM.

It will be noted that in passing from position (2^c) to (2^d) and from (2^f) to (2^g), at which times the change in voltage applied to the motor armature takes place, finger (1^i) connected to the solenoid coil, is momentarily cut out of contact with the drum and circuit through this coil is broken. At the instant the finger breaks contact with the drum, the switch drops and the auxiliary field winding is inserted in series with the armature of the motor, so that by the time that the increased voltage is applied to the armature, there is an increased field, which increases the counter-electromotive force and prevents a too sudden rush of current through the armature, with consequent strains on the motor. The ohmic resistance of the auxiliary coil is not relied upon in choking back the current when the voltage at the armature terminals is increased, as this resistance is practically negligible in its effect upon the current flow, but, as stated above, an increased field strength produces the desired result. As the solenoid coil is again placed in circuit at positions (2^d) and (2^g), the switch will be closed and the auxiliary field winding will be short-circuited, but on account of the slow upward movement of the switch, the motor will have had sufficient time to increase in speed before the switch is closed. When the controller is moved from "off" position (o) to the "starting" position (2^a), the switch is closed in the same slow manner.

There is as great or a greater danger of injury to the gear teeth when the speed of the motor is decreased as when the speed is increased, for two reasons: First, because the operator usually throws the controller handle to the "off" position quickly, thus bringing the motor to a sudden stop; and second, on account of the generator action of the motor when the potential at the armature terminals is decreased, which tends to suddenly reduce the speed of the motor. The result is that the motor tends to stop more quickly than the machine or tool to which the motor is geared, causing a hammer blow, which is liable to strip the teeth off the gears. The insertion of the series winding into the armature circuit tends to reduce the generator action on a decrease in the potential at the armature terminals, as will now be explained.

Assume that the motor is operated at the speed corresponding to the position (2^g), with the armature terminals connected across the 250-volt mains. The counter-electromotive force is less than 250 volts, say, 240 volts. If the voltage at the armature terminals is decreased to 160 volts, i. e., the voltage of the mains (6) and (5), the counter-electromotive force will be greater for a short space of time than the impressed electromotive force, and the current in the armature and series field will for this space of time be reversed. The result is that there will be a differential field action. The currents in the shunt and series field windings will be in opposite directions, causing for the moment a very weak field, which reduces the generator action to a minimum.

For reverse rotation of the motor the fingers are in positions (3^a to 3^i) successively For these several positions the connections can be readily traced out and will be found to be the same as [illegible] and (3^d) and between (3^f) and (3^g), the auxiliary field winding is cut into circuit with the armature, to relieve the strain on the motor, as already explained, [illegible] is cut out again after a predetermined time. The auxiliary winding also remains in circuit for a predetermined time after the controller is moved from position (o) to position (3^a).

It is seen, therefore, that this is really a compound-wound motor, the shunt-field winding only of which is normally in circuit, and the series field winding of which is automatically cut into circuit on a change of voltage, and again cut out of circuit after a predetermined interval of time has elapsed. It is also evident from the above description that 12 speeds forward and nine speeds in the reverse direction are obtainable.

Portable Outfit for Pumping Out Manholes.

A somewhat novel and interesting portable electric pump has been built by Yeomans Brothers of Chicago for the Omaha Electric Light and Power Company, and is used by the latter for pumping out the manholes of its conduit systems. A side view of the outfit is shown in the illustration.

The centrifugal pump is mounted on a bracket which forms one end of a long cast-iron bedplate designed to carry the motor and the inboard bearings of the pump.

The power is supplied by a direct-current, 10-horsepower, 835-revolution, 500-volt General Electric motor. The pump has a capacity of from 450 to 500 gallons per minute against a maximum head of about 25 feet.

Below the flexible coupling which connects the motor shaft to the pump shaft will be seen a small secondary pump driven by a belt from the main shaft. The function of this secondary pump is to prime the casing of the main pump.

When it is desired to put the apparatus in operation, the main discharge valve is closed and the motor being started up, the small centrifugal vacuum pump exhausts the air from the casing of the main pump, causing sufficient water to rise out of the sump or manhole to prime the casing of the latter. As soon as this is accomplished the discharge valve of the main pump may be opened, and the speed regulated to suit existing conditions of head and flow.

The priming pump is fitted with a fast-and-loose pulley, so that as soon as the main pump has begun

PORTABLE MOTOR-DRIVEN PUMP.

to deliver water, its belt can be shifted onto the loose pulley, thereby permitting the smaller pump to come to rest.

Speed control is accomplished by means of a regulating resistance box, which is shown on the left-hand side of the wagon. On the right is a reel carrying a flexible connecting cord 200 feet long, one terminal of which is permanently connected through the axle to the starting box, the other to be connected to a convenient source of electricity, which is to be found either in a manhole, in case of making connection with the underground system, or at a feeder or main junction box, in the case of a pole line.

The wagon-top is made removable, so that in case of necessity it can be taken off.

Provision is made for carrying the suction hose on the side of the wagon body, in a manner very similar to that employed in connection with fire engines.—General Electric Review.

Thomas H. Norton, consul at Chemnitz, reports that by the Slaby-Arco system of wireless telegraphy over 1,000 words were recently telegraphed from the trial station of the company at Nauen, near Berlin, to the Austrian military station for wireless telegraphy at Korneuberg, near Vienna, a distance of about 372 miles. He adds that this is the record result thus far in the use of the system for overland transmission.

Ducretet Tele-micro-phonograph.

By A. de Courcy.

The combination of the phonograph with a telephone apparatus, by which the sounds given out by the phonograph can be transmitted to a distance, is one which has occupied the attention of inventors for some time past, for such an arrangement would be useful for various purposes. But the advantages of the combination will be still greater if a loud-speaking telephone is employed

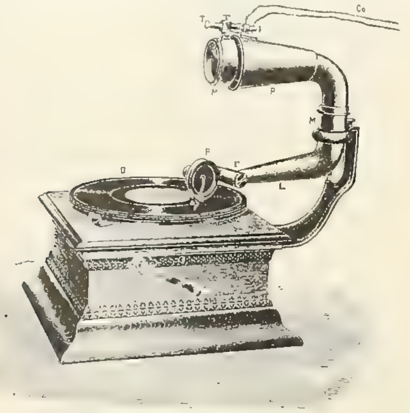


FIG. 1. TELE-MICRO-PHONOGRAPH (GRAMOPHONE FORM).

to receive the voice, music, etc., which is transmitted from the phonograph. In order to secure the best effect from the device, which consists of the phonograph in connection with the microphone transmitter, it is undoubtedly the best plan to have the latter placed independent of the diaphragm of the phonograph. No doubt the latest advance in this class of apparatus is found in the new "tele-micro-phonograph" which has been brought out not long since at Paris by Mr. E. Ducretet, a prominent worker in the field of radio-telegraphy, X-rays and telephones, who has constructed a number of very practical instruments in all these fields, some of these being used at present on the war vessels of the French navy.

Mr. Ducretet kindly furnished the writer with the following account of his device, which is illustrated herewith. The apparatus consists of two principal parts, first, the phonograph carrying the specially designed microphone, and second, at the distant end, the loud-speaking telephone. By such arrangement the sounds given out by the phonograph disk are received by the diaphragm of the microphone, which is placed at some distance from the former. As will be noticed, the point of the phonograph and its diaphragm are mounted in the usual way at (R), Figs. 1 and 2, and any of the well-known forms of gramophone or phonograph can be employed for this purpose. The mouthpiece

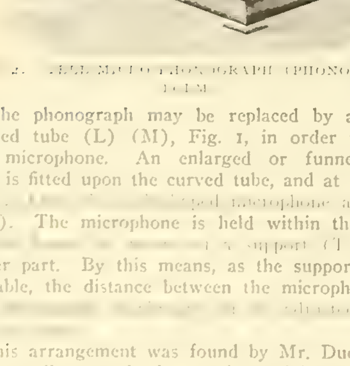


FIG. 2. TELE-MICRO-PHONOGRAPH (PHONOGRAPH FORM).

of the phonograph may be replaced by a double curved tube (L) (M), Fig. 1, in order to carry the microphone. An enlarged or funnel-shaped part is fitted upon the curved tube, and at its outer [illegible] microphone apparatus (Mi). The microphone is held within the mouth [illegible] support (T) at the upper part. By this means, as the support is adjustable, the distance between the microphone and [illegible] to the [illegible]

This arrangement was found by Mr. Ducretet to give excellent results in practice and is much more [illegible] efficient and rapid regulation of the distance be- [illegible] working point. In practice this can only be found [illegible]

a very good reception of the sound of the phonograph. The power of the microphone depends within certain limits upon the amount of current which is used in its circuit (Co), in connection with the receiver at the distant end. The microphone is of the Gaillard-Ducretet type, such as is now employed in the French navy on board the war vessels for the transmission of orders.

One great advantage which is found in the present case lies in the use of the new form of loud-speaking telephone, which has been improved lately. Some time ago the writer had occasion to observe the working of the loud-speaking telephone in Mr. Ducretet's laboratory, and the sounds can be heard very distinctly and at quite a distance from the mouthpice. The system was devised in the first place for use on shipboard, where the men are not obliged to place the receiver against the ear in order to receive instructions for the maneuvers, but can hear the orders at a considerable distance. In the 1908 type of loud-speaking telephone there is employed a micrometric adjustment screw between the diaphragm and the pole surface of the magnetic system, which is found to give a remarkably good regulation.

Current for the combination apparatus is given by a primary battery or a small storage battery, and a revolving switch is used to regulate the amount of current, and therefore the volume of sound in the loud-speaking receiver. Mr. Ducretet has devised, in addition, a practical device, by which the direct current from a lamp circuit can

FIG. 3. TELE-MICRO-PHONOGRAPH TRANSMITTER.

be used. To this end a plug is fitted as usual into the lamp socket, and in the circuit is placed a newly devised apparatus for reducing the voltage, which contains also a choke-coil for protecting the instruments. A regulating resistance brings the current to the best voltage for use in any particular case which can be found on trial. The loud-speaking telephone receiver with trumpet mouthpiece can be concealed or else placed visibly in various parts of houses, gardens, halls, etc.

The microphone system is shown mounted both on a disk gramophone (Fig. 1) and on the cylder phonograph (Fig. 2). It can also be connected by the line wire with several different receivers, which may be either grouped or scattered over the premises at will. Two of the loud-speaking telephones placed in a large hall are found to be enough to give a good diffusion of the sound. One point which is to be noticed is that the present apparatus suppresses the objectionable noises of the phonograph to a great extent, and the sound coming from the receiver is more natural and agreeable than that obtained by the direct use of the phonograph. It is also possible for the person having the apparatus in charge to speak to the audience placed at a distance for announcing the titles of pieces, etc. In this case he can be heard from the receivers either by speaking before the microphone (Mi), or, better still, by speaking into a separate microphone mounted on a support, which can be thrown into the circuit by a switch. The usual phonographs, etc., are not rendered useless for ordinary work, but, on the contrary, the device can be readily removed and replaced by the trumpet mouthpiece for direct hearing.

There are some special applications of Mr. Ducretet's apparatus in scientific work. Not long since Dr. Dupont used it in his researches upon the physiological effects caused by rhythmic currents

FIG. 4. TELE-MICRO-PHONOGRAPH RECEIVER.

upon the nervous system, which he described before the Academie des Sciences. The apparatus is also employed by Mr. Dussaud in his experiments upon persons with defective hearing.

Figs. 3 and 4 show the instrument in the home for temporary service.

Some Characteristics of the Flaming Arc Lamp.

By E. O. Schweitzer.

The exceptionally high efficiency of the flaming arc is due primarily to the phenomenon of luminescence.

Light sources may be divided into two classes. The light rays of any source are either due to its high temperature, in which case the light rays are classed as temperature rays, or the temperature may be only secondary in importance, and the high efficiency of the illuminant is due to a property called luminescence by E. Wiedeman and allactine by Warburg.

All of the older types of artificial illuminants illuminate by virtue of their high temperature. Examples of these illuminants are the wax candle, petroleum, illuminating gas, acetylene gas, etc., all of which illuminate by virtue of the glowing carbon.

Examples of illuminants which illuminate by virtue of their luminescence are the Geissler tubes, Tesla light, mercury-vapor lamp, etc.

The flaming arc illuminates by virtue of a combination of luminescence and high-temperature rays. The carbons are impregnated with strontium, barium, calcium or similar chemicals, which are vaporized in the arc. While in the ordinary direct-current arc lamp the light due to the arc is approximately 5 per cent., that of the crater 85 per cent., and that of the negative carbon 10 per cent. of the total light, the light of the flaming arc lamp is due primarily to the luminescence of the arc proper. Also the light of the flaming arc is due to the fact that the energy of the rays of light is confined to but a small part of the spectrum.

The specific consumption or efficiency of a direct-current flaming arc lamp, according to Laporte (Bulletin Soc. Intern. Electr.), at a current strength of nine amperes varies with the electromotive force of the arc—a variation of from 24 volts to 45 volts—and results in a variation of specific consumption or efficiency from 0.74 to 0.38 watt. According to the Physicallische Technische Reichsanstalt the specific consumption for direct current is 0.36 watt at 46 volts arc pressure to 0.48 watt at 36 volts. For alternating current the efficiency varies from 0.34 watt at 44 volts arc pressure to 0.59 at 48 volts. Generally speaking, the alternating-current and direct-current lamp efficiency is considered approximately equal. The above figures do not, of course, include the loss in the series resistance.

Underwriters' Electrical Rules.

The general meeting of the electrical committee of the Underwriters' National Electric Association will be held on March 25th and 26th at the rooms of the New York Board of Fire Underwriters, 32 Nassau Street, New York city. The sessions will open at 10 a. m. Mr. C. M. Goddard is secretary, with offices at 55 Kilby Street, Boston. The meeting is an important one to electrical interests, as some revision of the rules of the National Electrical Code will be considered.

Electric Drive in Woodworking.

An interesting example of the economies [illegible] other advantages effected by the introduction of electric drive in a woodworking plant is afforded by a visit to the works of the Mears-Slayton Lumber Company of Chicago, manufacturer of lumber, sashes, doors, etc. The newer portion of the plant has been equipped with induction motors and the same system will gradually be extended throughout the establishment.

The first impression made upon a visitor entering the new shop, where electric drive has been introduced, is that of light, cleanliness, order, clear head-room and the dispatch with which the work

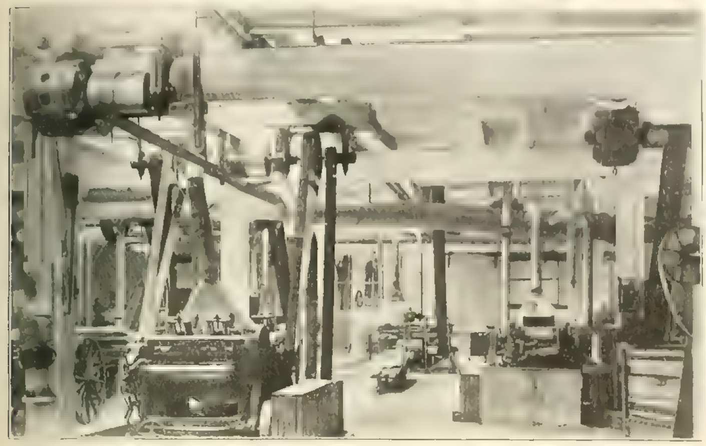


Fig. 1. Induction Motors Driving Stickers and Surfacers.

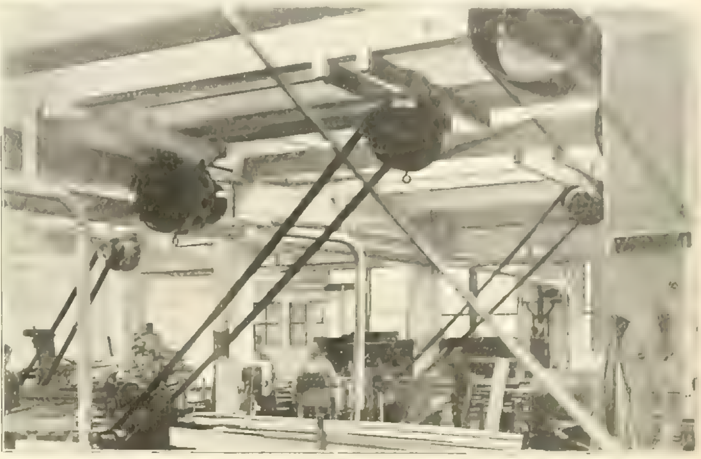


Fig. 2. Five Motors that Operate Stickers and Rip, Band and [illegible]

ELECTRIC DRIVE IN WOODWORKING.

is conducted. And that the last-named is no mere "impression" may be seen from the statement of Mr. Robert Slayton that, since the motors were put in operation, the daily capacity of the plant has increased fully 23 per cent.

The machine to be first seen, upon entering, is a 16-inch sticker, which is operated by a 20-horsepower motor. The details of this arrangement are shown in Fig. 1. It will be observed that the spaces above and around the machine are open, not only allowing the operatives to take advantage of the excellent lighting, but also giving much additional floor space for the piling and handling of the rough and finished material. This is not the least valuable consideration in a plant where the products are inevitably bulky and cumbersome.

Near this is a 30 by 12-inch double surfacer (Fig. 1), which is also driven by belting from a 20-horsepower motor. A special feature of this surfacer is the arrangement of the feed rolls. While only four are used, the pulling power is greater than on the ordinary six-roll machine. Four speeds of feed are furnished—44, 49, 53 and 70 feet per minute. A tight and loose pulley 16 by 8 inches is used.

At the right of the surfacer is a combination band rip (Fig. 2) and resaw, belted directly from a 20-horsepower motor. This machine, which lends itself particularly to the advantages of electric drive, can be quickly changed from a resaw to a rip saw, or vice versa. It is used for all kinds of resawing within its capacity of 14 inches in width and 16 inches in thickness, for which purpose it has practically all the advantages of a vertical band resaw. In addition, the construction of the feed roll is such that a thick cant or plank may be resawed into thin lumber without any adjustment. A variable friction feed is used, having a range of 24 to 80 feet per minute for resawing and 40 to 200 feet per minute for ripping. The driving pulley is 20 inches in diameter by 6½ inch face.

Placed in various corners of the room are seven swinging cut-off saws, each belted to a three-horsepower motor, and near one end are two 12-inch rip saws, each driven by belting from a 10-horsepower motor.

For cutting off all lengths and kinds of rough lumber or timber, motor-driven swing saws are rapidly coming into favor. The frame of each of the saws above mentioned is cast in one piece, of the best design to insure rigidity and strength, cored for lightness and counterbalanced by a weight for easy operating. It swings on turned extensions of the hanger bearings. Saws up to 30 inches in diameter are used.

The motor-driven self-feeding rip-saw tables are of particular value, because of the variety of work to which they can be applied. Each machine is driven by [illegible] pulley directly beneath the table; the belt runs from [illegible] top feed works. The feed, therefore, is controlled directly from the saw arbor. The material is fed from the front into the forward feeding spur and [illegible] roll at the rear of the saw feeds the stock away after it has been ripped. By shifting the housings of the motors through 90° or 180° so that the oil cups are placed in their proper relation to the shaft, they are easily adapted to side wall or ceiling mounting, which is ordinarily the most convenient arrangeemnt in a woodworking shop.

A hand-feed rip-saw of the Mears-Slayton Company's own design takes its power from a five-horsepower motor and is found very useful for certain classes of work.

In the center of the plant is a short line of shafting, driven by a 50-horsepower motor, from which are belted 14-inch and 9-inch stickers, 8-inch stickers and a 6-inch sticker.

The 14-inch and 9-inch stickers, shown in Fig. 2, exhibit a number of important improvements,

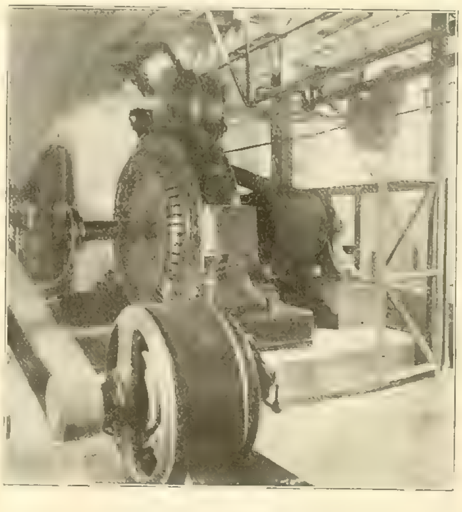


FIG. 3. GENERATING PLANT IN CHICAGO WOODWORKING ESTABLISHMENT.

the use of which is facilitated by electric drive, among them being the so-called "wide-open" feature. This consists of throwing the shaving hood and chip breaker back across the machine; the hinged pressure bars turning upward and the rear table beyond the lower head dropping, thus allowing free access to all cutter heads, for setting, sharpening or adjusting the knives. In front of the two top feed rolls there is a lever, which allows the operator to raise his rolls off the work whenever desirable, and a "double-quick" adjustment of the side-heads by which much time is saved.

All sawdust and shavings are effectually removed from the machines, freed from dirt, and carried to the furnace by a system which includes an 80-inch blower driven by a 40-horsepower motor. This is a right-hand, top vertical discharge fan. [illegible] rip-saw grinder, emery wheel and other tools. As [illegible] negligible as compared with what would be needed for shafting.

One feature which gives particular satisfaction to the owners of the plant is the saving in power effected by means of electric drive, which they find to be very considerable. When machines are not in use they, of course, take no current from the wires, and the load is thus distributed only where it is absolutely needed at the time, thereby enabling the entire system to be operated on only a fraction of the power that would be required for shafting continuously run. While the power necessary for operating this portion of the plant, with all machines running, is 150 horsepower, the average pull from the generator does not exceed 70 horsepower, and occasional overloads are easily taken care of.

In addition to the motors mentioned above, others are reserved for use in the yards, where they may be located at any point convenient to the work, which is principally the operation of rip saws, conveyors, etc. This illustrates one of the advantages of the electric system, viz., its great flexibility and the ease with which power generated at a central plant, frequently located some distance from the work, can be applied to any purpose required. Induction motors, such as those furnished by Allis-Chalmers Company for the Mears-Slayton Lumber Company, are adapted to remote control and can be installed and operated even in places not readily accessible.

Among the machines on the ground floor of the old shop are a 60-inch sander, belt-driven (which takes 25-horsepower), a panel planer, panel sanders, panel raisers, a turning lathe and a 50-inch blower, the last named being direct-connected to a 25-horsepower motor. About 150 horsepower is used here and on the three floors above, which are filled with lighter tools. The 16-foot elevator is run by a motor of 10 horsepower.

Among the electrically driven machines not already mentioned are tenoners, spindle shapers, additional rip saws, a 24-inch pony planer, emery grinder, large band saw and various accessory apparatus, operated by motors ranging in size from 2 to 35 horsepower.

Steam is generated in three Erie boilers placed over furnaces of a special design built by George Gulickson of Chicago. The prime mover is an 18 by 42-inch Allis engine, with 14-foot flywheel grooved for 17 ropes, from which an Allis-Chalmers alternator (Fig. 3) (with belted exciter of the same company's build, which also runs the lights) is driven. From the generator electric current generated at 440 volts, three-phase, 60 cycles, is carried over well-insulated wires run through iron conduits (grounded by wires leading to the nearest water pipe), to a distributing switchboard in the new shop, whence the motor circuits branch off to the various departments. With each motor is installed an Allis-Chalmers potential starter, which is practically "fool-proof," inasmuch as it is arranged that it is impossible to throw it from the "off" to the "running" position without first passing through the starting position.

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DATES AHEAD.

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MR. METCALFE'S serial, "Elements of Electrical Engineering," is drawn to a close in this issue after running in weekly installments in the Western Electrician for a little over a year. We know that many readers will regret the ending of this series of practical, elementary articles, which has been very popular, but of course the end had to be reached in due course. No one who has read the installments carefully can fail to have increased in some particular his knowledge of electric light and electric power in principle and practice.

COPYING supposed "American" methods of journalism has a curious effect on some of our staid English contemporaries. Thus one of the most dignified of the London electrical journals recently printed an advertisement of its own advertising space which began with the word "Slamgoozling" in startling black type across the page. This, it was explained, was "an American 'slangism' which can mean anything." Apparently the meaning is of an unfavorable nature, for we are assured that there is no slamgoozling about this particular proposition. No doubt this alarming word was the invention of an "ad" writer, merely striving to attract attention according to his lights; but why deliberately impute it to American slang, which has certainly sins enough of its own to answer for?

ELECTRICITY generated in Canada is imported into the United States at Niagara Falls, as is well known. The question whether this importation should be subject to customs duty has been discussed, and now it bids fair to come before the Board of United States General Appraisers and the federal courts. There is no provision in the present tariff law for electricity, and while the schedule contains a so-called "similitude" clause, as well as a section covering unenumerated unmanufactured and manufactured articles, these provisions apparently do not, or were not, intended to cover electricity. It appears that various American producers of electricity in the neighborhood of Buffalo have taken exception to the competition of the current generated on the Canadian side of the Falls. It is contended by the complaining electric-power companies that the foreign product should be held dutiable under some paragraph of the tariff.

Evidently a fine point is involved here. Electric power is intangible and is not covered, probably, in the tariff classification. On the other hand, it apparently comes into competition with an American-made product of like character which demands protection. As a matter of fact, nearly if not all of the Canadian-generated current sent into this country comes from a power plant built and owned by American capital and planned by American engineers. But that fact does not affect the principle involved, which is a novel one. Our recollection is that the Treasury Department has held previously that imported electricity is not dutiable, but probably the question has never been decided by the courts.

A SUGGESTION of much interest comes from England. It is that the name "kelvin" be adopted for the kilowatt-hour or (in England) Board of Trade unit. The kilowatt-hour, being a measure of practical electrical work, is one of the most frequently used of all the electrical units and one with which the general public is perhaps as familiar as any other. The proposal that the memory of Lord Kelvin be honored by applying his name to this unit is now revived, for it was originally made a number of years ago, during the great man's lifetime. Writing to the London Times Engineering Supplement of January 29th, Col. R. E. Crompton, president of the Institution of Electrical Engineers, announces that "proposals will shortly be made to perpetuate his connection with the electrical industry by giving the name of 'kelvin' to the commercial unit of electrical energy hitherto known in this country as the Board of Trade unit and abroad chiefly as the kilowatt-hour." These proposals will no doubt be laid before the International Standardization Commission in due form.

American electrical engineers will be sure to give this proposal a cordial welcome and careful consideration. Aside from honoring a man whom all delight to honor, the word "kelvin," with two syllables, is shorter and more euphonious than "kilowatt-hour," with four. It is rather unfortunate that it begins with the letter k, for when abbreviated to "k" or "kn" it may cause confusion with "kw" (kilowatt) or "kva" (kilovolt-ampere). But perhaps one of the duties of the commission will be to find a simpler expression for "kilovolt-ampere" and so abolish it. Again, "Kelvin" is part of a title of distinction; "Thomson" was the man's patronymic. Volta, Ampere, Ohm, Watt, Faraday, Henry and all the other names perpetuated in the international electrical units, so far as we are aware, are the surnames of the men thus honored. There may be some doubt which should be chosen in this case.

The subject is one of considerable importance, for the word "kelvin," if it should be finally sanctioned by international agreement, will be in daily use among practical electrical men. Such objections as there may be to the word should therefore be carefully considered at the present time, before the recommendation is finally adopted by the commission. Nowhere, we are sure, will there be any lack of disposition to do ungrudging honor to Lord Kelvin; the only question will be whether the adoption of the new name will, in all points of view, be in line with scientific nomenclature, not only in the English language, but in German, French, Italian and all others which have electrical significance.

IN SELECTING "Public Service" as the general subject to be discussed at its annual dinner in New York next week the American Institute of Electrical Engineers is to be commended. Few topics are of more importance to the people of this country. One of the speakers, it will be observed, is Mr. Frank W. Stevens, chairman of the Public Service Commission of the State of New York for the Second District. Mr. Stevens will speak on "State Control of the Public-service Corporations, Past and Present," and as he may naturally be expected to refer to the new public-service law in New York state, which he and the other commissioners are charged to execute, he will no doubt have something of interest to say. Mr. Stevens made a favorable impression when he spoke at the joint meeting of the Street Railway Association of the State of New York and the Empire State Gas and Electric Association in New York city last October. His fairmindedness may be judged by the following quotation from his speech on that occasion:

> "The object of the law is to promote justice and to prevent injustice, and no man can conscientiously observe the oath of office which he took, if, in order to correct one injustice, he perpetrates another. Corporations have their legal rights, and they should be protected in them. I wish to state with the utmost emphasis that I do not believe that any commission or commissioners who will ever be appointed in the state of New York, under the law which is now upon the statute books, will upon any occasion attempt to right one wrong by doing another. I have no hesitation in making a statement of that character, and I have no fear that any person will for a moment say that I am in sympathy with corporations and am not in sympathy with the people, because I believe that a true sympathy with the people requires that the ideal which the commission should have before it should be to promote the efficiency of the corporations to the utmost; and when corporations are efficient, when they perform the duties with which they are charged and which they ought to perform, I do not believe that they need fear for a moment that the American people will not always be willing to grant them a just and reasonable and a generous reward for the service which they render."

Mr Stevens realizes that the public-service corporations may have abused their rights, and that these abuses should be corrected; but nevertheless these rights exist, and, as he says, it will not do to commit one wrong to correct another. If, as perhaps he does, he reflects the spirit of the public-service commissions of the two districts (and under the statute the men who administer the law are given a wide latitude for the exercise of their individual judgment), the attitude of the corporations and the commissions toward each other should be, and no doubt will be, one of mutual respect and of friendliness. Well managed, the commission plan will make for good—for the good of the public not only, but that of the companies as well. It should not be forgotten that, in the language of Everett W. Burdett of Boston, "the public is best served where the corporations are most prosperous, and the corporations are most prosperous where the public is best served."

Pacific Gas and Electric Company Completes Its Control in 25 Counties.

On January 30th the Pacific Gas and Electric Company placed on file in San Francisco a deed of trust which completes the transaction giving that company the control of electric and gas plant in 25 counties in California, including San Francisco, Alameda, Santa Clara, Sacramento, Alpine, Amador, Butte, Calaveras, Colusa, Contra Costa, El Dorado, Marin, Napa, Nevada, Placer, Plumas, San Joaquin, San Mateo, Solano, Sonoma, Sutter, Tuolumne, Yolo and Yuba counties. This action was a step in carrying out the new plan of financing, which is being put into operation as rapidly as possible.

The last bond issue of this system was the California Gas and Electric general mortgage and collateral trust issue, made in March, 1903, for $10,000,000, substantially all of those bonds being issued at that time for the acquisition of various properties throughout Central California. Since that date the growth of the consolidated property has been very great. The gross earnings of the California corporation for the year 1907 amounted to more than $8,000,000, as compared with $2,888,000 gross for the year ending February 29, 1904, the first full year of operation of the consolidated company. This gain in earning power represents a tremendous increase in the property owned, power generated, etc., on account of the great development of the territory served, extension of the system into new territory, building of electric railroads, cement works and other large users of power.

A permanent financing of these expenditures has been postponed from time to time, resulting in the creation of considerable floating indebtedness, notwithstanding large investments by stockholders. The investments in the property by stockholders since the great fire have amounted to no less than $4,000,000, including appropriations out of earnings for new construction and the proceeds on assessment of the stock of the Pacific Gas and Electric Company, the holding company.

The present plan of permanent financing involves the authorization of a new unifying and refunding 30-year mortgage, with an authorized issue of $45,000,000. Of this total authorized issue, $30,282,000 is reserved with the trustee for the retirement of an equal amount of bonds now outstanding, representing 18 different issues of five and six per cent. bonds.

Of the remainder, $3,055,000 has been sold to an eastern syndicate and the proceeds will be used to refund the floating obligations of the corporation. The balance of $11,663,000 is reserved, and can be sold, according to the terms of the new mortgage, at not less than 90 to provide for 85 per cent. of the actual cost of future construction and new property acquired.

The numerous plants of this system have an aggregate capacity of 90,000 horsepower in hydroelectric development and 33,000 horsepower in steam-driven and gas-engine-driven plants in San Francisco and Oakland. Many hundred miles of high-tension electric transmission lines cover a large portion of California.

Death of William Lahmeyer.

Germany has lost one of the pioneers of its flourishing electrical industry. At the comparatively early age of 49 years Wilhelm Lahmeyer died in Bonn on December 9th last. A belated announcement to this effect has appeared in one of our German contemporaries, says the London Electrical Engineer of January 24th. Lahmeyer was the son of a mining official in Clausthal. His initial experience in engineering work was obtained in connection with the mine plant. After his early schooling in Clausthal he studied mathematics in Göttingen and Gieszen, then devoted his attention to electrotechnics in Hanover and Aix-la-Chapelle. The invention of an arc lamp by him resulted in the establishment of the firm of Garbe, Lahmeyer & Co. at Aix-la-Chapelle. This firm soon took up the manufacture of dynamo-machinery, and proved very successful.

"The chief service which Lahmeyer rendered the electrical industry," says the English journal, "was in designing and introducing with splendid tenacity the Lahmeyer dynamo. This machine differed considerably from any of its prototypes—for instance, the flat-ring and horseshoe types—and must be regarded as the standard design for all modern continuous-current machines. In the autumn of 1890 Lahmeyer founded the firm of W. Lahmeyer & Co. at Frankfort-on-the-Main, now the Felten-Guilleaume-Lahmeyer Works, which, unlike the Aix-la-Chapelle establishment, is laid out for the manufacture of the largest machines. Lahmeyer attempted to solve the problem of electrical power distribution with the help of high-tension continuous-current and rotary transformers, and obtained a considerable [illegible] We need but recall here the [illegible] line from Offenbach to the [illegible] Frankfort in 1891. When polyphase [illegible] began to be talked of in 1891 Lahmeyer [illegible] and by [illegible] perpetuate his fame."

Economy in Hotel Wiring.

The conditions which apply to the wiring of a modern high-class hotel are peculiarly favorable to the design of an economical circuit layout. The duplication of room arrangements on different floors allows a symmetrical layout of risers, feeders and distributing circuits; and if the conduits are located so that the runs to the various groups of lights are of the minimum length consistent with flexible control, a well-rounded and efficient wiring scheme is practically certain. The opportunity exists in installations of this character to save money on the first cost of wiring, including controlling switches and conduits, without increasing the maximum voltage drop beyond the two or three per cent. acceptable in good practice.

In many of the older hotel installations the location of chamber lights is inferior from the viewpoint of economical illumination of sufficient quantity to meet the requirements of good service. A single drop light of 16 candlepower, with no shade, hung in the middle of a hotel room, represents about the extreme of poor illumination, regardless of the size of the room. Installations of this kind are seldom provided with wall switches, and the wiring is necessarily simple and inexpensive, whether the distribution is effected by branches from a single corridor line feeding to the right and left from the main circuit or by connections through the walls of adjoining rooms.

The best modern installations provide for a central cluster of lamps in each room with diffusing shades, one or more wall-bracket outlets at the dressing table or mirrors, automatic closet lighting, one or two lamps in private bathrooms and possibly a drop light with flexible connection for table use. The wiring requirements call for the installation of a wall switch at the inside of the door of each room to obviate moving about in the dark, and the provision of separate keys or switches for the various auxiliary lamps.

If the mains are run down the corridors, the wall switches can be included in the feed of each room without extra complication, provided that accessible keys are located in the sockets of the lamps in the central overhead cluster. In case the latter are too high above the floor for easy reach, and it is desired to operate one or more of the side lights independently, a separate branch must be run from the main to the auxiliary outlets without connecting with the main switch at the door.

In a high-class hotel it is very desirable to be able to light any combination of the lamps in each room, and the additional cost of a circuit subdivision is small if the minimum wiring is sketched on paper with care before it is installed. Distribution for corridor mains enables the room circuits to be laid out with the least copper and conduit material for a given flexibility of operation, no doubling back to the door switch being necessary in connection with the central cluster. The use of corridor mains renders each room independent of any other in regard to interruptions, which is an important point in hotel service.

The use of a single size of wire in hotel corridor and room distribution is a great convenience in case repairs are necessary. It is desirable, so far as is practicable, to use the same size in mains and risers. It pays to figure the cost and voltage drop of several schemes of local circuit arrangement from the bus-bars of each distribution and cut-out cabinet. If a fuse blows, on account of a short-circuit in the wiring of any single room, it ought not to cut out adjoining rooms on the same main. The cost of fusing each room separately is not, as a rule, prohibitive in first-class houses, but in some cases the chance of such short-circuits is so remote that it may be as well to fuse a group of rooms together.

Subdivision of circuits is desirable in the wiring of dining rooms, assembly halls, lobbies and public corridors, and the saving in current made possible by a flexible switch installation may easily pay for the extra wiring necessary in the case of a large public room. Symmetry of distribution-circuit arrangement is on the whole the most economical.

"Public Service" Dinner of the Institute.

[illegible] designated as the "Public Service Dinner," and [illegible] public-service utilities either as members of com- [illegible] not including wine or cigars. As usual, ladies will be present. Guests will be seated at small tables accommodating eight persons. The dinner committee is composed of [illegible] A. A. Gray, Frederick C. Bates and George H. Guy.

Mr. H. G. Stott, the president of the Institute, will be toastmaster, and toasts will be responded to as follows: Walter C. Kerr, New York, "The Ethics of Public Service;" Theodore P. Shonts, New York, "The Electric Railways and the Public;" Frank W. Stevens, "State Control of the Public-service Corporations, Past and Present;" Charles R. Huntley, Buffalo, "The Electric-lighting Companies and the Public;" B. A. Behrend, Cincinnati, "Altruism versus Egoism in Public Service;" T. C. Martin, New York, "The Technical Press and the Public;" Charles P. Steinmetz, Schenectady, "The Engineer and the Public." Governor Hughes will be present if possible.

Direct Current Selected for Railway Operation in Belgium.

Mr. Frank J. Sprague, the well-known consulting engineer of New York, has just received confirmation by cable from Mr. Bertrand, administrator of traction and material for the Belgian State Railways, that after long investigation it has been decided to adopt direct current and the third rail for the initial electric-railway equipment at the Parc de Laeken, near Brussels.

This decision was made in accordance with the recommendations of a report by Mr. Em. Uytborck, electrical engineer of the government railways, who some months ago visited the United States and spent considerable time investigating the operation of the New York Central, New Haven and other installations, visiting the various manufacturing companies and fully acquainting himself with the state of direct-current and single-phase development in this country.

License has been taken on behalf of the Belgian government to use the Wilgus-Sprague type of protected third rail, and orders for much of the necessary material have already been placed in this country.

This decision, made in opposition to the strong technical influence of near-by German engineers, and in face of the claim made for single-phase operation, is regarded as of more than ordinary importance.

Engineers' Society of Milwaukee

Organized three years ago for the advancement of the science of engineering by bringing together those interested and by the reading and discussion of papers, the Engineers' Society of Milwaukee has now 107 members and is in a flourishing condition. For the season of 1908 it has arranged for discussions of various subjects, as "Electric Motor Controlling Devices," "Steam Shovels and Dredges," "The Recent International Balloon Race" and others. A number of the electrical engineers of Milwaukee belong to the society, which is a member of the Association of Engineering Societies. Following is a list of the names of the officers: President, S. L. G. Knox; vice-president, C. W. Burkett; treasurer, E. P. Worden; secretary, W. Fay Martin; directors, W. G. Starkweather, F. W. Ells, A. E. Manchester, Thomas W. Capen, R. E. Newton, C. A. Cahill, M. A. Beck, George P. Dravo, James De Voy.

Chicago Suburban Railways Consolidated.

Consolidation of the Calumet Electric Railway Company and the South Chicago City Railway Company is said to have been effected. Improvements are intended and the new company, to be known as the Calumet and South Chicago Electric Railway Company, will seek a new ordinance covering the consolidation. The two companies operate south of Sixty-third Street and the properties are said to represent a value of about $5,000,000. Mr. H. M. Sloan of the Calumet company, well known to electrical men, will no doubt remain as general manager of the Consolidated company.

International Electrical Standardization.

In an article in the London Times Engineering Supplement of January 29th Col. R. E. Crompton, president of the British Institution of Electrical Engineers, gives some interesting information on the subject of the international standardization of the nomenclature and ratings of electrical apparatus and machinery. Much that he says is familiar to readers of the Western Electrician, but the following will be of interest:

Mr. A. P. Trotter, the electrical adviser to the Board of Trade, is now engaged in drawing up a glossary of the terms in general use in the industry, with full explanations attached to each, so as to avoid future ambiguity. The commission will eventually publish the glossary of electrical technical terms in English and in French, and it is believed that the other national committees will, under the authority of the International Commission, draft and publish authorized translations of these terms into the language of their own country as well as in the official languages of the commission.

In order that work of this kind should meet with success it is necessary that complications should be eliminated wherever possible, and the fact that the official international languages have been restricted to two—French and English—is a great step toward simplification and augurs well for the ultimate success of this great undertaking.

It must not be forgotten that the work in each country will be carried out nationally. Each national committee will itself prepare its own translation of the suggestions circulated by any of the national committees through the central office which thinks fit to take initiative in any portion of the work of standardization. The duty of the International Commission will be to see that no errors creep in during the process of translation. As soon as this glossary of terms and definitions has been prepared and translated, then and then only will the more difficult matter of the standardization of electrical machinery be entered upon.

It is acknowledged that the international agreement with regard to the electrical machinery itself will be a much more difficult matter to deal with, but if it be approached in the friendly spirit which has characterized the whole course of the discussions, verbal and by correspondence, which have hitherto taken place on this question of international standardization, we have good reason to believe that a useful result will be arrived at by a reasonable amount of give and take. The International Commission, being a permanent body, any rules internationally adopted will be open to revision from time to time.

Lord Kelvin's position was so pre-eminent in the international world of science that his election as the first president was a matter of course. It is pleasing to be able to add that proposals will shortly be made to perpetuate his connection with the electrical industry by giving the name of "kelvin" to the commercial unit of electrical energy hitherto known in this country as the Board of Trade unit and abroad chiefly as the kilowatt-hour.

Annual Report of Western Electric Company.

All of the old directors were re-elected at the annual meeting of the Western Electric Company in Chicago on February 6th. Secretary H. A. Halligan presented the following annual report to the stockholders:

"The company's sales for the fiscal year ended November 30, 1907, were $52,724,168, as compared with $69,245,332, for the previous year, a decrease of 23.9 per cent.

"This reduction in the volume of business was due chiefly to the decrease in the sales to the Bell telephone companies, which made very large expenditures for new construction in 1906. A single statement will illustrate the great decline in this business. The sales to the telephone companies for the last six months of 1907 were about one-third the sales for the same period of 1906.

"The reduction in the volume of this business has left us with large stocks of merchandise and a large amount of idle plant. The merchandise inventories have been taken according to the same policy which has been followed for many years, and the work of taking the inventory has been carried on by employes who have done this work [illegible] years.

"The inventory valuations of the merchandise represent conservative and fair values for the merchandise on hand at the end of the year (November 30, 1907), and they do not cover any reserve [illegible] in the volume of business or fall in prices of material during the coming year.

"Our other business in this country and our [illegible] years. Taking the business of the company for [illegible] sales, due to the sudden falling off of sales, the [illegible] and material entering into these stocks, and to the high rates of interest on our large indebtedness of a year ago.

"The indebtedness of the company has been reduced during the year by $10,690,000, while the cash and receivables are more than sufficient to pay all liabilities.

"In December, 1907, there were in the company's employment 16,259 people, as compared with 26,038 in December, 1906, a decrease of 40 per cent.

"It is expected that our volume of business for 1908 will be smaller than for 1907, owing to the prevailing financial conditions."

"Don'ts" for Users of Electrical Instruments.

[From Electricity of London, rearranged, with additions, by Mr. R. C. Lanphier of Springfield, Ill.]

1. Don't stand a moving coil instrument on top of an excited dynamo—unless you have no further use for it.

2. Don't connect up an ammeter without its shunt, or a voltmeter without its external resistance. It will only "cost you more."

3. Don't forget to connect an ammeter onto its shunt. A moving-coil instrument does not want much current, but it can do with just a little.

4. Don't connect an ammeter across the mains as you would a voltmeter You won't hurt the generator much, but the instrument.

5. Don't connect a voltmeter onto an ammeter shunt. Nothing will happen if you do; that's just the trouble.

6. Don't file up a shunt because it won't fit. You'll increase the drop; and a "drop" too much isn't good for anybody.

7. Don't bolt a shunt onto the back stem of a fuse and blame it for getting hot.

8. Don't reduce or add to the length of leads furnished with a shunted ammeter or wattmeter for connecting to shunt. If you do, you will make your meter record high or low.

9. Don't abuse the maker because your ammeter is off zero. He has given you a simple means to rectify this. You might just as well send for a clockmaker because your watch was five minutes fast.

10. Don't forget that a watch won't go until wound up, nor will a voltmeter until connected in circuit.

11. Don't expect a voltmeter to work with a blown or absent fuse in series. The resistance of a fuse which is not there is sufficiently great to interfere with the satisfactory working of the instrument.

12. Don't be surprised if a permanent-magnet instrument won't measure alternating current; it begins to hesitate and cannot make up its mind which way to go.

13. Don't connect an alternating-current voltmeter, or the pressure coil of an alternating-current wattmeter, on a high-potential line without a potential transformer.

14. Don't put an alternating-current wattmeter with its series winding directly in a high-tension line on account of danger of grounding.

15. Don't connect an integrating meter without putting load on at the start to see if it is in operating condition.

16. Don't forget to release the moving element by bringing jewel screw to proper position in those types of integrating meters requiring this.

17. Don't expect integrating meters to run correctly without systematic inspection and test. They do the best they can, but every machine on earth requires attention, and a meter is a mighty delicate machine.

18. Don't forget that there is a difference between a recording wattmeter and an integrating wattmeter. The manufacturer can supply you with either, but would like to know which you want.

19. Don't expect an instrument to read if it has a pointer catch holding the pointer to zero. Some instruments are so provided, and it is considered good practice to release it.

20. Don't send away a switchboard with the instruments bolted on to it. If you have ever traveled by freight train, sitting on a marble seat, you will understand why.

21. Don't open up an instrument just to "see how it works." It probably won't do so any longer. Instruments are apt to resent the intrusion, hence the seals.

22. Don't suppose that an instrument is sealed because the manufacturer is ashamed of the inside. It is because he is proud of it. The seals are really provided for the protection of the user, if he only knew it.

23. Don't lay an oil-damped instrument on its back without emptying out the oil. It may be the very best oil, but it will disagree with the inside.

24. Don't specify a brass-cased instrument for use in a coal mine. It makes the coal look so dirty beside it for the first week; after that, it's the other way round.

25. Don't think that working instructions are put out merely to worry you. You may know all about it without reading them, or you may think so, which is not always quite the same thing.

26. Don't drop a meter and then tell the maker you didn't. He may not know as much as you, but he does know a little, and he keeps a tame Sherlock Holmes who is a perfect marvel.

27. Don't, when sending particulars of your requirements to the manufacturer, give as few, but as many, as possible. He is pretty good at conundrums, but might guess wrong.

28. Don't be afraid to consult the instrument maker when you are in a hole. He does not know everything, but he earns his bread and butter by knowing all about instruments.

29. Don't forget that you deal in amperes and volts just as a grocer deals in tea and sugar. He cannot afford to be without a good pair of scales, neither can you without accurate testing instruments.

30. Don't trouble about these "don'ts" if you think you know all about measuring instruments; but if you do, don't, because you don't.

Hydro-electric Development at Marble Falls, Tex.

What is said to be the largest hydro-electric plant in the Southwest is being installed on the Colorado River at Marble Falls, 40 miles northwest of Austin, Tex. There are natural falls in the river at the point and a natural dam of granite is to be raised to a height of 36 feet by the construction of a cap of reinforced concrete. The electric power generated will be transmitted to Austin, San Antonio and many smaller towns throughout the central and southwestern parts of Texas. Large granite quarries are being worked near Marble Falls and the power from the hydro-electric plant will also be used to operate the machinery of these quarries. The lake formed by the construction of the dam will be the largest body of fresh water in the Southwest. It is planned to make it a great pleasure resort.

The concern which is erecting this plant is called the Granite Manufacturing Company. G. W. Voires is manager. It is stated that the company has planned to establish a number of manufacturing plants in the vicinity of the power station. These include cotton and woolen mills, oil mills and flour mills.

New Light Rates Suggested in Chicago.

An ordinance is before the committee on gas, oil and electric light of the Chicago Council running to the Commonwealth Edison Company. It fixes the rates for current for a period of five years and also the compensation to the city. As drawn, the rate per kilowatt-hour for the first 30 hours' use per month of the maximum demand is 15 cents for the first year and not more than 13 cents for the next four. For consumption in excess of 30 hours per month the charge is fixed at nine cents for the first year, eight cents for the second and seven for the last three.

Rates for occasional or emergency use are not to be governed by the schedule in the ordinance, but the company can fix them arbitrarily. The company agrees to put its wires underground when so ordered by the city and to pay three per cent. compensation on all of its business.

Consideration of the terms of the ordinance was to have been taken up by the committee this week. It was drawn by Assistant Corporation Counsel Miller and William G. Beale, counsel for the Edison company.

Oak Park Elevated Railroad.

The annual report of the Chicago and Oak Park Elevated Railroad Company for the year ended June 30, 1907, was issued to the stockholders last week. After meeting all expenses and charges there was a deficit in earnings of $63,945. Gross earnings for the year were $892,569, compared with $890,554 for the previous year. Operating expenses were $527,180, against $505,538 the year before. Maintenance and equipment charges increased on account of an increase of 58,031 miles in train mileage and 100,660 miles car mileage.

The small increase in passenger earnings is attributed by President Knight to the electrification of the paralleling Madison Street surface line and the placing of modern equipment on this and the Lake Street surface lines. It is hoped during the coming year to bring about an extension of the company's lines through the territory lying west of Oak Park.

Western Pacific Railroad May Use Electricity.

A San Francisco dispatch dated February 8th says that the Western Pacific Railroad plans to be the pioneer long-distance railroad in the West to use electricity as a motive power. The dispatch follows: "The statement was made today upon the authority of Guy C. Earle, vice-president of the Great Western Power Company at Big Bend on the Feather River, that the Western Pacific, now being built from the east to this city, will use electricity for motive power. The Western Pacific is now perfecting its plans for the electrification of its system."

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

LV.—Electric Heating.

In drawing this series of articles to a close a brief consideration of the subject of electric heating deserves attention. Electric railway car heaters have already been described under the general head of electric railways, and this application of electricity to heating was about the earliest form of electric heating to be extensively adopted in a commercial way.

The theory of the electric heater is extremely simple. When a current of electricity has any kind of resistance inserted in its circuit a certain amount of energy is expended by the current in passing through this resistance, and this loss of energy appears as heat. An electric heater may therefore be considered merely as a resistance inserted in an electric circuit.

Take, for example, the incandescent lamp. Its filament, which has a very high resistance, is inserted in an electric circuit and the current passing through this resistance heats it to a temperature at which it becomes incandescent. The electric arc, which attains an enormously high temperature, is also another example of heating by means of introducing a resistance in an electric circuit.

It is apparent, however, that neither of the above examples would be of any commercial value as heaters, because the temperature of the material composing the resistance is so high that it would quickly burn up. In order to produce a practical electric heater the resistance must be made of some material which is capable of attaining a moderately high temperature without deterioration, and it must be proportioned so that the temperature attained in service will not exceed that which the resistance material can safely carry.

Iron is the metal most commonly used for heater resistances for the reason that it is cheap and strong, offers a comparatively high resistance and may be heated to fairly high temperatures without affecting its structure. In certain applications of electric heating it is necessary to raise the resistance material to such a temperature that it would soon become oxidized and thus gradually be destroyed if exposed to the air. Where such high temperatures are required it is usual to cover the resistance with some material which prevents it coming in contact with the air. This may be done in various ways, one of the most convenient being to cover the whole resistance with some kind of enamel, which is baked on at very high temperature, so that all of the material composing the resistance is embedded in a solid mass of enamel.

In most cases, however, it is preferable to operate the resistance at a lower temperature and to use a greater number of heating elements. If the heaters are used, for example, to warm the air in a room, more satisfactory results will be obtained by using two heaters at a moderate temperature than by using one heater at a very high temperature, and the heaters which are worked at the lower temperature will not depreciate nearly so fast as those worked at the higher temperature.

Electric heaters have the advantage of being perfectly clean and instantly available. They do not vitiate the air and the amount of heat may be regulated at will. However, unless current can be obtained at a low price the cost of heating houses or large buildings will be prohibitive. Small heaters, however, are used to considerable extent for heating small offices, bathrooms and other places where the heat is only required for short periods of time.

The most extensive application of electric heating is in connection with various household utensils and small machines requiring heat, and for many of these applications the cost is so small in comparison with the advantages offered that its use is becoming quite widely extended.

Among domestic utensils the sadiron or flatiron was one of the earliest to be adapted for electric heating, and at the present time these electric irons are very widely used. As these irons can be heated to their proper working temperature in two or three minutes, and will maintain a uniform temperature as long as the current is turned on, they can be used continuously, or as long as needed, without further attention. All of the heat generated is localized at the particular spot where it is needed for use, so that there is no heating of the room or pollution of the atmosphere. The cost of operating these irons is very trifling and probably amounts to but little, if any, more than the cost of running a stove or gas heater for heating several irons.

The heating elements [illegible] for most all of the [illegible] of iron wire [illegible] which can be wound in coil [illegible] manner that [illegible] portion of [illegible] small [illegible] fold of the wire [illegible] all the rest. These heating elements are frequently made up in small compact [illegible] laid in suitably insulated pockets or openings in the apparatus to be heated.

Cooking utensils of nearly all descriptions are now made electrically heated, so that it is possible to perform almost every kind of cooking operation entirely without the aid of stoves or fire. Frypans, stew-pans, baking ovens, broilers, waffle-irons, griddles, toasters and many other utensils are built with double walls, between which the heating elements are enclosed.

The perfect cleanliness of this method of cooking will appeal to many people, as there is an entire absence of coal, ashes, gas flame or dirt or odor of any kind.

In many cases the work of cooking can be done much more rapidly by means of electric heating, which will often partially or fully offset the extra cost of this method of heating. In a broiler, for instance, both sides of a steak are presented to the heating surface at the same time, so that it may be cooked much more rapidly than if placed over a fire, and boiling and baking operations are performed very rapidly because the heat is all confined in the utensil and can be almost instantly regulated to suit the work being performed. On the other hand, the economical slow cooking of the "fireless cooker" can be used very well with the electric method where desired.

In almost all cooking utensils provision is made for obtaining different degrees of heat, the usual arrangement being to permit either a low, a medium or a high heat. This is done by cutting in or out different sections of resistance, or sometimes by changing the sections of resistance from series to parallel connections, or vice versa.

A number of electrically heated utensils are extensively used in the manufacture of confectionery, these being very similar to the domestic cooking utensils previously mentioned. Among these utensils may be mentioned peanut roasters, candy cookers, chocolate kettles, dipping tables, vacuum kettles, etc.

Electric heaters are also used in the printing and publishing industry. The melting pots in which the type metal for linotype and monotype machines is melted can be heated by electricity with more satisfactory results than by any other method because the molten metal should be maintained at a very uniform temperature to produce the best results. This uniformity of temperature cannot be so readily obtained by any other method of heating because the temperature of the electric heater can be exactly regulated by the operator.

Press heads for stamping and embossing presses are largely heated by electric heaters, and they are difficult to heat satisfactorily by any other method. Glue pots and dry glue cookers arranged for electric heating are largely used in bookbinding work both separately and in combination with other machines, such as box covering and pamphlet-covering machines where the temperature of the glue must be kept very constant in order to work properly.

Electrically heated wax trimming knives and case warmers are extensively used in the electrotyping and stereotyping trades, and branding machines, singeing machines, calender and drying rolls, soldering irons, curling irons, and in fact nearly all kinds of apparatus requiring heat have been adapted for electric heating.

In many cases convenience and cleanliness have dictated the use of electric heat, while in other cases the very accurate control of temperature which it permits has been the chief reason for its adoption, as it permits of a nicety of regulation not obtainable by any other method of heating.

[The end.]

In the annual appropriation the finance committee of the Chicago Council will probably provide for 5,500 additional electric street lights. These will be supplied with current from the Lockport plant of the Sanitary District, and some of them will replace gas lights.

QUESTIONS AND ANSWERS.

Changing Alternating to Direct Current.

C. W. [illegible]

[illegible]

These consist of an alternating-current motor driving a direct-current generator. The mercury-arc rectifier (see the Western Electrician [illegible] 7, 1907, p. [illegible]) [illegible] small installations the method outlined in the answer to L. S. S., given below, may be used.

Charging Storage Batteries from Alternating Lighting Circuit.

L. S. S., St. Charles, Ill.: Is there a contrivance by which one can charge a storage battery from a drop light that is on an alternating-current circuit?

Answer.

The simplest device for such a circuit as a drop light is an electrolytic rectifier, otherwise known as "aluminum cell." This contains as electrodes a plate of aluminum and one of iron or carbon in a solution of ammonium borate, bicarbonate, or phosphate. The best results are obtained with a solution of ammonium borate made as follows: Dissolve one pound of crystallized boric acid in 10 quarts of water and add one quart of ammonia (specific gravity 0.91). This cell acts to check one-half of the alternating-current wave. Current can flow from the iron to the aluminum but not in the reverse way. A cell of this kind connected in series with the storage battery and a lamp or other resistance for adjusting the current and this set properly connected across the alternating-current light circuit will be found to answer the purpose. Its first cost and efficiency are both low.

A more efficient set would be a small motor-generator unit, which would be much more expensive in first cost, however. Owing to the limited current-carrying capacity of a drop-light circuit, all storage-battery charging from it is very slow unless the battery is very small.

Definitions of Electrical Units.

F. K., Chicago: Please define ampere, volt, watt.

Answer.

The ampere is the unit of electric current. In value it is equal to the unvarying current, which, if passed through a solution of silver-nitrate in water, will deposit 0.001118 gram of silver per second. Roughly, it is about the current that two common 16-candlepower carbon incandescent lamps in parallel on a 110-volt circuit take.

The volt is the unit of electric pressure or electromotive force. It is that pressure which when applied to a conductor having a resistance of one ohm (such as a uniform column of mercury 106.3 centimeters long at 0° C. and weighing 14.4521 grams) will pass through it one ampere of current. It is also defined as $\frac{1000}{1434}$ of the electromotive force of a Clark standard cell at 15° C. Roughly, it is about equal to the electromotive force of a Daniell cell.

The watt is the unit of electric power. It is the work done in one second by a current of one ampere in a circuit having a difference of pressure of one volt. The number of watts expended in a direct-current circuit is the product of the volts at its terminals by the amperes passing through it. The watt is $\frac{1}{746}$ of a horsepower.

The Chilean government is studying the possibility of changing the first and second sections of the state railways for the use of electrical instead of steam power. The first section connects Valparaiso with Santiago and is about 100 miles long, and the second section extends from Santiago to Conception and is about 350 miles in length. Double track is being laid on the first section. At present the coal bills for the state railways are heavy, since a large proportion of the coal used is imported at a high cost.

Consumption of Poles in 1906.[1]

The information in this circular concerning the consumption of poles during 1906 is based upon the number of poles purchased rather than the actual number produced during the year. It seems safe to assume, however, that the two were practically identical. Inquiries were sent out to more than 6,000 companies operating telegraph and telephone lines, electric-light and power systems, trolley and street-railway lines, and to railroad companies which operate their own telegraph or telephone lines. Practically all replied. The number of poles purchased during the year, as shown by these statistics, was 3,574,666, valued at $9,471,171 at the point of purchase.[2] These figures do not include poles less than 20 feet long. Shorter poles are used for local lines and for temporary work, but they constitute only a small percentage of the total.

In both round and sawed poles cedar ranks first and chestnut second. These two together furnish nearly nine-tenths of all the poles used, cedar supplying about three-fifths and chestnut over one-fourth.

In an average value per pole at the point of purchase, pine stands highest. This is due not to greater intrinsic value of the wood, but to the greater proportion of large pine poles as compared with other kinds. Oak shows the lowest average value. The average price per pole for all kinds of timber in the United States was $2.65. Round poles brought an average of $2.63 and sawed poles $4.22 each.

Cedar and chestnut are the principal trees cut for round poles; pine and redwood the chief ones sawed. Redwood is seldom found small enough to use for round poles. The sapwood of pine decays rapidly; consequently a sawed pine pole from which the sapwood has been removed will last longer than a round one.

The shortest or 25-foot class of poles takes in three-fourths of the redwood poles, three-fifths of the cedar, one-half of the chestnut, and two-fifths of the juniper. With cypress the quantities are more evenly distributed among the 25, 30 and 35-foot sizes.

The accompanying table shows the kind, quantity and value of the poles bought by the four principal classes of consumers—telegraph and telephone companies, steam-railroad companies, street-railway companies and electric-light and power companies. The street railways are grouped with the electric-light and power companies, because not infrequently one company serves in a double capacity and separation was impossible.

men's Association, which operates in the Lake states, as shown by the association statistics, was more than 1,700,000. The greater part of the production outside the Lake states can be credited to two sources—Maine and the adjoining states, including the Adirondacks in New York, and the Idaho cedar territory. From these districts cedar poles are shipped to practically every state in the Union.

The regions from which the supply of chestnut poles is drawn are even narrower. A small territory, embracing parts of Pennsylvania, Maryland, Virginia and West Virginia, furnishes nearly all of these poles. Cypress poles necessarily come from the South, probably the greater part from the Gulf states; juniper, from Virginia, the Carolinas and other South Atlantic states. Redwood comes wholly from California.

With the regions of supply so restricted, transportation becomes an important factor. The cost of the pole is sometimes doubled by freight charges. This difficulty is obviated in a measure by the use of local woods, cypress and pine in the Southern states, for instance, and chestnut and juniper in the Atlantic states. On the Pacific Coast cedar is supplemented to a considerable extent by pine and redwood. But such local supplies are insufficient and cedar and pine are found everywhere.

There are no data available which show even approximately the quantity of cedar still standing in this country or Canada to meet the enormous demand of 2,000,000 poles each year. It is certain, however, that when the present supply is exhausted it will be gone forever, since the cedar, though it reproduces fairly well, grows so slowly that other kinds of trees, chestnut, for instance, will be more profitable to produce by systematic management.

Suitability of Various Woods.

There are several qualities which timber must possess to adapt it to use for poles. The most important of these are: Durability in contact with the soil, minimum weight, straightness coupled with relatively small size and little taper. The wood must be soft, so that the spikes of a climber may enter readily, and at the same time it must have strength to support considerable weight. These qualities are admirably combined in cedar and in juniper, which commercially is a cedar. No other woods possess so many.

Chestnut and cypress are both durable; chestnut is not so straight as cedar and is liable to be knotty. The wood, though soft, is not as soft as cedar. It has greater strength, but this advantage

Poles Purchased by Various Classes of Consumers in 1906.

Kind.	Total.			Telephone and Telegraph Companies.			Steam Railroad Companies.			Street Railroads, Electric Light and Power Cos.		
	Quantity.	Value at Point of Purchase	Average Value per Pole.	Quantity.	Value at Point of Purchase	Average Value per Pole.	Quantity.	Value at Point of Purchase	Average Value per Pole.	Quantity.	Value at Point of Purchase	Average Value per Pole.
	No.	Dollars.	Dol.	No.	Dollars.	Dol.	No.	Dollars.	Dol.	No.	Dollars.	Dol.
Cedar	2,174,279	5,579,891	2.57	1,532,906	3,079,852	2.01	144,359	371,246	2.57	497,014	2,128,793	4.28
Chestnut	988,084	2,625,568	2.66	661,898	1,510,484	2.28	63,151	139,579	2.21	263,035	975,505	3.71
Cypress	111,657	256,950	2.30	21,395	36,559	1.71	11,976	20,271	1.69	78,286	200,120	2.56
Juniper	57,064	163,437	2.86	38,331	91,854	2.40	465	638	1.37	18,268	70,945	3.88
Pine	177,809	686,803	3.86	121,609	478,427	3.93	16,826	22,866	1.36	39,374	185,510	4.71
Oak	9,924	13,951	1.41	2,980	1,500	.50	2,736	2,549	.92	4,208	9,902	2.35
Fir	9,601	21,637	2.25	9	94	10.44	1,284	2,533	1.97	8,308	19,010	2.29
Redwood	24,760	87,189	3.56	7,140	24,390	3.42	9,871	21,920	2.22	7,749	40,879	5.28
All other	21,488	35,745	1.68	9,454	11,789	1.25	3,600	4,225	1.17	8,434	19,731	2.34
Total	3,574,666	9,471,171	2.65	2,395,722	5,234,949	2.19	254,268	585,827	2.30	924,676	3,650,395	3.95

The telegraph and telephone companies purchased about two-thirds of the total number reported and the street-railway, light and power companies about one-fourth. The remainder is credited to railroad companies which own and operate their own telegraph or telephone lines.

Supply.

The regions of supply of the two principal pole timbers—cedar and chestnut—are fairly well defined and are, unfortunately, extremely limited. The present source of supply of cedar poles in the United States is confined almost entirely to the Lake states. The total purchase of cedar poles reported for the United States in 1906 was 2,174,279. The production of the Northwestern Cedar-

[1] Parts of a circular (No. 137) issued by the Forest Service of the United States Department of Agriculture, and [illegible]. The Bureau of the Census and the Forest Service co-operated in the preparation of the re- [illegible] collection and compilation of the statistics were [illegible] of W. M. Stewart, chief [illegible] and J. E. Whelchel, expert [illegible] of the Bureau of Census, and [illegible] of Wood Utilization, and [illegible] on the part of the Forest Service.

[2] [illegible] the figure of $9,471,171 [illegible]

is more than counterbalanced by its greater weight, which prohibits long shipments. Cypress frequently is too large for use as a pole and has greater value for lumber. Even when its general diameter is small enough the butt will often be so big that it adds too much weight. Pine, besides being heavier than cedar, is so much less durable that it cannot compete as a pole wood without preservative treatment. Redwood possesses durability, lightness and softness, but its size necessitates sawing, which adds to the cost.

Preservative Treatment.

One of the results of the increased cost of poles and the difficulty of obtaining a sufficient quantity of satisfactory stock has been an effort to increase the period of service of poles by preservatives, generally by applying a liquid to the whole of the pole or, more generally, to the butt, which is most liable to decay. Poles which have not been treated with preservatives may be expected to give from 10 to 15 years of service, roughly speaking.

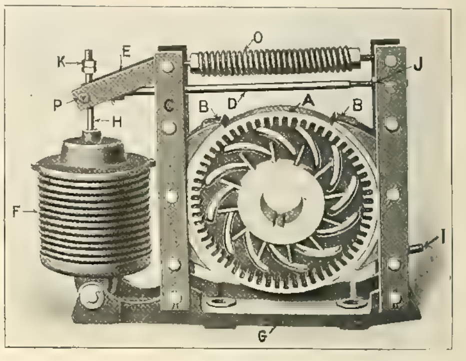
Creosote is probably more extensively used than any other preservative, though ordinary paint is a common agent. For the butt tar is often employed, and charring by fire is found useful. The American Telephone and Telegraph Company is carrying on extensive experiments in co-operation with the Forest Service to determine the best methods and materials. Several experimental lines of variously treated poles have been erected, and careful record of the behavior of each pole is being kept. By the comparatively new open-tank treatment the preservative is forced into the wood of the butt by a much simpler and more inexpensive method than was formerly used.

Successful preservatives make possible the use for poles of a great number of otherwise unsuitable timbers, many of them among the cheaper and more abundant woods.

Westinghouse Post Brake for Rolling-mill Motor.

The latest addition to the Westinghouse Electric and Manufacturing Company's list of apparatus for rolling mills is an improved brake especially designed to meet the severe requirements of motor work in iron and steel-mill service. It is of the solenoid post type, designated as Westinghouse post brake type SP.

A brake wheel and two friction shoes are mounted within a structural frame supported by a steel base, being controlled by a heavy steel spring and a solenoid in a cast-steel frame, which completely encloses the coil. The brake is built entirely of

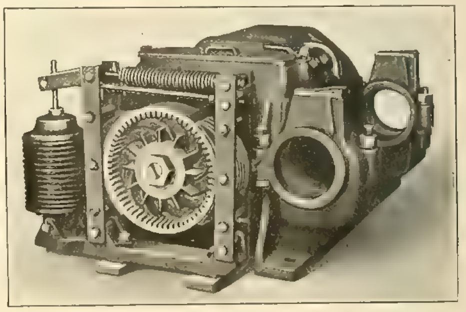


A, wheel; B, shoe; C, beam; D, compression member; E, tension member; F, casing-enclosed solenoid; G, motor frame supporting the brake; H, connecting rod; I, screw for adjusting clearance; J, screw to take up wear of shoe; K, nut for adjusting travel to beam; O, pressure spring; P, fulcrum of lever.

FRONT VIEW OF WESTINGHOUSE ROLLING-MILL MOTOR BRAKE.

cast-iron and steel. Cast-iron is used in the wheel and shoes, where its better wearing qualities and cheapness of renewal make it preferable. The shoes and wheel are operated perfectly dry, and cast-iron is found also to be the best for metallic surfaces unlubricated. The wear on the wheel is about one-sixteenth of that of the shoe. The open construction permits easy inspection of all parts.

The shoes are clamped to the wheel during the brake period by means of a steel spring, and are released by the solenoid. The full force of the brake is applied at the moment of contact between the shoes and the wheel, and as soon as contact is made the spring ceases to contract. It follows that the braking force never gets beyond its normal value, and the stress on the brake parts and



WESTINGHOUSE BRAKE ATTACHED TO MILL MOTOR.

motor shaft is much less than is the case with ordinary brakes. Likewise, the load is stopped in a much shorter time. To do away with the hammer-blow effect experienced in other types of brakes, the plunger is provided with lost motion to permit of overtravel. No lubrication of either shoes or wheel is required.

In the design of the brake special attention has been paid to heating tendencies, and ample provision made to counteract their effect. The rim of the wheel is corrugated on the under side for the double purpose of increasing its strength and giving the maximum radiating surface. The arms are numerous and curved to permit an expansion of the rim, due to heating, without producing undue stresses in the arm or rim. On each side of the arms and extending from the hub are vanes which produce a current of air directed against the corrugations inside the rim while the wheel is running. This increases the radiation of heat generated and keeps the heat away from the motor bearing.

In operation the shoe is free to turn on a pivot and find a true seat on the wheel. The

pressure against the wheel is thus uniformly distributed and unusual wear in any one part of the shoe is prevented. The magnet is of cast steel, the frame completely enclosing the coil. It is pivoted at the base, which prevents any tendency to bind as it follows the wear of the shoe.

The coil may be either series or shunt wound for a direct current circuit of 110, 220 or 500 volts. The series winding is preferable to the shunt, due to its quicker action, and is considered a standard. The series coils will release the brake at 0.6 of the full-load current of the motor, and will hold it open at 0.1 full load current.

The brake is secured to the motor by means of suitable brackets, which may be made integral with the motor frame when so specified. This arrangement is recommended, as it precludes all possibility of the brake getting out of alignment.

These brakes are at present made in five sizes, for 25, 50, 75, 100 and 150 horsepower motors, and may be applied to any type of motor used in mill or crane service.

Outside Telephone Construction.[1]

By C. E. Fleager

In talking tonight on the subject of outside construction I wish to cover the portion of the telephone plant outside of the central office, but not including the subscriber's station. This portion may be divided into two general divisions—underground and aerial.

Underground construction is subdivided into underground conduit and underground cable.

Underground Conduit.

As the name suggests, underground conduit is that portion of the plant placed underground, consisting of conduit or pipe for the receiving of wires, usually in the form of cable. In addition to the conduit proper, manholes must be placed at intervals to allow of branch conduit (termed laterals) being taken to buildings or poles and to allow of the cable being hauled and spliced.

Conduit is made of various substances, but may be divided into three general classes:

(A) Wooden and fibrous ducts.
(B) Cement ducts.
(C) Vitrified clay ducts.

To the first class belong several types of specially constructed wooden ducts, a few of which are round duct, square duct, Valentine built-up duct, etc. The round duct is manufactured from solid logs by means of special machinery, the tool for cutting the inner circle being made up of a pipe with a cutting knife fastened to the forward end and a square or rectangular band riveted spirally around the outer surface of the pipe, for removing shavings. It is usually the case that the ducts used in telephone work, being smaller, are taken from the core of some longer pipe. At Olympia, Wash., there is a concern engaged in making round wooden pipe, the larger portion of its output being used as water pipe. The ends of the round ducts are fitted with male and female joints for joining to make continuous pipe.

The square ducts are made from square timbers cut to the proper dimensions and the inside circle removed in an identical manner to that for round ducts. The advantage of square ducts over round ducts is in their better adaptability in piling up when several ducts are grouped in the same run. One disadvantage is in the cost being slightly higher, due to more material being involved.

This will not be the case, however, where the round ducts are made separately from any other product, as the saving results from using the by-product from some other operation.

Wooden ducts have the great advantage of being low in cost per foot laid. They should be thoroughly saturated with dead oil of tar, etc., if a reasonable life is to be expected.

As examples of fibrous ducts may be mentioned two the writer has had experience with—a molded fiber duct and a built-up tube of asphalted paper. These two forms of ducts have the advantage of being made of very light material and being easily laid. Claim is also made, and seems to stand on good grounds, that the great trouble with underground cable (electrolysis) is eliminated with this form of duct. The molded fiber duct is found to be very brittle after lying a time underground, and therefore becomes easily thrown out of shape should excavations be made near it and not properly filled, or should street improvements require the moving of the conduit.

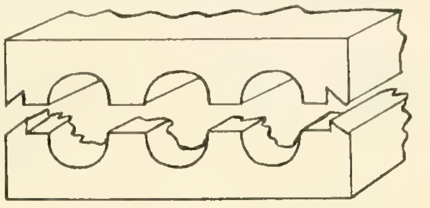
Laying Conduit Ducts.

In laying the square wooden ducts a trench is excavated the proper width and depth, and if deemed necessary a creosoted plank is laid in the bottom of the ditch. The individual ducts, usually delivered in lengths of from 2 to 10 feet, are laid in place and joined together by dipping the male joint of one piece into hot pitch or asphalt and then driving this firmly into the female joint of a piece already laid. After the proper number of ducts are in position dirt is tamped firmly along both sides of the conduit, being [illegible] the alignment. A top covering of creosoted plank to prevent [illegible] is then laid and the trench backfilled. When the number of ducts laid are small (two or three) it may be necessary to tack battens on the sides to give greater strength to the completed conduit. Joints should be staggered to give greater strength.

The round ducts are laid in similar manner, being of course, piled in a different shape than the square duct. If greater strength and protection is required concrete may be used to surround the wooden ducts.

The fibrous ducts are laid in a similar manner to the round, wooden ducts, concrete being used to surround and protect the ducts.

Special forms of wooden ducts are made. An example is the Valentine wooden ducts, made in the shape shown in the sketch. These ducts are laid very simply, the only radical difference from laying pump logs being in the making of curves. With the Valentine ducts it is necessary to mitre the joints, while with the pump logs a curve of reasonable radius



VALENTINE WOODEN DUCTS.

may be made by using the shorter length and bending slightly at each joint.

Cement ducts have not been used to a large extent, but as knowledge of how to handle cement increases, it may be possible to overcome some earlier objections, and also to bring down the cost to allow them to compete with other forms of ducts. The first form of cement duct was made by coating an iron pipe of the proper diameter with cement. This had the disadvantage of the pipe rusting and leaving sharp pieces to injure the cable when drawn or withdrawn. In a later form the coating of cement was placed inside the pipe, thus doing away with the previous trouble, but still not bringing the cost low enough to compete successfully with other styles of conduit. A still more recent form does away entirely with the iron pipe, being manufactured by pressing a hydraulic cement into a proper mold. This form did not have a socket for making joints, and hence had an objection in that the joints frequently were imperfectly aligned.

Probably the best form of permanent ducts so far invented is the multiple vitrified clay ducts. This form of duct has been worked out by previous attempts to make a satisfactory duct of vitrified clay. It consists of a partitioned square pipe having pins and holes at either end for preserving the alignment after laying. It is also made in numerous other shapes, for which various manufacturers claim advantageous points, but they are not absolutely essential, nor are they general.

This form of duct is laid in similar manner to wood or fiber ducts with a concrete protection, and it is in this regard that the cost remains higher than wood or fiber. Properly to lay the ducts, a mason is required with his attendants, and, as you well know, the price of such labor makes a large proportion of the total cost of the completed ducts.

Manholes.

Manholes have been constructed in various ways, ranging from the first wooden one through to the present concrete one. Before the advent of concrete as a reliable construction material, the best manholes were constructed of brick. The sides were built in a manner familiar to all (that used in constructing houses), and in order to give as large a space as possible, the top was constructed with brick arches between rails laid at proper distances across from side wall to side wall.

The concrete manhole is built by the use of forms, which are usually made in removable sections. The side walls are made by tamping the mixed concrete into the forms. A favorite top for telephone companies is the reinforced top, the reinforcement being scrap pieces of guy strand, of which there are usually a large quantity junked from aerial line construction on hand.

The size of the manhole depends upon the number of cables passing through and the depth of the conduit below the street level. It should be of ample size to allow of each cable being spliced and assigned a place on the wall, as, should several cables have to be moved to get at one located behind them, the labor of doing that soon more than offsets the extra cost of the larger manhole, leaving you nothing for inconvenience and danger of injury to the cables moved.

Manholes are fitted with a cast-iron top, mounted flush with the street paving and having ventilating holes to allow the escape of dangerous gases. Other equipments are pulling-in irons and posts. The first to assist in hauling cable, the second to hang the cables on.

If the nature of the soil permits, bottoms are not placed in [illegible]

Lateral Conduit.

Lateral conduits [illegible] into buildings and to turning around obstacles. When laterals are run into buildings the end should be fitted with a water-tight cap or plug, in order to prevent any possibility of water entering the building and causing damage.

Underground Cable.

Underground cable is naturally divided into two divisions, closely following the underground conduit subdivisions, namely, (a) main cable, (b) lateral cable.

Main cable is that portion extending from the central office through the main conduit, from manhole to manhole, while the lateral cable is that portion extending from the manhole to the various distributing points (building or pole).

The underground cable of today has been developed through effort after effort from a source of trouble and expense to one of the reliable parts of the plant. The form it now takes is that of a number of wires, each with its proper insulation, arranged in pairs, twisted at least once in every three inches, the pairs being arranged in layers wound spirally, successive layers winding in opposite directions. The whole is then protected against moisture by applying a tight coating of lead about one-eighth of an inch thick. This lead covering must be carefully made, as it must be free from even the minutest of holes to prevent the entrance of water, which would almost instantly destroy the insulating qualities of the paper. The lead has about 3 per cent. of tin in alloy with the lead, as pure lead gave trouble owing to rapid corroding.

Paper has been selected as the insulating material, owing to its having a lower specific capacity than any other material so far available. Air has the lowest specific capacity of any substance, and were it possible to separate the wires to afford insulation, would produce the best cable, as the capacity would be greatly reduced.

The capacity of a paper-insulated cable with 22-gauge wire is about 0.07 microfarad per mile, while with a 19-gauge wire it is about 0.08 microfarad per mile. As telephonic transmission varies in accordance with the KR law, which is the product of the capacity and the resistance, this is a great improvement over earlier cables, where the wire was insulated with rubber, the capacity being about 0.030 microfarad per mile for a 22-gauge wire, and .040 microfarad per mile for a 19-gauge wire.

Installing the Cable.

In installing underground cables, the cable is delivered on reels to the manhole at which the pulling is to start, where the reel is mounted on a pair of wheels or on standards, to allow of its revolving. The duct is then rodded or fished with a steel wire, in order to pull in a steel hauling-rope. Rodding consists of pushing a short length of special rod into the duct, then joining another rod and pushing the two further in, continuing until the rods appear at the further manhole. The hauling rope is fastened to this and the whole pulled through, rod after rod being disconnected until the rope appears.

After the rope appears, a snatch-block is connected to the pulling-in iron, which has been built in the wall. The rope is passed through it and up to connect with a winch, capstan, engine drum or other means of furnishing the power for hauling. The cable is then lashed to the other end of the rope by means of iron wire or by some patented device, of which there are several, and, after lubricating the cable, it is slowly pulled through the duct. Care must be exercised not to allow the cable to kink while entering the hole, as the kink may easily become a crack.

Lateral cables are hauled in a similar manner.

Splicing.

After sufficient cable has been hauled, splicing is started. A piece of lead pipe, after being properly prepared, and somewhat larger than the cable, is slipped over one end, and the two ends to be spliced have the lead sheath removed, allowing a space of from 15 to 24 inches between the ends, overlapping at least that much. The wires are then taken, pair by pair, and the insulation removed from the wires, so that when pulled tight it will just overlap. A small paper sleeve about two inches long is placed over each wire of one pair, the wires in one cable are twisted together several times with their proper mates in the other, and the surplus wire is cut off. The joint is then bent flat and the paper sleeve slipped over it. Other pairs are handled in a similar manner, the splices being staggered as much as

1. A lecture delivered at the College of Engineering, University of Washington, Seattle, December 18, 1907. The author is superintendent of construction for the Washington, Idaho and Oregon Pacific Telephone Company.

possible, to prevent a bad bunch in one spot. Hot paraffine is then poured over the plice to expel all moisture that may have collected, the whole being bound with cloth tape and hot wax again applied. The lead sleeve is now slipped into place, the ends beaten in and wiped with metal in the plumber's familiar manner.

The cable is then bent into its place on the side of the manhole, fastened in place and tagged with its number.

At manholes where laterals are to be taken out, splicing is done in a similar manner, three wires being twisted together instead of two.

Where cable is to be withdrawn, this splice is cut off with a saw, and the ends of the cable beaten in and filled with solder to prevent moisture entering and damaging the cable. The winch and rope are then connected to one end and cable pulled out and reeled.

Connecting the Terminals.

At the terminals of a cable it is necessary to connect a different class of cable, as the paper is so hydroscopic that it would be practically impossible to protect wires so insulated from water without destroying the mechanical strength of the paper. At the central office end it is now common practice to splice several lead-covered switchboard cables direct to the underground cable, in the same manner as I have just described. These switchboard cables have the wires insulated with wool, silk or cotton, which when beeswaxed are waterproof and easily handled.

At the pole or building end of the cable a different arrangement must be made. There are two general methods to do this, one called a pot-head and the other a cable-head. A pot-head consists of a short piece of cable having the wires insulated with a non-hydroscopic material, such as rubber, and minus the lead covering, connected to a short piece of the usual cable, the joint being filled with an insulating compound, such as Chatterton's Compound, which is absolutely waterproof. Such a pot-head has the advantage that the individual pairs can be turned in any direction from the end of the cable, thus allowing of a large variety of wire terminals to be used.

The cable-head consists of a watertight box having binding posts arranged in some symmetrical method around the outside, a short piece of the usual cable extending through a hole and the wires fastened to their proper binding posts inside the box. This makes a fine arrangement for pole work, where the number of pairs are small, but it is not desirable for connection between aerial and underground cable.

Fuses.

For the electrical protection of underground cables a fuse should be placed at all cable terminals, where there is any chance of exposure to a dangerous voltage. Where braided rubber-covered wires lead out from the end of an underground cable and there is chance of their becoming crossed with other braided rubber-covered wires carrying electric-light or other dangerous current, protection should be placed. Protection should also be placed where the wires continue in aerial cable.

These fuses can be conveniently mounted in strips and connected to the cable by means of a pot-head.

Pole Lines.

Aerial construction is properly divided into three sub-divisions—pole line, aerial wire, aerial cable.

Pole lines carrying aerial wire were the early methods of reaching the outside subscribers, and were early developed, so that you are no doubt all familiar with construction methods. In later years, however, the aerial wire has proved itself not only to be undesirable from a maintenance standpoint, but to be more costly than aerial cable.

Let us, then, go over a few construction methods with a cable plant in mind.

The poles in exchanges will not always be set at the proper intervals, on account of property rights and intersecting streets, but as far as possible the proper distance between poles should not be deviated from. This distance will vary from 90 to 120 feet, depending on the weight of cable and wire to be carried. Where the line terminates or turns, end spans should be strengthened by shortening. Corners should be firmly guyed and anchored, and in long stretches carrying heavy cable, side guys should be placed at frequent intervals.

Poles should be stepped and painted to improve their looks and lengthen their lives.

Stringing Aerial Cable.

In stringing aerial cable two methods of supporting are followed. One is to attach the messenger wire directly to the pole by means of suitable messenger clamps; the other is to attach the messenger wire to a suitable cable arm. The first method is usually followed where a small number of cables are to be ultimately attached to the pole, and the latter where the cables exceed two. With either method the attachments are placed in position, the messenger wire then strung and stretched to the proper tension, [illegible] at each pole and dead-ended at each end.

[illegible] of importance, and [illegible] and messenger wires by a careful calculation of [illegible] strength of the messenger, and the proper safety factor, taking into account the effect of the variation in temperature.

After the messenger wire is in place, cable pulleys are placed at frequent intervals on it and upon a suitable approach and threaded with a pulling rope. The cable is tied to this rope and pulled into place. A man then rides the messenger wire in a suitable car and places clips at intervals of from 15 to 20 inches, depending upon the size of the cable.

There are several forms of patented clips, almost all depending upon a hook over the messenger wire, and a metal band around the cable, the fastening being where they differ. There is also the marlin clip, which consists of a simple hook and a tied loop of marlin twine. This twine is wrapped around the cable and the hook slipped through the loops and then over the messenger wire. It is easy to place, cheap, and has a good life.

Overhead Terminals.

After the cable has been strung, the next step is to splice it. This is done in an entirely similar manner to splicing of underground cables, it being necessary to swing platforms or other suitable means of support for the splicer.

In distributing from aerial cables it is necessary to have terminals located at frequent intervals. The location of these, and the wire numbers to which they are to be connected, are usually laid out by the engineering department, after a careful engineering study. As these terminals usually come at points, where cable is not cut, it is necessary for the splicer to open the cable, locate the wire numbers, to which he desires to connect the terminal, by a suitable test, splice the terminal to these wires, and wipe the joint in the usual manner.

The terminals used in this work are usually of the cable-head type, as it is only necessary to bring out the small number of wires in each block, and it is not considered necessary to place protection between the aerial wire, either in the form of wire on cross-arms or insulated twisted pair stub wire, where it is connected to these terminals.

Bonding Overhead Cables.

In order to protect against accidental crosses with light wires or other sources of foreign current, the aerial cable should be bonded to its messenger at intervals not to exceed 1,000 feet, and at intervals not to exceed a mile both messenger and cable should be connected to a good earth. In bonding the cable to the messenger, a convenient way is to use the standard messenger bolt clamp (used for guy purposes), to connect a short piece of scrap messenger wire to the messenger strand, the other end of the short piece of wire being frayed out and wiped to the aerial cable.

As an illustration of the necessity of this bonding and grounding, I have in mind a recent case that was called to my attention, in which neither cable nor messenger wire was bonded, and which became crossed with a light circuit carrying 2,200 volts. The messenger wire reached ground at either end through the guys and anchors, and as there was a rainstorm in progress at the time the accidental cross occurred, the current rushed from the cable to the messenger wire at each one of the marlin clips, resulting in almost 2,000 feet of cable being so badly burnt and pitted that it was impossible to do other than take down the whole length and replace it with new. Had the cable and messenger been bonded together it is my opinion that, while the cable might have been burnt in two where the cross occurred, the damage could have been repaired, possibly, by replacing 100 feet of cable instead of the 2,000 feet.

Anglo-Japanese Enterprise in Hydro-electric Development.

A Japanese newspaper states that on December 6, 1907, the minister of home affairs of Japan granted a license to the Anglo-Japanese Oi-gawa Hydro-electric Power Company, which has for its object the supplying of electricity to Shizuoka and other cities on the Tokaido and neighborhood by utilizing the cataracts of the great Oi River. The company intends to develop waterpower of about 66,000 horsepower at Tamochimura, about 27,000 more horsepower at a point between Ikama-mura and Hambaraumechi, and about 8,000 horsepower at Uchinakubi, in Yamanashi prefecture, respectively. The first, being the largest among the three works, will have to be postponed for some time. The second and third will be started in 1908 at an estimated cost of $5,000,000. The company is said to have a capital of $5,250,000, half of which will be equally subscribed by the British and Japanese promoters. It is further reported that the company will issue $2,500,000 worth of its shares for subscription.

Fond du Lac Has Another Battery.

The Fond du Lac (Wis.) Commonwealth of February 4th says that a demonstration of a new primary electric battery that evidently fulfills some of the expectations of the Curtis electric battery tested in Fond du Lac a year ago is being made in that city. Eight incandescent lamps are being used for the demonstration, which is in charge of J. A. Robinson of Milwaukee, who was brought to Fond du Lac by F. R. Tabor, who is interested in the new battery. Mr. Robinson is a graduate of the engineering department of the University of Wisconsin.

A company is said to have been incorporated for the promotion and manufacture of the battery, its headquarters being in Milwaukee.

J. H. Gugler of Minneapolis, says the Commonwealth, is the inventor of the solution that is used in the new battery. A correct solution that can be manufactured cheaply has now been worked out, it is said, and the mechanical parts of the jar have been perfected. Patents have been applied for.

"In the demonstration being made 18 cells, 4 by 4 inches in size, are being used. They produce a brilliant light with the eight incandescent lamps and with carbons make an arc that is apparently as bright as a street lamp." A test with an automobile was recently made in Milwaukee and is said to have been successful.

Interchangeable Face Transparency.

A clear and attractive electrically illuminated transparency now being made by the Electric Motor and Equipment Company of Newark, N. J., is illustrated herewith. The faces shown are interchangeable and may be furnished with any reading matter whatsoever, to be used by the cigar store,

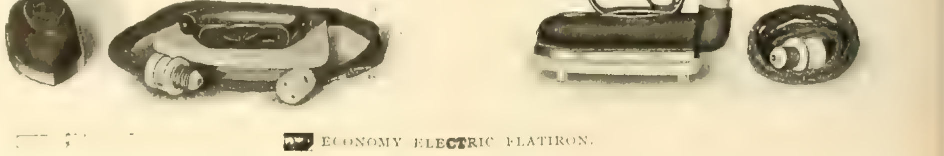
INTERCHANGEABLE FACE TRANSPARENCY.

restaurant, cafe or any retail store. With the proper arrangement of incandescent lamps on the inside of the frame, these sign faces show up brilliantly and attract the transient public.

The sign frame is made entirely of metal and is suitably painted a flat black. The wiring for the incandescent lamps is done in an approved manner, brought out at the end of the frame and not exposed to view, but ingeniously concealed in the iron pipe hanger. The painted faces are of heavy glass and are easily removed and replaced, but the general appearance of the sign does not portray its interchangeable feature. Every detail in regard to the whole outfit has been carefully studied, and the workmanship is of a high order.

Economy Electric Flatiron.

Electric flatirons have come into favor because of the saving in time effected and because of cleanliness, convenience, durability and economy. The Economy iron, put out by the electrical department of the Art Machine Company, 217-221 Fulton Street, Brooklyn, N. Y., is constructed on the company's new patented principle, which is said to economize current by producing the heat at the bottom of the iron. From the scientific or mechanical viewpoint the Economy iron is said to be correct, the internal electric heater covering the entire bottom of the iron.



ECONOMY ELECTRIC FLATIRON.

This flatiron, illustrated herewith, is made in a variety of shapes and sizes suitable for traveling, sewing room, family and laundry use. The handle is removable and consumes no current and does not require a protecting pad. Each iron is furnished with eight feet of flexible fireproof approved cord, with a separable plug at each end, one to screw into the standard Edison lamp socket and the other on the flatiron, which serves as an indicating switch, and it is easily seen whether the iron is connected. This makes it very convenient to disconnect at the iron. A strong asbestos stand is furnished.

Waterpower Possibilities of Appalachian Mountains.[1]

The amount of waterpower in the Southern Appalachians frequently has been [illegible]. The Geological Survey has been measuring the streams for seven years, and its report on the "Relation of the Southern Appalachian Mountains to the Development of Waterpower" presents facts concerning the remarkable asset the nation has in the water resources of this region. Based on the lowest two weeks of the year an average for seven years [illegible] that the streams afford 2,700,000 horsepower. This much power would be available the year round. In common practice it is found profitable to develop a waterpower to the minimum of the four high-water months of the year, depending upon steam power during low-water season to make up the deficiency. In order to be conservative in this estimate, the time limit has been made six months. No streams or portions of streams were considered that did not flow out of the Southern Appalachians. No streams with less than 500 horsepower were considered. In all calculations only 90 per cent. of the observed fall and 80 per cent. of the energy of the falling water is used. Moreover, three important streams—the Big Sandy, the Cumberland and the Kentucky—are not included. With these allowances and omissions the minimum power for the year and for the six high-water months is as follows:

MINIMUM HORSEPOWER OF SOUTHERN APPALACHIAN STREAMS.

Stream.	Horsepower.	
	Minimum for the Year.	Minimum for Six High-Water Months.
Potomac	131,800	240,556
James	155,000	236,474
Roanoke	131,000	215,700
Peedee	167,800	256,945
Santee	319,590	472,000
Savannah	209,000	314,600
Chattahoochee	145,000	228,800
Coosa	104,580	17[illegible],880
Monongahela	58,900	235,715
Great Kanawha	335,000	853,420
Tennessee	973,600	1,580,474
Total	2,740,700	4,929,573

The above table shows the power available under present conditions. Development of the storage facilities of the various streams would increase the minimum from 3 to 30 times, depending upon the stream.

It is estimated by the Geological Survey that at least 50 per cent. of the indicated minimum horsepower, and probably much more, is available for economic development. On this basis the rental of 1,350,000 horsepower at $20 per annum is worth $27,000,000 per year. If we take in the same way 50 per cent. of the power which is present for half the year we increase this sum by $11,000,000, bringing the total to $38,000,000.

Until a few years ago scarcely any of this power was utilized.

Coincidental with this industrial advance has come about a strong demand for electricity generated by waterpower. Electric development plants have sprung up on nearly all streams, and in great numbers on those flowing through the Piedmont Plateau. While relatively little of the nearly 5,000,000 horsepower is as yet utilized, its utilization is increasing at a marvelous rate.

Ready power to the value of $38,000,000 will give the country tremendous advantage, not alone in manufacturing, but in transportation, in lighting and in every kind of development. Waterpower is especially valuable to those sections which have no deposits of coal, and its advantages will steadily enhance in the future, as the supply of coal grows scarcer and the price correspondingly higher.

On the great watersheds forming the White Mountain region the four most important streams of New England have their rise. Upon them are located the great cotton, woolen, and paper mills of New England. They abound in fine waterpower, only a part of which is now utilized. It has been estimated that the capital invested in the manufacturing enterprises which utilize the power of these streams amounts to $250,000,000. Important and flourishing cities have grown up in consequence of these industries. Bellows Falls, in Vermont; Manchester and Berlin, in New Hampshire; Holyoke, Lowell and Lawrence, in Massachusetts, and Biddeford, Brunswick and Lewiston, in Maine, are representatives of such cities, ranging in population from 10,000 to 150,000.

The Connecticut River, the largest of New England streams, rises in the Connecticut Lakes of Northern New Hampshire. It forms the boundary between Vermont and New Hampshire for 180 miles and flows across Massachusetts and Connecticut for 120 miles. Its drainage basin includes 10,924 square miles, of which nearly one-fourth lies in New Hampshire and one-tenth in the White [illegible] Mile Falls and McIndoe Falls on the main river [illegible] months of the year of 120,000 horsepower. Less than half is utilized.

In very low water the power is reduced nearly one-half, so that but a small margin remains over the amount required for daily use. At Holyoke, Mass., the margin is frequently so small as to require the most careful use of water to make the supply meet the needs. The census of 1880 reported for the Connecticut and all of its tributaries 2,298 mills, using 118,026 horsepower developed from the streams. It is estimated that these figures have since been increased by about 20 per cent., making the present total over 140,000 horsepower.

The Merrimac River is undoubtedly the most notable waterpower stream for its length in the United States. Between Franklin and Newburyport, a distance of 110 miles, it has a fall of 269 feet, of which 185 feet is developed, representing approximately 50,000 net horsepower. Of the remaining 84 feet, it is believed that less than half can be utilized. Probably the total development in the main stream will not exceed 60,000 horsepower. Its great waterpowers are at Manchester, N. H., and Lowell and Lawrence, Mass. On the tributaries of the Merrimac valuable powers also exist. Those at Franklin on the Winnepesaukee are equal in value to some on the main stream. The Merrimac is formed by the Pemigewasset and Winnepesaukee rivers. The latter has its source in the lake of the same name, while the former rises in the Franconia Notch of the White Mountains and drains a large area of high, mountainous country. Since the Pemigewasset has no lakes or swamps to conserve its waters, it depends upon the forest cover alone for its regularity of flow.

The Saco River rises in Crawford Notch, in the heart of the White Mountains, and drains a larger proportion of the principal ranges than any other stream. None of its tributary streams from the mountains have lakes to restrain their waters, though, like the Merrimac at its lower levels, it is the outlet of important lakes. Toward its headwaters the Saco is variable in its flow and has no important waterpowers, but on its lower reaches in Maine its flow is broken at six places by falls, affording waterpower of a high value. At Saco and Biddeford, at Union and Salmon Falls, and at Bar Mills fine waterpower exists, a large part of which is utilized. At Hiram, 45 miles from the sea, is found the most extensive power on the river. The Saco, while its possibilities are great, is more dependent upon the forest cover for the evenness of its flow than any other river having its source in the White Mountains.

The Androscoggin River has a drainage basin with a higher general elevation and a larger lake system than any other New England stream. It is formed by the union of Magalloway River and the outlet of Umbagog Lake, at Errol, N. H. At its headwaters is the magnificent system of Rangeley Lakes, the outlet of which is controlled by dams. The flow of the upper river is therefore very uniform.

Further down its course the Androscoggin receives the drainage of the northern part of the principal ranges of the White Mountains through Peabody and Moose rivers. On this part of its drainage there are no lakes of importance. The waterpowers of the Androscoggin are centered at Berlin, N. H., and Rumford Falls, Livermore Falls, Lewiston, and Brunswick, Me. In the 167 miles between tidewater and Umbagog Lake there is a fall of 1,235 feet, of which 610 feet is used, corresponding to about 120,000 net horsepower. Of the remaining 625 feet, possibly two-thirds can be utilized, corresponding to 60,000 net horsepower, and bringing the total to about 180,000 horsepower, or approximately three times that of the Merrimac without its tributaries.

The streams of the White Mountains, therefore, furnish power for great industries, and are the basis of development for many prosperous cities in all the New England States but one. These streams are all influenced vitally in flow by the forest which covers the slopes of the White Mountains.

1. From the report of the Secretary of Agriculture on "The Southern Appalachian and White Mountain Watersheds," transmitted to the United States Senate on December 11, 1907, and referred to committee on agriculture and forestry.

Electricity for Intermountain Road from Denver to Golden.

The electrification of the Intermountain Railway, operating between Denver and Golden, Colo., is now under way, according to reports from Denver, and will be completed by April 1st. This will give two electric railways from Denver to Golden. The Intermountain road will in all probability be extended to Morrison, with a branch to Fort Logan.

Thomas B. Doan, assistant manager of the Denver Union Water Company, organized the Intermountain Railway Company. Electric cars will be operated for passenger service exclusively. The [illegible]

BOOK TABLE.

[illegible] the methods involved in practical line or factory [illegible] description of some of the commercial types of galvanometers, resistances, voltmeters and ammeters. This is followed by chapters on the Wheatstone Bridge and portable testing sets, wherein the theory and operation of each [illegible] explained. Several methods of measuring resistance are given including which are the fall of potential, direct deflection, bridge and series voltmeter methods and several methods for measuring galvanometer and battery resistances. A chapter is devoted to the theory and manipulation of the potentiometer as applied to the measurement of electromotive force and the calibration of voltmeters. This is followed by a brief treatment of the condenser and the galvanometer methods of measuring capacity. The tests with a voltmeter include those of insulation of cables, of apparatus and of distributing circuits, the measurement of temperature and the tests for open and closed circuits. The latter part of the book is given entirely to the testing of telegraph and telephone systems and is well illustrated by diagrams. The Varley and the Murray tests for locating grounds, crosses and other troubles are discussed in full, and a detailed description is given of the Leeds and Northrup fault finder and its manipulation for the different kinds of tests. This book, although of an elementary character, is an example of clearness and simplicity and should appeal to the beginner or the practical engineer.

ELECTRIC RAILWAYS. Vol. II. (Engineering Preliminaries and Direct-current Sub-stations). By Sidney W. Ashe. New York: D. Van Nostrand Company. Pp. (5¼ by 7⅝), vi., 282, with 145 illustrations. Price, $2.50, net.

The second volume of Ashe and Keiley's three-volume work on electric railways is a valuable contribution to electrical literature. It maintains the same high standard of excellence of Vol. I. in the manner of dealing with the subject-matter, though as a separate work it surpasses the former through the presence of the practical data and operating statistics which are incorporated into it. The 25 tables of such data and the illustrations, which include more than 50 diagrams, giving train-resistance, speed and energy, motor performances, motor losses, speed-time, power, acceleration, load and starting curves, etc., render the volume especially valuable to the railway engineer or student. The subjects dealt with are: Preliminary considerations, determination of required motor capacity, schedules and load diagrams, power-house and sub-station location, rotary-converter sub-stations, the rotary converter, the transformer, insulating oils and auxiliary sub-station apparatus. This volume was written by Professor Ashe alone.

POCKET-BOOK OF ELECTRIC LIGHTING AND HEATING. By S. F. Walker. New York: The Norman W. Henley Publishing Company. 1907. Pp. (4 by 6⅜ inches), xxviii., 438, with 272 illustrations. Price, $3.

This book might well have been given a more accurate title. From the name one is warranted in expecting the volume to be a compendium of data, tables, etc., relating to and facilitating the design of distributing circuits for lighting and heating service. This is not the case, however, for such information is wanting, and instead there is given a large and reasonably complete collection of the makers' data of dynamos, lamps, recording and indicating meters, switches, rheostats, etc. To the extent of supplying dimensions, capacities, sizes, etc., of stock electrical apparatus of well-known English and American manufacture, the volume is of no small value to the engineer or designer who has frequent demands for constructional data of standard machines and apparatus. Praise can be bestowed on the mechanical execution of the book, which is excellent.

The date of the proposed electrical show in St. Louis has been changed, and is now announced as April 18th to 25th, giving prospective visitors more time for preparation. The show will be held in the First Regiment Armory, Grand and Manchester avenues. It is said that the Union Electric Light and Power Company will make a fine display, including a six-room "electric house." G. Stuart Hill and W. H. Y. Tiernan, with office in the Mermod-Jaccard Building, St. Louis, are promoting the show. They say that they have received promises that the Missouri and Illinois Independent telephone associations, Missouri Electrical Contractors' and the Missouri Electric Light, Street Railway and Gas associations will hold conventions during the "electrical week."

CORRESPONDENCE.

Continental Europe.

Paris, January 28.—A project of considerable interest in Paris is that of providing a wide avenue to run from the city for a considerable distance into the suburbs, ending at the St. Germain forest. This would be carried out by beginning a new section at the suburb of Courbevoie, to which there is now a straight avenue running from the center of town, including the Champs Elysées as the first portion. The present avenue is only three miles long, however, while the new project calls for 10 miles length at least. One feature of the project is a double-track electric tramway or light electric railroad, which would run on each side of the avenue, and this would be well patronized by the inhabitants of the suburbs. An idea of this kind was brought up in 1902, but for some reason it was allowed to drop. This time a capitalist, Mr. Francq, one of the leading financiers of the city, proposes to carry out the scheme, provided he shall have the exclusive rights for operating the electric road. Under these conditions there seems some likelihood that the project will be favored.

One of the large hydraulic plants in the north Italian region is the one which is erecting in the region of Spezzia, and, according to the present hydraulic work, it will furnish somewhere near 20,000 horsepower, using a 360-meter head of water. In order to secure a regular supply, there are provided four reserve basins, which contain a total of 6,000,000 cubic meters. The plant operates on the three-phase system, using 30,000 volts on the pole line. Among the cities and towns which will use current from the lines are Spezzia, Parma and Modena. At Spezzia the government arsenal will use a large amount of current for lighting and motors.

Professor Korn, whose work in image transmission is already familiar, finds that he can transmit an image over a telephone wire at the same time as the conversation, and the image is scarcely affected by the telephone current. One of the leading journals of Copenhagen has lately taken advantage of this principle, and intends to run a combined system of telephone and image transmission in connection with Berlin.

A three-phase electric road which presents some new features is located in the southern part of Switzerland, near the Italian frontier, and runs between Locarno and Bignasco. The trolley line is operated at high tension, and transformers mounted on the car serve to run the motors at low voltage. A voltage of 5,000 (20 cycles) is adopted for the trolley, and each car contains two transformers of 100 kilowatts each. They reduce the voltage by means of a variable secondary coil to 200 to 400 volts. On each axle of the car are mounted two motors of the Oerlikon type, rated at 40 horsepower, making four motors per car, or a total of 160 horsepower. Current is furnished from a hydraulic plant which is located at Pontebrolla, one of the stations on the electric line.

The Italian government has lately decided to allow a credit of $14,000,000 in order to carry out some improvements on the leading electric railroads of the country, especially those which have heavy grades and long tunnels. The amounts allotted to each road will be used in track construction and for the purchase or improvement of rolling stock.

According to recent reports, it appears that the project of a high-speed electric railroad from Rome to Naples, which has been discussed for some time, is taking a more definite shape, for the state has now granted a concession for such a railroad to a syndicate of French and Belgian capitalists. The distance in a straight line is but 120 miles, and the electric trains would cover this in two hours. The steam railroad which runs between the two cities is 150 miles long, and the trip requires five hours.

A. DE C.

Great Britain.

London, February 1.—During recent years there have been several attempts to obtain injunctions against the working of electric generating stations by the owners of adjoining property, on the ground that the working of the machinery, with its consequent "noise and vibration," constituted a nuisance. The actions in question have been nominally for a cessation of the nuisance, so called, which is impossible, so that it would virtually mean the shutting down of the station. In the earlier instances of this character, at any rate, there was a distinct ulterior motive on the part of the applicants, viz., to sell their property at an enhanced value to the owners of the electric generating station. In at least two cases this object was gained. But the plea is now being set up that provided the electric-supply authority, which is working under parliamentary sanction and is bound to perform its functions, carries out its duties in what is admitted to be a reasonable manner, with up-to-date machinery, it should be exempt from any injunction of the character referred to. Since the earlier attempts of this character a considerable number of supply authorities have taken the precaution to secure [illegible] Act of Parliament [illegible] [illegible] has to all intents and purposes died out. An interesting case that has been occupying the attention of the High Court for over a week is that of the vicar of a Brighton church, who seeks to restrain the Brighton Corporation from committing an alleged nuisance at a motor-generator station in the center of the town, a humming from the working of the machinery, it is claimed, interfering with the conduct of the services. It is certainly high time that statutory undertakings of this character should be given some degree of legal protection in these matters.

Although the period for depositing petitions against bills in Parliament is still a long way off, great activity is being evinced by the London local authorities in putting their house into order regarding their attitude toward the electric power bills. All the signs point to no abatement of the complete hostility to these measures, and it is not beyond the bounds of possibility that the political influences of these authorities will again prevent a definite conclusion being arrived at. Every authority which is at all touched by the bills has decided to petition against them.

All arrangements are now completed for the holding of an electrical exhibition at Manchester in the autumn, and designs for buildings are being prepared. The consulting engineers to the undertaking are the electrical engineers to the Manchester and Salford corporations, Messrs. Pearce and McCowen. Hitherto the arrangements have been in the hands of two gentlemen who organized the preliminary matters, but the control has now been taken over by the recently appointed executive committee, which is composed of representatives of manufacturing firms.

The publication of the half-yearly accounts of some of the electric traction companies in London shows little signs of a substantial improvement in the economic conditions which have been the cause of so much anxiety during the last two years. Thus the Central London tube railway has to report a decrease during the second half of the year 1907 of nearly $85,000, against which has to be set a decrease of only $25,000 in the working expenses. A factor in this latter increase has been the employment of only one man on the cab of the locomotive instead of two as hitherto. The Metropolitan Railway Company reports a decrease in the number of passengers carried, but this has been more than neutralized by the increase in certain of the fares. The Great Northern and City Railway Company gives notice that no dividend will be paid upon the preferred "A" shares for the December half year.

An interesting and novel scheme for obtaining condensing water for the electric supply station at Edinburgh is now in course of construction. It consists in utilizing sewage water. It appears that a large sewer runs close to one of the generating stations of the corporation, and it was decided to tap this as the least objectionable and expensive of several schemes for obtaining the condensing water in question. A shaft has been sunk down to the sewer, and water is pumped up, copper-wire gauze being employed to prevent any solid matter being drawn up by the centrifugal pumps. After use the water is returned to the sewer. Precautions have been taken to prevent the escape of any gases from the outlet shaft.

G.

New York.

New York City, February 8.—A case before the United States Board of General Appraisers against the Midvale Steel Company on Tuesday attracted much attention. At the trial tests and experiments were made to assist in determining the duties which should be imposed on certain imported metalliferous ores, among which ferro tungsten was the main source of discussion. This metal is valued at $1,000 a ton, and the Treasury Department has recently contended that it should be classed as "metallic mineral not specifically provided for in the tariff law," and so dutiable at 20 per cent. ad valorem, or $200 instead of $4 a ton, the duty charged at present. The defense asserted that by itself ferro tungsten is not capable of being wrought into commercial form. To disprove this assertion J. Allen Heany, an expert metallurgist, well known to electrical men, with an apparatus of his own attached to an electric-light socket, produced a light of 75 candlepower by the use of ferro tungsten, using, he said, no more current than needed for an ordinary 16-candlepower lamp.

The north tube of the Hudson and Manhattan Railroad Company, commonly known as the McAdoo tunnels, running under the North River from Hoboken to Morton Street, Manhattan, will be opened to the public on February 25th. On that day the regular schedule of trains between the Hoboken terminal, just north of the Lackawanna station, and Nineteenth Street and Sixth Avenue will be started. The opening of the tunnel and the completion of the first section of the $60,000,000 system will be fittingly celebrated. The McAdoo system, which has been frequently adjudged to be the greatest and most costly engineering feat of the century, as well as the most comprehensive traffic arrangement ever devised, was first started in 1874. De Witt Clinton Haskin, a civil engineer, of California, who had been active in the construction of the Union Pacific Railroad, drew the plans and made the surveys at his own expense. Work since has been stopped several times by failures and other causes, and its successful completion is now being carried out by the company organized by William G. McAdoo.

During 1907 in Brooklyn 102 persons were killed by street railways, 26 were killed on the elevated roads, six were killed by live wires and 83 were accidentally suffocated by gas. The victims of the trolley cars were largely children playing in the streets.

O. F. Nichols, civil engineer, long identified with the engineering departments of many of the city's public works and who had engaged in many private enterprises, died on February 4th at his home in Gates Avenue, Brooklyn, in his sixty-third year. He was born in Newport, L. I., and was a graduate of Rensselaer Polytechnic Institute. In 1888 he was made chief engineer of the Brooklyn Elevated Railroad Company and in 1892 general manager. He was prominent in the engineering work of the large bridges, and in 1904 was appointed chief engineer of the Department of Bridges. Mr. Nichols was a member of the American Society of Civil Engineers, the Engineers' Club, and other scientific organizations. His wife and two daughters survive.

In the receivership cases of the New York City and the Metropolitan Street railways, Judge Lacombe, in the United States Circuit Court, has given an opinion dismissing the petition which had been presented in behalf of the state receivers to enable them to take the assets of the two railway companies from the hands of the Federal receivers, Douglas Robinson and Adrian H. Joline.

A notable tribute was paid to H. H. Vreeland, president of the Metropolitan Street Railway Company, who was the guest of honor of the New York Railroad Club at the Hoffman House, Twenty-fifth Street and Broadway, last night. He received a handsome silver water pitcher as a testimonial of the high esteem in which he is held by the members of the club, of which he has been a member for 18 years. He has been president of the club for a number of years. There was much applause when the toastmaster, William G. Besler, paid a tribute to Mr. Vreeland and spoke of his usefulness not alone as a member and officer of the club, but to the community at large. There was a large attendance of prominent men, including some well-known electrical engineers.

Harry V. Osborne, leader of the dissenting stockholders of the Newark (N. J.) Telephone Company, attacked the management of the company at the annual meeting of stockholders on Monday in that city, charging that the concern was being maintained by the New York and New Jersey Telephone Company to stifle competition, and that a receiver should be appointed, as recent reports showed a deficit, and that no dividends had been paid in the 10 years of its existence.

The properties of the United States Independent Telephone Company were bid in by the reorganization committee of the bondholders at the public foreclosure sale in Rochester on Tuesday by Chairman Walter P. Duffy of the committee for $250,000. Later the reorganization committee of the United States Independent bondholders bought in the properties of the Independent Telephone Securities Company, comprising the Rome, Syracuse and Utica companies, at the foreclosure sale, for $150,000.

Application for the right to issue $10,000,000 of preferred stock and $50,000,000 of bonds was made by the Long Acre Electric Light and Power Company yesterday to the Public Service Commission. It was referred to Commissioner Maltbie. The company was started by theatrical men and others who resented what they termed "the arbitrary and unreasonable attitude of the Edison company." It informed the commission yesterday it had a city franchise to place wires for electric light, heat and power in Manhattan and the Bronx. It has a small plant in operation and is supplying customers.

W.

Ohio.

Toledo, February 8.—At the regular meeting of the Toledo Section of the American Institute of Electrical Engineers, held in the Builders' Exchange last night, H. W. Fisher of Pittsburg gave a talk on "Electric Cables," which was very instructive and interesting. Mr. Fisher is chief engigineer of the Standard Underground Cable Company, and an authority on matters of electric transmission.

The financial report of the Lake Shore Electric for the month of December shows total earnings of $68,475.92, being a gain of $1,800.66 over the corresponding month of the previous year.

A decision handed down by the Supreme Court of Ohio this week holds that municipalities have not the power to furnish electric light to private consumers. The question arose in the case of Robert H. Jackson vs. the City of Nelsonville. The city was installing a plant to supply its citizens with electric light and power, as well as to light the public streets. The old law giving this power was inadvertently omitted when the new municipal code of Ohio was enacted in 1902.

Contracts have been closed for the installation of a wireless-telegraph station at Upper Sandusky. The apparatus will be installed by William B. Patty on February 14th.

R. E. Choate, formerly of Nashville, Tenn., has removed his family to Massillon, Ohio, where he has assumed his duties as the new manager of the Massillon Electric and Gas Company.

Plans have been completed for the proposed new building of the Central Union Telephone Company at Youngstown. The structure will be two stories high, 37 by 121 feet, and fireproof, and will cost approximately $30,000.

Peter Harrison, the young electrician who received a shock from the 20,000-volt circuits at the Fremont power house a few weeks ago, is on the road to recovery.

The Buckeye Traction Ditcher Company of Findlay will soon be operating at full capacity again. The concern has closed a very successful year. At the recent annual meeting the officers were selected, with N. L. MacLachlan as president.

The Farmers' Telephone Company, incorporated for $50,000 and operating in Sandusky, Seneca, Huron, Crawford and Richland counties, is offering a limited amount of its stock for sale. H. L. S.

Indiana.

Indianapolis, February 8.—At a meeting of the Indiana State Board of Agriculture, held February 6th, Rubush & Hunter, architects, were ordered to prepare plans for the construction and equipment of an independent electric-light plant on the State Fair grounds, to cost about $28,000. Bids will be in order as soon as plans are completed.

The Noblesville Gas and Independent Improvement Company has ordered an issue of $100,000 in bonds, secured by mortgage on its natural-gas plant, consisting of 51 wells, 160 miles of pipe line and a pumping station. The money secured from the bond sale will be used to extend the system and for the construction of an artificial-gas plant to cost about $60,000. The officials of this company state that their gas wells are growing stronger instead of weaker.

The Indianapolis and South Bend Traction Company has filed articles of incorporation. The company is to construct electric railways for passenger and freight service, connecting Indianapolis and Noblesville and passing through about 20 towns. Robert H. Keller and associates are the directors.

The Kokomo, Frankfort and Terre Haute Traction Company has been organized at Frankfort to construct an interurban line from Kokomo to Terre Haute by the way of Frankfort, Lebanon and other intermediate towns. Oliver Gard of Frankfort is president.

Arrangements have been made to begin the work of constructing an electric railway between Sullivan, Ind., and Decatur, Ill., by way of Mattoon, connecting the interurban systems of Indiana, Ohio and Illinois.

The report of the Fort Wayne and Wabash Valley Traction Company for the year ended December 31st, shows gross earnings of $1,283,781, against $1,092,806 in 1906. The net receipts were $537,745, against $432,246 in 1906.

The Indiana railroad commissioners announce that they are ready to recommend to the next Legislature a stringent law to keep trespassers off of railroad tracks, with a view to reducing the number of accidents and deaths occasioned thereby. The commission also has notified the railroads of the state that they must place warning signs at the 10,000 unprotected railroad crossings of public highways in the state.

The Indiana Appellate Court has decided that a street-railway company has a right to extend its tracks across a steam-railroad track at grade without constructing an interlocking crossing, and the fact that such company also operates interurban cars to distant points does not affect this right.

The Commercial Club of Warsaw has passed a resolution in favor of municipal ownership and requested the City Council to buy the Winona Water and Light Company's plant, which is now being offered for sale. S. S.

Northwestern States.

Minneapolis, February 8.—The Wausau Street Railroad Company of Wausau, Wis., has purchased the Wausau Electric Company and also the Mosinee waterpower for the use of the company.

The Minneapolis, St. Paul, Rochester and Dubuque Traction Company will build five power houses along its line between the Twin Cities and Dubuque, Iowa. It is estimated that the buildings will cost $250,000.

Professors in the electrical college at the University of Minnesota propose the establishment of a trades school and will endeavor to train students for practical electricians.

The City Council at Brainerd, Minn., is considering the purchase of a second-hand arc-light machine.

A. Anderson, a Lake City (Iowa) engineer, outlines plans for an interurban railroad to be built between Des Moines and Lake City and beyond the latter point into Northwestern Iowa. There has been $100,000 pledged toward the contract.

Electrolysis was the chief subject discussed by the Water Board at St. Paul recently. The board feels that the local railway company has made great improvements in the electrical return system. It is probable that nothing more will be done with respect to further testing of the system during the [illegible] Fletcher and others. R.

Illinois.

Peoria, February 8.—The Illinois Traction Company is now handling a mail service from this city and from Bloomington, cars leaving both cities at seven in the morning with mail and picking up mail for the intermediate towns. All the towns between here and Bloomington will be served.

An interurban road from Springfield to Quincy, with branches, is proposed to be built by the Mississippi Valley Interurban Railway Company, which was incorporated with a capital of $1,000,000. The road, if built, will pass through about 20 cities. The incorporators and first board of directors are James H. Ward of Butler, Ill., George E. Watson of Hillsboro, Ill., H. R. Lakin of Rochester, Ill., and John E. Melik and F. E. Melik of Springfield.

The service inspectors of the Central Union Telephone Company met at local headquarters in Springfield this week and discussed matters of interest. At the conclusion of the meeting a banquet was served at the St. Nicholas. The district superintendents also held a meeting at the same place this week and the visiting superintendents were entertained at a dinner given by the local superintendent.

A change will probably be made in the system of charging for baggage now practiced by the Illinois Traction Company. The new method will be the same as used on the steam roads, to charge excess on all pieces weighing over 150 pounds. V. N.

Western Canada.

Winnipeg, Man., February 8.—Serious trouble has arisen in Winnipeg over the dismissal of Cecil B. Smith, civic expert for the municipal power plant to be constructed on the Winnipeg River. The Board of Control voted his dismissal unanimously, but the City Council referred the dismissal back to the board by a vote of 9 to 7. In the interim several meetings of the ratepayers had been held and it was decided to petition the City Council to proceed with the work of constructing the civic plant, and petitions, extensively signed, are being collected by a committee of ratepayers in favor of immediate construction.

The new Grand Trunk Pacific Railway Telegraph Company has connected its lines with Winnipeg, where an office has been opened in the Somerset Block. This line is now in operation for a distance of 280 miles west of Winnipeg, but so far the steel for the railroad has not been laid over this portion of the line.

The British Canadian Wood, Pulp and Paper Company of Vancouver is now in a position to build the first unit of its plant. The government has granted the company the water rights on Rainy River sufficient to develop 5,000 horsepower. The head office of the company is at 313 Cordova Street, Vancouver, B. C. W. H. H. Collister is one of the chief shareholders.

The work of surveying the Dog Lake Falls and the plans for developing power there for the town of Port Arthur, Ontario, have been completed by Cecil B. Smith, C. E. The transmission line will be 23½ miles long.

After having been operated by steam for the last two years, the Winnipeg, Selkirk and Lake Selkirk electric railroad, running between Winnipeg and Selkirk, Man., a distance of 18 miles, will be operated by electricity from March 1st.

C. Holden, formerly a member of the Winnipeg civic power staff, has been appointed superintendent of the municipal plant at Moosejaw, Sask.

The civic authorities at Edmonton, Alberta, have canceled the contract awarded the Lorimer Automatic Telephone Company for the installation of a telephone system, alleging delay, and the Automatic Electric Company of Chicago is applying for a franchise to install its system. R.

Pacific Slope.

San Francisco, February 5.—The public-service companies of San Francisco and the municipal authorities of the city are still very far apart in the matter of regulations. Various ordinances are now before the Board of Supervisors, but none of these has received even the partial approval of the corporation. The management of the street-railway company asserts that the ordinance proposed for the improvement of the street-car service has not a single clause that is not objectionable, and that many of them are impossible of enforcement. All the corporations concerned object to the proposed ordinance concerning the removal of overhead wires.

The Pacific Telephone Company this week reestablished the Chinatown Exchange, which was a feature of the San Francisco system before the great fire. The exchange has been established tem[illegible]

[illegible] cisco, acting together, have suspended the manu[illegible] department was decidedly more expensive than the [illegible]

The city authorities of Sacramento, Cal., have [illegible] structing its own electric-lighting plant at this time. The Pacific Gas and Electric Company, which has heretofore been doing the street lighting at a cost to the city of $7 per month per arc light, offered to reduce the cost to $6.30 during the ensuing year, and, as Professor Cory, who made the estimates on the city plant, figured that with its own lighting works the arc lights for street purposes would cost $6.70, the City Council decided to accept the company's offer and to award the contract accordingly.

John Turrell of Creswell, Ore., has secured a franchise for the construction and operation of an electric-lighting plant at that place. He will also supply power to the surrounding territory.

Proposals are being received by the commissioner of public works at Tacoma, Wash., for a 75-arc-light, air-cooled, constant-current regulating transformer and for an arc-lamp panel.

F. X. Waldron of Vashon Island, Wash., has applied for an electric-light and railway franchise on the island. His petition is signed by 260 residents of the island.

The management of the Ocean Shore Railway Company, which is building a third-rail line from San Francisco to Santa Cruz, Cal., announces that the electric trains will be running to Green Valley from San Francisco by April 1st, and that it is expected to have the entire line in operation by January 1, 1909.

W. E. Pierce, president of the Boise and Interurban Railroad Company of Boise, Ida., has gone to Pittsburg to confer with the other stockholders of the company relative to the proposed extensions of the system.

The Board of Supervisors of San Bernardino County have granted to the Corona Gas and Electric Company of Corona, Cal., the right to run an electric transmission line along certain of the public roads of the county.

The Board of Supervisors of Alameda County, Cal., has granted the application of E. M. Downer of Pinole, Cal., representing the Great Western Power Company, for the right to erect a transmission line along the roads of the county. A.

PERSONAL.

Messrs. O. H. Caldwell and M. B. Bogart, two seniors in Purdue University, were in Chicago last week making an efficiency test of a West Side plant for the electrical production of nitric acid. They will prepare a thesis on the results of this test.

Mr. S. B. Livermore, for several years local manager of the Winona Railway and Light Company of Winona, Minn., who is to retire from the position, will be succeeded by Mr. George H. Shaw, for 18 years superintendent of the Madison Street Railway Company of Madison, Wis.

Dr. Louise G. Robinovitch of New York, the woman physician whose researches into the subject of electric sleep have been mentioned in the Western Electrician, will soon, it is said, receive a grant from the municipal authorities of Paris which will permit her to apply the system on a large scale in hospitals for the insane in that city.

Mr. George H. Nicoll, manager of the Western Union Telegraph Company for Council Bluffs, Iowa, has been promoted to the position of chief clerk in the office of J. C. Nelson, superintendent of the Third District, in Omaha, taking the place of H. M. Goulding, who has retired to engage in business. Succeeding Mr. Nicoll in the Council Bluffs office will be O. T. Welch, who has been employed in the Omaha office. Mr. Nicoll has been in the employment of the Western Union Telegraph Company nearly 30 years.

Mr. C. F. Harding, B. S., has been appointed head of the school of electrical engineering of Purdue University, Lafayette, Ind., filling the place made vacant by the death of Prof. C. P. Matthews. Professor Harding is a young man, but his careful training and wide practical experience have equipped him well for the place, both in the theory and application of electrical science. He is a native of Fitchburg, Mass., a graduate of Worcester Polytechnic Institute, and an electrical engineer of high standing. Professor Harding was successively electrical engineer for the first high-potential high-speed electric railway in New England, electrical engineer for the D. & W. Fuse Company, publicity manager for the Fort Wayne Electric Works and engineering expert with Stone & Webster. He also made a marked success as associate professor of electrical engineering at Cornell. Professor Harding has a pleasing personality. He is married, and is expected to join the university about March 1st.

ELECTRIC LIGHTING.

C. H. Hoback has sold the lighting plant at Bertrand, Neb., to George Hendrickson.

R. P. Runckle and others are applying for an electric-light franchise in Hinckley, Minn.

The city of Rogers, Ark., is figuring on the establishment of a municipal electric-light plant.

The Billings (Mo.) Light, Power and Water Company has been incorporated with a capital of $35,000.

The Buffalo (N. Y.) General Electric Company is said to have purchased the Gruener Hotel property, to be used as the company's headquarters.

The Interstate Hydro-electric Light and Power Company, of which W. D. Chesney, Rosedale Station, Kansas City, Kan., is secretary, is developing 5,000 horsepower from the White River, near Eureka Springs, Ark.

Citizens of Ferguson, Mo., a suburb of St. Louis, raised $15,000 at a meeting called to consider the building of an electric-light plant. A co-operative company, to be known as the Ferguson Electric and Supply Company, may carry out the project, and the city will be asked for a franchise.

The president and trustees of the village of Sheboygan Falls, Wis., are advertising for bids for a franchise to be granted for the term of 25 years, commencing March 8, 1908, for the use of streets, lanes and alleys of the village, in the establishment and operation of an electric-light plant and system, according to the specifications on file in the office of the clerk. The proposals are to state what percentage of the gross receipts from the operation of the plant the bidder will pay annually into the treasury of the village. All bids are to be filed with the village clerk on or before March 16th.

ELECTRIC RAILWAYS.

R. B. Hutchinson, R. G. Smith and associates of Checotah, I. T., interested with eastern men, have organized a company at Checotah and are preparing preliminary plans and estimates for the construction of an electric railway 100 miles long to connect Fort Smith, Ark., and Shawnee, Okla.

Officials of the Woodstock, Marengo, Genoa and Sycamore Railway Company are securing rights-of-way for the proposed electric railway to connect the Illinois towns named. It is said that the road may be built this summer, as the active co-operation of prominent business men in the towns benefited is being secured.

The Milwaukee City Council a few nights ago by unanimous vote adopted resolutions expressing confidence in A. C. Frost, president of the Chicago and Milwaukee Electric Railroad Company. The good will of the city toward the enterprise was also carried by the resolutions. The enterprise is looked upon as a distinct benefit to Milwaukee.

Wilford A. Bailey, a few years ago considered a "Napoleon of finance" in Worcester, Mass., the man who built the Worcester and Southbridge electric railway in fairly luxurious style, but at such cost that the road was purchased at a bargain by the New Haven steam-road interests, was recently arrested in Worcester on two charges of uttering forged instruments of $5,000 each.

Moderate gains in gross and net earnings, despite increased expenses, are reported in the annual report of the Milwaukee Electric Railway and Light Company for the year 1907. Gross earnings were $3,823,383, compared with $3,523,438 for the preceding year. Expenses and taxes were $2,204,124 for 1907 and $1,945,993 for 1906. Net earnings for 1907 were $1,619,250, compared with $1,577,445 for 1906.

The Texas Union Traction Company of Clarksville, Tex., has been incorporated and proposes to build some important interurban lines in Texas. It is planned, it is said, to build from Texarkana to Sherman, 154 miles; from Paris to Ennis, 124 miles; from Texarkana to Fort Worth, 215 miles; Paris to Cleburne, 15 miles, and numerous branch lines. The incorporators are J. P. Moore and J. T. Upchurch of Longfellow, Tex., and A. A. St. John of El Paso.

With the advent of the Chicago Railways Company, which takes over the Union Traction properties, are indications of improved service. With [illegible] early spring the Board of Supervising Engineers is making preparations for extensive track reconstruction and other rehabilitation. [illegible] pany has issued new rules which call for efficiency, [illegible] part of employé.

[illegible]

gets on a train to go home after five o'clock," said the speaker, "he finds half of the seats occupied by women who should have been at home two hours before."

In the pamphlet report of the North American Company for 1907 President Wetmore says: "During the year the company has sold to the Milwaukee Light, Heat and Traction Company the entire common capital stock of the Milwaukee Electric Railway and Light Company ($9,000,000, par value), and has received in payment therefor the capital stock and refunding and extension mortgage bonds of the traction company, the sale or exchange having been made in the belief that the future development of these properties can be more effectively provided for through the instrumentality of the traction company as the controlling company."

The local transportation committee of the Chicago Council is hard at work trying to solve the elevated railway Loop problem. Plans submitted by the four companies which use the Loop have been considered and the committee has its own experts and engineers at work. The Loop is extremely congested during rush hours and is entirely inadequate for handling the traffic. Property owners along the route have always opposed the structure and object to any extension of platforms or additions for cross-overs. It is the opinion of many that the through routing of trains, instead of making the loop, is the only solution. Some members of the committee favor the ultimate abandonment of the Loop structure, which could be brought about by the contemplated subway and elevated terminals.

The Chambersburg, Greencastle and Waynesboro Street Railway Company of Waynesboro, Pa., is extending its road 11½ miles from the present terminus at Greencastle to Chambersburg. Tracks, poles and trolley wire are up for one-half the distance. To provide increased generating capacity at the power house sealed bids are being asked for the following machinery and appliances installed complete: 500-kilowatt, 2,300-volt, 60-cycle, three-phase steam turbine or engine-driven generator set; jet condenser and cooling tower; 30-kilowatt steam-driven exciter set; switchboard panel; 14-mile transmission line, 23,000-volt, three-phase, to be erected on existing poles; transformer and sub-station equipment complete; 10½-mile No. 0000 direct-current feeder erected. The road is to be in operation in 112 days. J. F. Geiser is electrical engineer and superintendent of the company.

POWER TRANSMISSION.

The Northern California Power Company of Redding, Cal., is figuring the cost of supplying current to some of the large farms. Oakland men owning a large tract of land near Willows are desirous of getting electric light and power to the farm.

Cold weather is said to have diminished the flow of water from the mountains, and as a result steam plants at Tacoma and Seattle, Wash., have been put in operation to help out the Puget Sound Electric Company's power plant at Electron. Service on the local street-car system or the interurban road has not been interfered with.

The Berkshire Power Company of Canaan, Conn., has been indicted in connection with the overflowing of the Housatonic River, caused by the company's erection of a dam at Canaan. This action is the result of a complaint made by a number of farmers at Sheffield. It is alleged that the waters of the Housatonic River were dammed in such a way by this company that the water was set back, obstructing two highways in Sheffield.

The Sanitary District of Chicago has just entered into a contract to supply three manufacturing concerns with electrical power and light from the Lockport plant for five years. The Sanitary District will receive 2½ to 9 cents per kilowatt for the power. The companies contracted with are the Winthrop Asphalt Shingle Company, 4641 Twenty-sixth Street; the Shavings and Sawdust Company, Western Avenue and Twenty-third Street, and the McDonnell & Brennan Company, Thirty-fifth Street and Kedzie Avenue.

Mines in the eastern part of Okanogan County, the Chekapa mines on the west, the territory reaching from the British Columbia boundary on the north to Brewster at the mouth of the Okanogan River on the south, with boundaries to Chesaw and Molson, in north central Washington, will be supplied with electricity for lighting and power purposes by the Similkameen Power Company, which has just received a 50-year franchise from the commissioners of Okanogan County, northwest of Spokane. The company has a 1,500-horsepower plant at the falls of the Similkameen River, where it is proposed ultimately to generate 10,000 horsepower. Monroe Harman, Nighthawk, Wash., is president of the company, and H. W. Johnson, Oroville, Wash., is general manager.

A 60,000-volt hydro-electric plant has just been put into service in Japan, power being obtained by impounding the Ugigawa River. The main station has six 3,000-kilowatt, 50-cycle, 6,600-volt, waterwheel-driven alternators. The line voltage is 60,000 volts, raised through three banks of three each single-phase, water-cooled, 2,000-kilowatt transformers. Current is transmitted 25 miles to the Waseda sub-station just outside the city of Tokio, where water-cooled transformers step down to 11,000 volts for transmission underground through lead-armored cables to 11 distributing sub-stations. In the smaller sub-stations oil-cooled transformers step the voltage down to 2,000 volts, the line potential of the city circuits. The transformer, regulating and controlling equipment was furnished by the General Electric Company.

SOCIETIES AND SCHOOLS.

The new Nova Scotia Technical College in Halifax will contain an electrical research laboratory.

A course of 26 lectures on electricity and telephony was started in the Y. M. C. A. building, Salt Lake City, Utah, on February 3d. The lectures are given in the evening, several days apart, and the course will end on April 30th. Prof. L. W. Hartman, instructor in electricity in the Association Institute, is in general charge. The course was opened by Mr. D. McNicol, manager in Salt Lake City of the Postal Telegraph-Cable Company, on the subject, "Wireless Telephony Demonstrated." Mr. C. W. Wright of the Utah Light and Railway Company lectured on the commercial and domestic uses of electricity, and Mr. T. Bergelin of the same company has as his subject "City Distribution Systems for Light and Power." Messrs. H. W. Kline, R. J. Ardiff and C. S. McDonald of the Rocky Mountain Bell Telephone Company, and Mr. A. L. Dennis of the Utah Independent Telephone Company and K. A. Scheid of the Underwriters will cover the telephone subjects. Such subjects as electric traction, motor troubles, meters, power transmission, lamps, substations, etc., will be taken up by Messrs. F. D. Winegar, W. L. Emory and D. B. McBride of the Utah Light and Railway Company, Mr. Leonard Wilson of the General Electric Company, and Mr. D. M. Grosh of Gray & Grosh.

PUBLICATIONS.

The article on "Rubber Insulation for Conductors," by Mr. Fred J. Hall, has been reprinted in booklet form by the Habirshaw Wire Company of Yonkers, N. Y. The article is limited to the consideration of rubber as insulation for electrical conductors.

The Electric Journal, Pittsburg, has ready for distribution a topical index of all the important engineering articles that appeared during its four years of publication (1904-1907, inclusive). By printing on one side only the references are conveniently arranged for pasting on cards in a card index. Each article is briefly abstracted and the number of tables, curves, illustrations and words given.

Westinghouse portable and precision meters are the subject of circular No. 1104 from the Westinghouse Electric and Manufacturing Company. The circular has 54 pages and the devices described, illustrated and listed represent the latest development in meter manufacture, being designed and constructed with a view of not only securing high initial accuracy but also permanency. Permanency of calibration is an essential in the successful commercial meter, and this essential is said to have been fully met in the Westinghouse product. The catalogue contains some valuable data with illustrations and drawings.

Revised Circular No. 1104 from the Westinghouse Companies Publishing Department contains an exceptionally well-written treatise on the various portable meters manufactured by the Westinghouse Electric and Manufacturing Company. The large number of cuts illustrating the application of these meters to the measurement of single-phase and polyphase circuits should prove of much assistance to engineers and others called upon to make such measurements. The thorough system of indexing employed permits a ready reference to any desired subject, a feature of much importance in a work of this size.

In the monthly bulletin of the Ohio Brass Company for February is an interesting article on porcelain insulator testing, it being an exposition of the company's own methods. The value of the article is enhanced by drawings and tables. The bulletin also shows, among other things, the type D third-rail insulator for industrial railways. The insulating medium used in the Ohio Brass Company's insulator is a semi-porcelain, a material developed by this company for the class of service mentioned. The material is said to embrace the insulating properties of pure porcelain together with the ability to withstand severe shocks and vibration.

The Sprague Electric Company of New York has issued four handsome new bulletins, beautifully illustrated, which contain much valuable information and interesting data. Bulletin No. 107 goes into the merits of the company's continuous-current direct-driven type S generators for light and power.

A large number of working installations are shown, also parts of the machine. Bulletin No. 224 is the second edition on type D direct current motors. These machines have many desirable features, and the bulletin gives some interesting diagrams and illustrations. In bulletin No. 310, which is devoted to ventilating fans and blowers driven by direct-current motors, are pictures of some of the large buildings of the country which have been equipped by the Sprague company. Bulletin No. 507 treats of flexible steel-armored hose for steam and compressed air, and the numerous applications are treated in an interesting manner.

MISCELLANEOUS.

Mrs. F. Violet Sanborn is giving a series of lectures on domestic science at the free industrial exposition of the Wm. Barr Dry Goods Company in St. Louis. The lectures are given daily at 10 a. m., and the fourth week includes a different recipe each day. Mrs. Sanborn is a well-known writer and lecturer, her specialty being illustrated lectures on cooking by electricity.

Trustees of the Sanitary District of Chicago are offering $1,917,500 of an authorized issue of $2,000,000 of serial, coupon four per cent. bonds, dated December 1, 1907, and maturing from December 1, 1909, to December 1, 1926. Bids will be opened February 19th. A large part of the proceeds will be devoted to widening the Chicago River and completing the purchase of right-of-way for the new North Shore channel from Wilmette to the North Branch at Lawrence Avenue.

The Chicago Heat, Power and Refrigeration Company, which proposes to build conduits through which to furnish the service its title indicates, has laid its plans before a committee of the Chicago City Council and asks for a franchise. John C. Fetzer, Henry A. Allen, Fred W. Blocki and associates are interested in the company. The company proposes to establish a central power plant and, by means of underground pipes and wires, furnish steam and electricity for heat and power and refrigeration. It promises to enter a competitive field and materially reduce the cost of fuel and ice. It is said that sufficient capital is available for the project.

TRADE NEWS.

Robert W. Hunt & Co. have established their St. Louis office, which is in charge of Mr. C. W. Gennet, Jr., at 1445 Syndicate Trust Building. They have arranged to [illegible] and chemical laboratory [illegible].

Proposals will be received [illegible] igation, Navy Department, Washington, D. C., until noon March 10th for the [illegible] in power house at the Naval Training Station, Lake Michigan, near North Chicago, Ill. Blank forms of proposal and specification [illegible] plans may be procured upon application to the commandant, Naval Training Station, Great Lakes, North Chicago, Ill.

The Southwestern Machinery and Supply Company of Los Angeles, Cal., recently organized for the purpose of representing manufacturers of machinery and supplies exclusively in the fast-growing Southwest, is under the management of Mr. Charles L. Michod, who has been in this business at St. Louis and Havana, Cuba, for the past five years. The president of the company is Mr. J. Wallace of New York, while Mr. Theo. G. Finley of Los Angeles is vice-president and treasurer. Considerable business with Mexico is anticipated, but Southern Nevada, Arizona and Southern California will be the principal territory covered.

On February 5th one of the rope shops of the John A. Roebling's Sons Company at Trenton, N. J., was destroyed by fire. The shop destroyed was one of the several wire-rope shops at the works and was, compared with the other shops, of minor importance. Owing to the fact that business in general has been somewhat depressed and that at this season of the year the demand for wire rope is always less than during the spring and summer months, the facilities of the company's rope shops have not been overtaxed, and the productive capacity of the remaining shops will enable the company to continue prompt shipments of wire rope to its customers. Rebuilding of the shop which was destroyed will be begun at once, and no trouble whatever is anticipated in fully meeting the present trade demand for wire rope and in being in a position, through additional facilities, to meet the increase which will naturally come within a short time.

BUSINESS.

The Frank Mossberg Company of Attleboro, Mass., is manufacturing a new display stand which is meeting with favor. It is designed to make an efficient display of wrenches. Besides its line of special machinery and tools, punching dies and metal stampings, the Mossberg company makes a [illegible]

[illegible] by the trade at the recent Chicago Electrical Show, has been approved [illegible] among the list of standard electrical fittings for [illegible]

[illegible] and Michigan cedar poles, the company is in position to take care of the largest orders, whether they be confined to large or small sizes, or a combination of both. Yard stocks are ample to care for immediate demand. The company handles much of the larger pole business of the country and has a good reputation for the expeditious manner in which it is taken care of.

The Holmes Fibre-Graphite Manufacturing Company of 5155 Wakefield Street, Germantown, Philadelphia, manufacturer of the Holmes fiber-graphite commutator brushes, dynamo brushes and kindred manufactures, is again ready to meet business demands. Considerable loss by fire was sustained in October, 1907, by this company, but it is now in readiness to attend to all customers with promptness and care. The stock is in prime condition to supply all demands with dispatch, and the excellence of the product is well known.

Dossert & Co. of New York have recently received large orders from the Western Electric Company and the Central Electric Company of Chicago for Dossert solderless two-way and cable-tap connectors for use on the reconstruction of the Chicago City Railway Company's lines. The same firm has likewise sold a large order of solderless cable taps to W. L. Barstow & Co. for use in the installation of the cement plant of the Fordwick Company at Longue Pointe, Montreal. The Shawinigan Water and Power Company will supply the power to the extent of 44,000 volts, stepping down to 440. It is also to be noted that Dossert solderless terminal lugs are used throughout on all the lighting and power panels as well as the switchboards installed in the new 11-story fireproof Joseph J. Little printing building, Twenty-second Street, near First Avenue, New York, by E. C. Tibbals & Co.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 4, 1908.

877,901. Lock-out Device for Party-line Telephones. William M. Bruce, Jr., Springfield, Ohio, assignor to the American Automatic Telephone Company, Rochester, N. Y. Application filed February 15, 1906.

Each subscriber's station has a relay that can be bridged across the line. A shunt around the relay includes the talking instruments and a circuit-closer actuated by the relay. Another shunt is connected around the talking instruments. The resistance of the relay and of this second shunt, when connected, is such as to prevent the operation of any other relay on the line.

877,902. Telephone Switch. William M. Bruce, Jr., Springfield, Ohio, assignor to the American Automatic Telephone Company, Rochester, N. Y. Application filed February 18, 1907.

A hook switch arm engages a switch lever near its pivot, and through it opens and closes a number of contacts.

877,914. Telegraphic Transmitter. Patrick B. Delany, South Orange, N. J. Application filed March 31, 1906.

The local battery circuit contains two electromagnets so arranged that when one is energized its armature closes the circuit of the second and the armature of this one then opens the circuit of the first. The local magnets thus send a succession of impulses over the line.

877,915. Telegraphic Transmitter. Patrick B. Delany, South Orange, N. J. Application filed April 26, 1906.

A counterbalanced circular oscillator is set in motion by the key lever and in turn governs contacts so as to send a series of dots over the line automatically.

877,919. Electrical Contact Device. Friedrich Fink, Recklinghausen, Germany. Application filed February 25, 1907.

Two levers are pivoted in slots of an insulating block so as to have their lower ends engage a multiple layer conducting spring in one position and thus form a spring switch.

877,921. Telephone-exchange System. Samuel B. Fowler, Lafayette, Ind. Application filed May 22, 1906.

The supervisory relay is arranged to short-circuit part of its winding and thus to allow enough current to pass to light the supervisory lamp. This is extinguished when the short-circuit is removed.

877,953. Trolley. Jean E. Saucier, Montreal, Quebec, Canada. Application filed October 6, 1905.

A trolley pole has a yoke provided with integral lugs. A second yoke is pivotally secured to the first one and is provided with curved outwardly expanded arms, a roller and an adjustable spring.

877,959. Fluid-pressure Brake System. George M. Spencer, St. Louis, Mo. Application filed August 3, 1907.

The compressor is motor driven and electrically controlled.

877,968. Combined Telephone Drop and Jack. Henry C. Thomson, Boston, Mass., assignor to the Electric Goods Manufacturing Company, Boston, Mass. Application filed June 7, 1907.

A grooved and perforated insulating block has a sleeve for the jack plug and a transparent guard plate mounted in a groove in front of, but not touching, the signal drop.

878,012. Automatic Electric Supervisory and Signaling System. James G. Nolen, Chicago, Ill., assignor of one-half to Frank B. Cook, Chicago, Ill. Application filed December 23, 1902.

A fire-alarm system is connected with a telephone exchange through a master box. From the latter branch circuits run to switches and heat responsive devices located throughout the building. If any of these is opened an alarm is sounded in the building and in the exchange.

878,013. Electric Signaling System. James G. Nolen, Chicago, Ill., assignor of one-half to Frank B. Cook, Chicago, Ill., and one-half to the Automatic Fire Protection Company. Application filed March 11, 1904.

Modifications of the previous system are described.

878,017. Party-line Telephone System. Arthur F. Poole, Wheeling, W. Va. Application filed February 20, 1905.

The telephone apparatus at each subscriber's station is inoperative as long as a relay there is not energized. Each relay has a high and low resistance winding. The first is short-circuited when the second is actuated and the current then cannot energize any other relays on the line.

878,018. Lock-out Telephone System. Arthur F. Poole, Wheeling, W. Va. Application filed December 30, 1905. Renewed September 27, 1907.

This is a modified form of the above, in which both windings of the relay aid each other after the high-resistance winding has been energized.

878,062. Trolley Brush. George Heineman, San Francisco, Cal. Application filed September 13, 1907.

An electric car has a trolley-brush pole secured to each end thereof and extended above the roof of the car. Cross heads are connected to each of the poles, a series of longitudinally disposed wires are secured to the cross heads and a series of transverse wires are connected to the longitudinal wires, the whole set constituting the field of the trolley brush.

878,082. Combined Cigar Tip Cutter and Lighter. Thomas P. Moody, Chicago, Ill. Application filed July 20, 1907.

The cover for the box has a contact piece which wipes over a contact within so as to produce an electric spark.

878,083. Vibrator. Walter N. Nicholls and Frederic W. Nicholls, Toronto, Ontario, Canada. Application filed April 17, 1907.

A vibrator for induction coils has a vibrating reed mounted in, but insulated from, a bracket on the magnet core. The end of the reed is a cup fitting loosely over a ball. The bracket arm has an adjusting contact screw.

878,087. Electric Alarm Operated by Alarm Clocks. Edward Ploudre, St. Louis, Mo. Application filed March 20, 1907.

The alarm stem of the clock moves a rod which closes the circuit of an incandescent lamp and bell.

878,106. Electrical Signaling Apparatus. Benjamin F. Wooding, Denver, Colo. Application filed February 23, 1906.

In this block system a spring-held contact is pivotally mounted on the train for closing the circuit between trains when on the same signaling section or block, the contact having an inclined member having sufficient movement to maintain it in operative relation with the signaling conductors, regardless of the swaying movement of the train.

878,112. Electromechanical Switchboard Signal. Ernest W. Brackett, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed May 29, 1907.

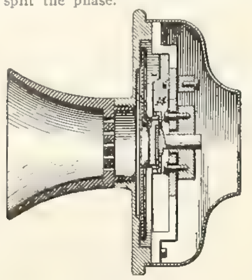
An electromagnet has an arc-shaped tongue at one end of its core and a U-shaped return bar at the other end. The bar has forwardly extending arms holding a shaft between them, on one side of which is a target and on the other an armature adapted to swing toward the core when the magnet is energized.

878,125. Reel for Coil Windings. Isaac de Kaiser, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 3, 1906.

A reel for winding coils in the slots of dynamo-electric machines consists of a base, a rod supported thereon, a substantially horizontal shaft adjustably attached to the upper end of the rod, a pulley mounted upon the shaft and means for adjusting the angular position of the rod.

878,138 and 878,139. Alternating-current Signaling Apparatus for Electric Railways. John S. Holliday, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Applications filed June 3 and June 28, respectively, 1907.

A relay for a single-phase railway has two windings connected in series across the track rails. One terminal of each winding is connected to outside wires of a three-wire two-phase signaling circuit. In the second patent single-phase is used for the signaling circuit and one winding of the relay has an inductance in series with it to split the phase.



NO. 878,192.—TELEPHONE TRANSMITTER.

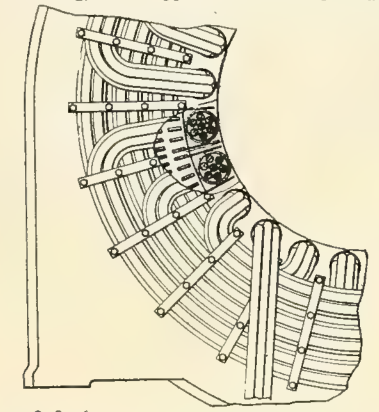
878,146. Electric Sign. Daniel F. Miller, Lowell, Mass. Application filed March 14, 1906.

This sign consists of a box with opaque sides, in which are transparent letters illuminated by electric lights mounted on a revolving framework which also carries a number of differently colored panes of glass.

878,151. Telephone System. Albert L. Parcelle, Boston, Mass.; Walter A. Parcelle administrator of Albert L. Parcelle, deceased. Application filed September 22, 1906.

A local transmitter circuit comprises branch circuits arranged in multiple, each having a primary winding with a separate core, and only one having therein a microphone. The receiver circuit has a secondary winding common to the primary windings and cores.

878,165. Dynamo-electric Machine. Egbert M. Tingley, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 4, 1906.



NO. 878,165.—DYNAMO CORE CONSTRUCTION.

In combination with a laminated core structure having slots for the reception of coils are spacing members which are located in the ventilating spaces at intervals between the laminæ and which encircle the slots and make their walls continuous. (See cut.)

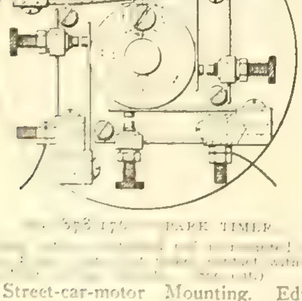
878,167. Commutator Cover. John E. Webster, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 6, 1906.

The field magnet frame constitutes an enclosing casing and has an opening over the commutator. Means are provided for fastening a cover to the frame over this opening and resilient means are interposed between cover and frame that serve to hold the cover at a short distance from the frame to allow ventilation of the interior and to prevent chattering.

878,173. Automatic Cashier and Discount Machine. Charles E. Yale, Burlington, Vt., assignor to the Yale Wonder Clock Company, Burlington, Vt. Application filed October 9, 1906.

The machine comprises a coin-controlled mechanism and means for electrically indicating in advance the variable value of the check to be ejected after a coin is deposited into the coin chute or receiver.

878,176. Spark Timer. Darwin Almy, Providence, R. I. Application filed May 16, 1906.



[illegible] 878,176.—[illegible]PARK TIMER.

[illegible] contact with a number [illegible] (See cut.)

878,179. Street-car-motor Mounting. Edward A. [illegible] Application filed [illegible]

[illegible] parallel with the [illegible]

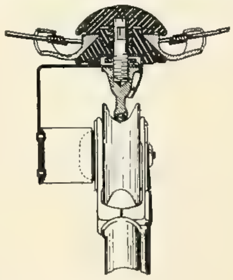
878,192. Telephone Transmitter. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed August 9, 1905.

This transmitter consists of a cup containing granular carbon, a diaphragm having a stiffening rib or flange and an electrode carried by the cup, resting intraperipherally and directly against the edges of the flange so as to receive motion therefrom. (See cut.)

878,212. Electric Fuse. Swan J. Leveen, Rock Island, Ill., assignor of one-half to the Electric Construction and Machinery Company, Rock Island, Ill. Application filed November 3, 1906.

An enclosed fuse with metal caps has a fuse plate, a fuse wire having its ends wrapped around the plate, and indicating means connected with the fuse wire and exerting tension on it.

878,247. Overhead Electric Contact. Thomas W. Small, Cleveland, Ohio, assignor to the Acme Automatic Street Indicating Company, Cleveland, Ohio. Application filed December 5, 1906.



NO. 878,247.—OVERHEAD ELECTRIC CONTACT.

A trolley hanger is provided with a contact device including a depending member and a series of flexible metallic plates arranged side by side with their broad sides transverse to the direction of travel of the trolley. The trolley harp has a contact boss on its side adapted to engage such contacts successively. (See cut.)

878,248. Automatic Time-switch. Harry B. Snell, Toledo, Ohio, assignor to the Snell-Judd Company. Application filed December 10, 1907.

A motor-driven arbor connected with the swtich has an escapement wheel with shoulders engaging two pivoted levers that are controlled by a clock.

878,249. Electric Apparatus for Railway Signaling. Henry W. Spang, New York, N. Y., assignor to Charles H. Ketcham, Yonkers, N. Y. Application filed January 12, 1903.

The rails of an insulated section of track have a generator connected with the farther end. A resistance, normally in circuit, and a signal-controlling relay, normally out of circuit, are located ahead of the near end of the section. A circuit controller having contacts with immersion points and bodies of mercury is adapted for excluding the resistance and including the relay and vice versa.

878,260. Electric Air Compressor. Nelson M. Watson, Detroit, Mich. Application filed April 23, 1906.

Two solenoids are arranged in tandem so that air cylinders form their cores. The pistons are connected together. The solenoids are alternately energized so as to produce a reciprocating motion of the pistons. When the pressure reaches a certain limit the current is automatically cut off.

878,264. Telephone Central Office Apparatus. Charles S. Winston, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 21, 1904.

In combination with a trunk circuit extending between a magneto telephone exchange and a common battery exchange is a cord circuit at the outgoing end of the trunk provided with a bridged clearing-out signal, and means whereby when the connection is taken down at the incoming end of the trunk a current is sent through the clearing-out signal in the cord circuit at the outgoing end of the trunk.

878,265. Automatic Trunking System. Charles S. Winston, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 2, 1907.

In a combined telephone system with automatic and manual subscribers' lines terminating in their respective offices, is a trunk circuit for connecting the lines of the two systems for conversation extending between the offices and terminating in the manual exchange in a cord and plug, and means to make and maintain a restoring connection with the trunk line for a short duration of time when the conversation has been terminated.

878,272. Conductor for Discharging High-voltage Electric Charges. William H. Chapman, Portland, Me. Application filed May 18, 1906.

A conductor for discharging electricity into the air has one or more discharging points, each of which has inserted between it and the source of supply a section of material having relatively high resistance, which will limit the quantity of electricity of high voltage which will pass in an instantaneous discharge.

878,273. Method of Neutralizing Static Electricity. William H. Chapman, Portland, Me. Application filed May 25, 1906.

This process of neutralizing static electricity in yarn or other like moving material consists in subjecting the material to the action of a charge of high voltage electricity radiated from discharging points, the electricity being of a polarity opposite to that of the electricity in the material.

878,302. Insulator. Harley R. Markel, Dayton, Ohio. Application filed July 10, 1907.

An insulator having a two-part body consists of a pair of duplicate matching members provided with similarly arranged wire openings, and each having a central guard tenon presenting a shoulder next to the adjacent wire opening, and a keeper mortise for the tenon of the other member.

878,305. Means for Mounting and Driving Dynamos for Electric Car Lighting. Alexander McGary and John W. Jepson, New York, N. Y., assignors to the Bliss Electric Car Lighting Company, Milwaukee, Wis. Application filed November 18, 1905.

The mounting for a dynamo on a car comprises a supporting frame or plate mounted upon the end sill of the car truck and a driving connection from the car wheel or axle to the dynamo.

878,361. Electrolytic Irrigator. Pierino Del Gaudio, New York, N. Y. Application filed July 8, 1907.

This electrotherapeutic device consists of a fountain with outlet and a battery having a terminal contained in the fountain clear of the outlet, and out of contact with the body of the user.

878,402. Magnet for Alternating Currents. Christian Krämer, Frankfort-on-the-Main, Germany, assignor to the Felton & Guilleaume Lahmeyerwerke Actien-Gesellschaft, Frankfort-on-the-Main, Germany. Application filed March 12, 1906.

An electromagnet has a core consisting of three parallel pole pieces and a yoke connecting them. The winding upon one pole piece is connected in series with a motor across the single-phase source and the windings upon the other two pole pieces are connected in series across the source.

878,412. Electric Sparking Device for Gas Engines. Edward R. Moffitt, San Francisco, Cal., assignor to the Imperial Gas Engine Company, San Francisco, Cal. Application filed March 13, 1907.

The spark plug contains a stationary electrode and a stem free to oscillate on its axis and to move longitudinally in the plng. This stem has a contact piece on its end inside the explosion chamber of the engine.

878,423. Combined Gage and Circuit-closer. Joseph F. Raynes, Hyde Park, Mass. Application filed May 21, 1907.

A gage with a dial and a hand is combined with an automatic switch which comprises a relatively stationary segmental contact disposed over the dial, a movable contact adapted to bear on the first and actuated by the hand, and a magnet arranged to operate on the movable contact to open the switch.

878,425. Electrolytic Apparatus for Electrolysis of Metallic Salts. William H. Rines, Rumford Falls, Me. Application filed June 17, 1907.

The apparatus consists of a receptacle, a cathode plate having deep V-shaped corrugations in cross section arranged horizontally therein, and a diaphragm of asbestos, substantially conforming with the plate and arranged over the same.

878,435. Induction Coil. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed February 8, 1905.

A box has a number of induction coils mounted therein and individual mechanical and electrical connections for each coil whereby any one of them may be removed without disturbing the connections of the others, and a single switch for controlling the primary current to all the coils.

878,465. Electrical Signaling and Switching Apparatus. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Original application filed September 10, 1906. Divided and this application filed May 29, 1907.

A telephone spring jack comprises side plates connected by transverse bridges or yokes and contact springs mounted upon one of the bridges and lying between the side plates, one of the side plates being provided with a sight opening opposite to and permitting inspection of the contacts.

878,467. Induction-coil System. Israel C. Orswell, Amesbury, Mass., assignor to the Orswell Igniter Company, Boston, Mass. Original application filed January 25, 1906. Divided and this application filed April 20, 1907.

A casing contains two compartments, the upper one containing a vibrator and the lower one a number of induction coils connected thereto.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 10, 1908:

445,969. Electric Insulator. J. R. Branch, Richmond, Va.
445,991. Electromechanical Indicator for Fire-alarm Telegraphs. T. F. Gaynor, Louisville, Ky.
446,030. System of Electrical Distribution for Mines. E. A. Sperry, Chicago, Ill.
446,031. Electric Switch. E. A. Sperry, Chicago, Ill.
446,037. Extensible Bracket for Electric Lamps. J. E. Titus, Orange, Mass.
446,092. Dynamo-electric Machine and Electric Motor. E. K. Brown, Brooklyn, N. Y.
446,104. Electrode for Secondary Batteries. M. M. M. Slattery, Fort Wayne, Ind.
446,108. Electric Arc Lamp. R. H. Mather, Windsor, Conn.
446,109. Arc Light. R. H. Mather, Windsor, Conn.
446,142. Electric Signal and Searchlight Lantern. G. W. Martin, Somerville, Mass.
446,159. Switch and Signal Apparatus. G. Westinghouse, Jr., and J. G. Schreuder, Pittsburg, Pa.
446,188. Telephone Transmission. J. W. McDonough, New York, N. Y.
446,200. Fire Indicator and Extinguishing System. S. Broichgans, Milwaukee, Wis.
446,214. Method of Laying Electric Cables. C. H. Wilson, Chicago, Ill.
446,229. Regulator for Electric Motors. L. S. Harris, Detroit, Mich.
446,245. Electric Locomotive. G. R. Baldwin, Montreal, Canada.
446,284. Automatic Potential Regulator for Electric Currents. A. L. Ellis, Kansas City, Mo.
446,297. Electric Arc Lamp. C. J. Schwarze, Brooklyn, N. Y.
446,298. Arc Light System. C. J. Schwarze, Brooklyn, N. Y.
446,313. Electric Signal System for Railroads. E. C. Wiley, Bristol, Tenn.
446,376. Electric Railway and Contact Device Therefor. E. M. Bentley, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Tusciano River Hydro-electric Plant in Italy.

By A. de Courcy

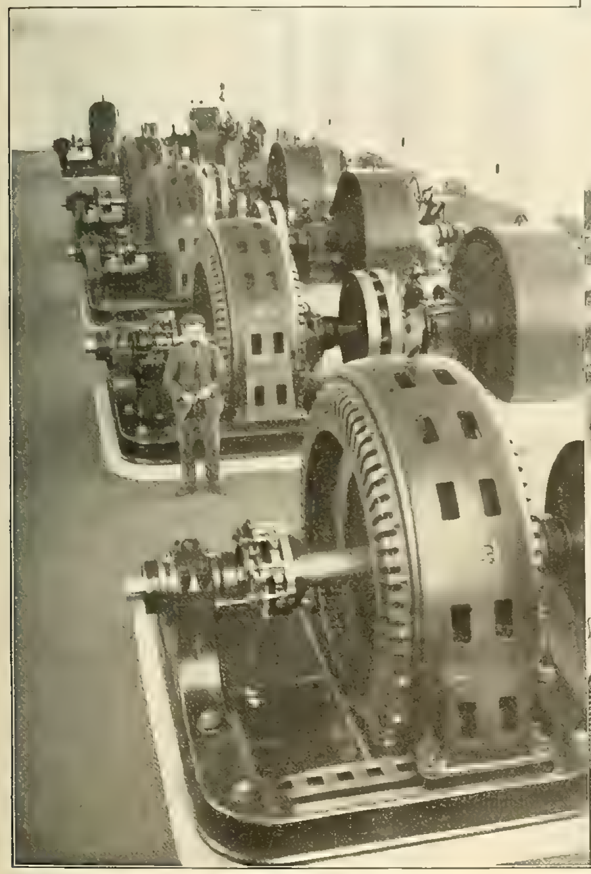
One of the recent power-transmission plants to be erected in the southern part of Italy is the Tusciano station, which is controlled by the Southern Electric Company. The power house is situated near the village of Olevano, about four miles from the railroad station of Battipaglia, and it utilizes the power of the Tusciano River in order to operate a power line on the high-tension, alternating system and to distribute current to the industrial centers of Salerno, Nocera, Scafati and Torre Annunziata. The last named lies at a distance of 37 miles from the central station. The electric outfit of the present plant has been furnished by the Société Anonyme Westinghouse and constructed at its works at Havre.

Tusciano River rises on the southern slope of the range formed by the Accellica, Cervialto and other mountains and flows into the sea near Battipaglia. Its basin, as well as that of its main affluent, the Isca della Cava, lies in an open region with but little forest, and on this account the freshets are sudden and large. On account of the nature of the ground to be traversed, as well as the great length of the intake canal, the Franco-Swiss company, which carried out the construction work, decided to build the canal entirely underground. The dam lies at a height of 431 meters above sea level, and the water is led off on the right bank of the river at 20 meters above the dam. Near this point is the first basin, placed below the dam. Connected with it by a gate is a second basin, from which starts the offtake canal. This canal is 3.6 miles long. At the end of it is a settling basin which is connected in turn with two main reservoirs. From each of the reservoirs there will be a penstock leading to the power house. The head of water is 283.9 meters and the total amount of power which can be utilized is 13,247 horsepower. But as the whole amount is not used by the Southern Electric Company, this company has only 7,190 horsepower, which corresponds to 5,400 horsepower upon the turbine shafts. At present there is but a single penstock constructed, and the general disposition of this part of the plant will be noticed in one of the accompanying pictures. The penstock ends at the station in a general distributing pipe which supplies the different turbines.

The power house contains a generator room which is 44 meters in length and 12.50 in width, and also a wing in the front part in which are located the transformer room, a repair shop and other annexes. The stories above these rooms are used for offices and also to contain the main high-tension switchboard. Five turbine waterwheels have a capacity of 1,400 horsepower each and are coupled upon a horizontal shaft to the main alternators, while two small 150-horsepower wheels are used for the exciters. The turbines operate at a standard speed of 500 revolutions per minute. Each is provided with a motor governor for operating the water feed. This type of governor is entirely mechanical in its action and has some advantages over the usual hydraulic piston governor, especially when the water contains sediment. A hand-operating device is also used in connection with the governor, which serves for starting and stopping the wheels, and by a proper arrangement the attendant cannot close off the water too quickly, thus avoiding any shocks to the water column in the penstock. These wheels have an efficiency at full load of 76 per cent., varying down to 62 per cent. at one-quarter load. About 10 tons is the weight of each turbine, and it is connected to the alternator by an electric disk coupler.

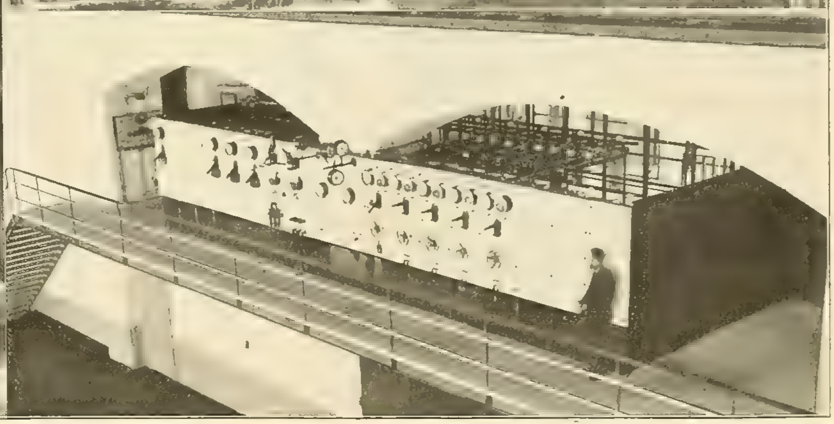
Turning to the alternating-current generators of the plant, which will be observed in one of the pictures, it will be noted that these machines are of the revolving-field, horizontal-shaft pattern, and furnish current of 3,000 volts and 50 cycles on the three-phase system. The field winding is made up of copper strips and the poles have air circulation gaps which correspond to similar openings in the armature. Apparatus of the Leblanc system is [illegible] The drop in voltage between no load and full load [illegible] the normal voltage and [illegible] per cent [illegible] and 20 per cent for [illegible]. The weight of the armature portion of each alternator is very nearly eight tons, while the revolving field and its shaft weigh 6.3 tons, and the bed-plate and bearings figure for 6.1 tons. Although the peripheral speed in this case is relatively high, being 45 meters per second at the standard speed of 500 revolutions per minute, there is no difficulty from this cause, and they have been run on test at as high a speed as 800 revolutions per minute, which corresponds to the racing of the turbines.

The exciters are compound-wound, four-pole machines, rated at 110 kilowatts, and furnishing 110 volts when running at the normal speed of 700 revolutions per minute. Lighting current for the station is also given from these circuits and several motors are run in the repair shops.



View in Generator Room of Power House.

Generating Station near Village of Olerano.



Switchboard Controlling the 3,000-volt Generators.

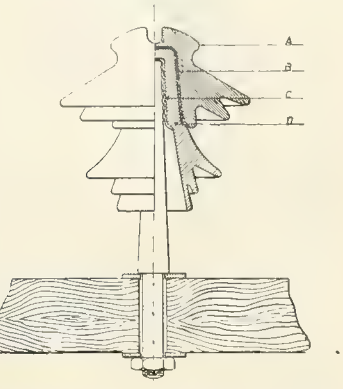
TUSCIANO RIVER HYDRO-ELECTRIC PLANT IN ITALY

The 3,000-volt current from the alternators is raised to 30,000 volts by means of three groups of transformers. Each group comprises three single-phase static transformers, these being placed in an adjoining room. These transformers are of the oil-insulated pattern without artificial cooling, and their weight, together with the oil, is six tons. They are connected in delta upon the bars of the alternators and in star upon the terminals of the pole-line, which transmits current at 30,000 volts. By connecting them in delta for the latter case the operating voltage can be limited to 17,500 volts if desired.

There are three main switchboard frames in the station. One of these contains the 3,000-volt panels for the machine current, while the second receives the 30,000-volt current from the transformers. A third switchboard carries the low-tension apparatus.

The overhead line is formed of electrolytic copper wire of seven-millimeter gauge. At present there are two lines of three wires each. Where the lines

leave the station they are placed parallel to each other and in the same horizontal plane upon a long iron beam held upon two latticework poles, at the extremities of which are placed two lightning arresters of the horn pattern. From this point the wires go to the main poles of the line. The latter are all of metallic latticework construction and have three cross-arms upon which the insulators are fixed so as to have one line on the right and the other on the left of the pole. About



INSULATOR FOR TUSCIANO RIVER TRANSMISSION PLANT IN ITALY.

60 centimeters distance is allowed between the wires and the poles are spaced 60 meters apart on the average.

A distance of 38 miles is covered by the present line. Starting from Olevano, on the Tusciano River, it runs to the villages of Salerno and Vietri, passing thence to Cava Dei Tirreni and crossing the railroad, then following the north slope of the Mount Albino and descending to the plain near Scafati. It then passes along the railroad until it reaches the sub-station, which is situated near the railroad station of Torre Annunziata. In the accompanying diagram is represented the type of insulator which is used for the pole-line, and it has been recently adopted as an improvement over the insulator formerly used, which was found to be of insufficient strength. The present insulator is made up of two pieces of porcelain cemented together by a litharge and glycerine cement, while the insulator is fixed to the metallic rod support by a threaded brass cap. Referring to the drawing (A) is the porcelain, (B) cement, (C) the threaded cap. A series of tests were made with these insulators. For the perforation the two parts separately stood 50,000 volts, and the two pieces assembled 100,000 volts. For the exterior arc, under rain falling at 45 degrees at 1.0 millimeter per hour, no arc is produced at a tension of 45,000 volts. As to mechanical resistance, under a tractive effort of 800 kilogrammes, neither the porcelain nor the metal parts was found to suffer. The joints of the wires are made by means of Hoffmann joints with melted tin run into them.

In the portion of the transmission line lying between the main station and the town of Pontecagnano the poles carry a third line working at 3,000 volts which is used to supply several industrial establishments, among which may be mentioned the agricultural plant of the Campione firm.

The sub-stations on the line are divided into two stories, the lower story containing the transformers and the upper the switches, lightning arresters, fuses and other apparatus. The windings of the transformers allow of reducing the line voltage of 30,000 volts to 2,000, 1,000 and 500 volts, according to circumstances, by a simple change in the secondary winding, while if need be the primaries can be modified so as to take 17,000 volts as a standard line voltage.

Tidal Power Plants to be Built in Maine.

Plans are under way for the construction of tidal power plants, based upon the invention of William O. Webber of Boston, at Thomaston and Portland, Me. Alfred S. Black, E. B. McAllister and F. E Holman of Rockland, with Mr. Webber [illegible] capitalists, are the men chiefly interested in the enterprise. Sites have been [illegible] and Portland. Mr Black states that the plant at Thomaston will furnish [illegible] service and manufac[illegible] a few miles distant and [illegible] for Portland. Work at Thomaston will begin in the spring.

Electro-pneumatic Multiple-unit Control System with a Single Train Pipe.

The multiple-unit system for controlling the motors of a train of cars has certain marked advantages that have led to its extensive adoption on electric railways carrying a traffic heavy enough to warrant the running of a number of cars in a train. Among these advantages may be mentioned utilization of practically the entire weight of the train for tractive effort, rapid acceleration and the fact that the track construction does not have to be as heavy as would be required if all the motive power is concentrated in a single motor car or locomotive. An objection to the system is that it is usually complicated, especially where purely electrical control is utilized. To overcome this, combined electric and pneumatic control systems have been devised in which the controllers on each car are pneumatically operated from any one of a number of master controllers, which can regulate the air pressure in a system of train pipes.

In these systems it has been necessary to provide at least two pipes extending throughout the length of the train. To simplify this still further, George B. Schley of Norwood, Ohio, has invented a system in which only one train pipe is required for this purpose. The invention was recently patented and assigned to the Allis-Chalmers and Bullock companies. The main features of this system are that the controller on each car for the motors thereof is operated by variations in air pressure through connection by a single air pipe with the master controller of the leading or any other car. For forward running the pressures are above atmospheric; for backward running they are below atmospheric, i. e., the operation is by means of a

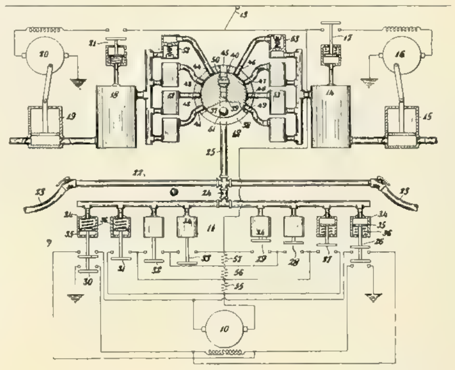


FIG. 1. MULTIPLE-UNIT CONTROL SYSTEM.

partial vacuum. The two diagrams herewith illustrate only the general application of the system in two modified forms.

Referring to these drawings, (10) represents the motor or motors to be controlled on a car, (11) a pneumatically operated car controller therefor, and (12) a master controller for the car controllers. Operating current is supplied through a trolley or contact shoe (13). A reservoir (14) is supplied with compressed air by a pump (15) driven by a motor (16). This motor is controlled by a pressure-operated switch (17), responsive to the pressure in the reservoir to keep it approximately constant. A reservoir (18) has air exhausted therefrom by means of a pump (19) driven by motor (20). This motor is controlled by a pressure-operated switch (21), responsive to the degree of exhaustion in the reservoir (18) so as to maintain it approximately constant. The switch (17) closes to start the motor (16) upon a decrease in pressure in the reservoir (14) and opens to stop it upon an increase in such pressure, while the switch (21) closes to start motor (20) upon an increase in the pressure in the reservoir (18) and opens to stop it upon a decrease in such pressure. The values at which the switches (17) and (21) operate respectively may be set at anything desired. These pressure switches may be of any well-known form, being preferably snap switches.

There is a single pipe (22) extending throughout the length of the train to be controlled. The pipes on adjacent cars are connected by the usual flexible connections (23). On each car the train pipe is connected to the controller by a pipe (24) and to the master controller by a pipe (25). So far the description has related equally well to both the drawings.

In the form shown in Fig. 1 the car controller (11) comprises a number of separate pneumatically actuated switches (26) to (33) inclusive. As shown, the operating means for each of these switches includes a cylinder (34) in which is a piston (35) connected to the switch. Within each of the cylinders is a spring (36) which tends to open its associated switch. On one side of the piston each cylinder is connected to the pipe (24) and on the other side of the piston to the atmosphere. These switches are arranged to be all open when the air in the train pipes is at atmospheric pressure. The switches (26) to (29) close as the air in the train pipe reaches successively higher pressures above atmospheric, while the switches (30) to (33) close as the air reaches successively lower pressures below atmospheric. Any desired method of obtaining this successive action may be used, such as varying the distances which the switches must travel in order to close. The switches (26) and (30), respectively, close the motor circuit for rotation in opposite directions. The difference between the connections of the two switches is merely that the current in one element, as the field, of the motor or motors to be controlled is reversed. In Fig. 1 only one motor is shown, but obviously any desired number of motors may be used.

The master controller (12) consists of a disk (37) fitting within a ring (38) so as to rotate therein. The disk has a central opening (39) connecting the pipe (25) and a radial opening (40). In the ring are a number of radial openings (41) to (49) inclusive. The opening (45) is connected to the atmosphere. The openings (41) to (44) are connected through pressure-reducing valves (52) to the reservoir (18), the different valves being adjusted so that these openings have successively higher pressures, all lower than atmospheric pressure. The openings (46) to (49) are connected through pressure-reducing valves (53) to the reservoir (14), these valves being adjusted so that the latter openings have successively higher pressures, all higher than atmospheric. Normally the opening (40) connects with the opening (45) as shown. The disk can be rotated, as by means of a removable handle (51), to bring the opening (40) opposite any of the openings (41) to (49) inclusive. A valve (50) is located in opening (40), this valve being open when that particular master controller is being used and closed at other times. If desired this valve may be arranged to be opened and closed respectively by putting on and taking off the handle.

The operation of the system is as follows: The valve (50) on the master controller to be used to control the train is opened, the valves on other cars being closed. When the disk of this controller is in its normal position and the openings (40) and (45) are connected, the train pipe is connected to atmosphere, and the switches (26) to (33) inclusive throughout the train are all open as shown. When movement in one direction is desired, the disk of the master controller is moved to bring opening (40) opposite the opening (46), thus supplying to the train pipe a pressure slightly higher than that of the atmosphere. This increased pressure causes all of the switches (28) to (33) inclusive to move downward, and is sufficient to close the switch (26) on all the cars of the train while bringing the other three switches nearer to closed position. The closing of switch (26) completes the circuit of the motor through the resistance sections (55), (56) and (57) and causes the train to start. When the disk is moved further in the same direction to bring openings (40) and (47) opposite each other, a still higher pressure is let into the train pipe (22) and the switches (27) on all the cars operate to cut out the first resistance section (55), and increase the speed of the train. As the opening (40) in the disk is suc-

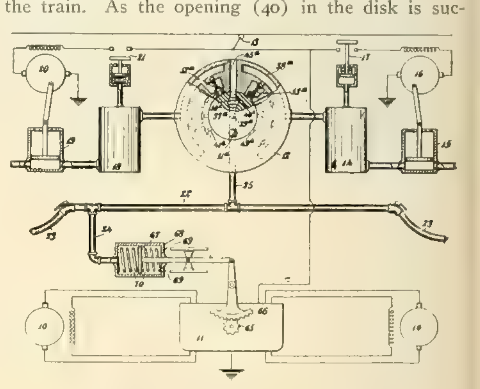


FIG. 2. MULTIPLE-UNIT CONTROL SYSTEM.

cessively brought opposite the openings (48) and (49), the switches (28) and (29) are successively operated to cut out the remaining resistance sections, thus further increasing the speed of the train. When it is desired to stop, the disk is returned to its normal position, and the train pipe thus being connected to the atmosphere through opening (45), all of the switches which have been closed are opened. When movement of the train in the other direction is desired the disk is moved to bring the opening (40) successively opposite openings (44) to (41) inclusive, thus successively diminishing, step-by-step, the pressure in the train pipe and causing the operation of the switches (30), (31), (32) and (33), in the order named. The closing of the switches controls the motors in

a similar manner to that just described. As before, the train may be stopped by bringing the disk back to its normal position and connecting the train pipe to the atmosphere. The control system here described has been purposely made ample for the sake of clearness. The car controller (11) may be modified in many ways.

Should the train happen to break and the connections between the pipes (22) on the different cars be interrupted, these pipes will be connected to the atmosphere, and the controllers (11) brought to their "off" position, causing the train to stop. Throughout the operation as described above, the pressures in the reservoirs (14) and (18) are kept constant by the motor-driven pumps (15) and (19), respectively, controlled by the pressure switches (17) and (21), respectively. This method of keeping constant the pressure in a reservoir is old and well known and needs no further explanation here.

Referring to Fig. 2, the reference characters (11) to (25) denote the same elements as in Fig. 1. In Fig. 2, however, the main controller (11) is not composed of a number of separately actuated contacts, but is of the drum or other similar type, and is arranged to have a neutral or "off" position and to move in opposite directions from such position for forward and backward movements of the car or train, respectively. This controller is operated through a pinion (65) and a gear segment (66) by a piston in a cylinder (68). The space to the left of the piston (67) is connected to the pipe (24) and through it to the train pipe (22), while the space at the right of the piston is connected to the atmosphere through openings (69). A spring or springs (70) maintains the piston and the controller (11) in their central or neutral positions when the pressure in the train pipe is equal to that of the atmosphere. The master controller in Fig. 2 consists of a movable disk (37^a) fitting rotatably within a ring (38^a). This disk has openings (39^a) and (40^a) similar to openings (39) and (40) in Fig. 1. The opening (40^a) may be brought opposite any one of the openings (41^a) to (49^a), inclusive, the opening (45^a) being connected to the atmosphere, the openings (41^a) to (44^a) to the reservoir (18) through pressure-reducing valves (52^a), and the openings (46^a) to (49^a) to the reservoir (14) through pressure-reducing valves (53^a). In Fig. 2, however, the pressure-reducing valves are shown built into the master controller instead of being separate therefrom, as in Fig. 1. In the opening (40^a) is a shut-off valve (50^a).

As the disk is moved clockwise or counter-clockwise, the pressure in the train pipe is successively raised or lowered and the piston (67) is moved either to the right or to the left accordingly. Movement to the right from the neutral or middle position causes the pinion to be moved counter-clockwise to connect the motors for movement in one direction. Continued movement of the piston with its connected controller drum or drums causes higher speeds of the motors to be obtained, these motors being connected in any desired manner to accomplish this end. When the piston is moved to the left from its middle position, the direction of running is reversed.

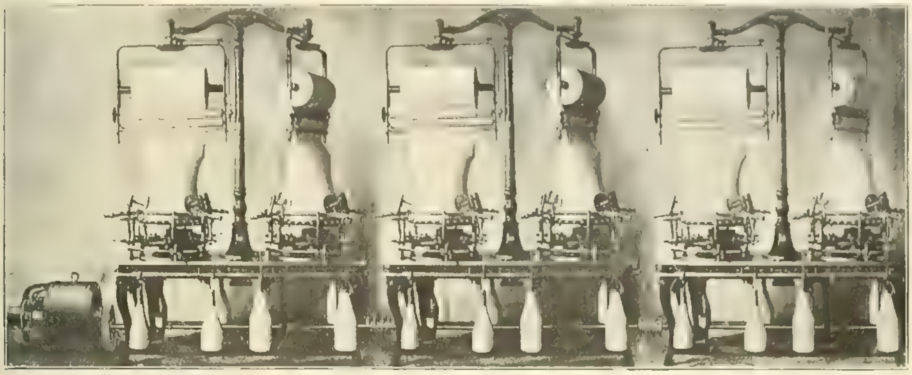
Speed of Submarine Telegraphy.

The fact is that the great submarine cable systems are far more efficient than telegraphy over comparatively short distances by land. Thus, though New York is some 4,000 miles from London, cablegrams are transmitted there, and an answer secured, in far less time than it usually takes to get a telegram between London and Liverpool. Transatlantic cablegrams are, indeed, transmitted direct into stockbrokers' offices at London and New York quite ordinarily within a minute; and about five minutes is, as a rule, sufficient to cover a complete buying and selling operation between the London Stock Exchange and Wall Street, New York. For this pitch of perfection we have, in the first place, to thank healthy rivalry between four competing companies.—Charles Bright, F. R. S. E., in London Times Engineering Supplement.

Advancement in the Knitting Industry.

[illegible] they understand the operation of the machines. They can readily discern quality in the finished product, but seldom inquire into the causes which from time to time effect improvement in the various garments. In the textile industry in general the introduction of electric drive has brought about probably the principal advance of recent years.

The machines illustrated herewith are three Tompkins two-head knitters driven by gearing, through a common belt, from an Allis-Chalmers type K motor. These are used for knitting almost any kind of yarn into a tube of cloth, which is afterward cut and seamed into garments or sold in the roll under the name of "Stockinet," the name being derived from the fact that years ago stockings as well as underwear were cut and seamed from it. The machines shown are technically "circular, spring-needle, loop-wheel, knitting machines." They are called "circular" because the needles are in a circle, spring-needle" because the needle has a spring beard instead of a latch, and "loop-wheel" because the yarn is looped into the needles by a toothed wheel or bur.



TOMPKINS KNITTING MACHINES DRIVEN BY ELECTRIC MOTOR.

This type of machine is to knitting what the steam turbine is to steam engineering; namely, the purely rotary machine; consequently it has many of the qualities of the steam turbine. For instance: High peripheral velocity, durability, simplicity and freedom from noise and jar. This type of machine is supposed to have been invented in France, but was first exploited in England, and has reached its highest development in the United States, where its high production and applicability to a wide range of work makes it more appreciated than in the older countries where labor is cheaper and where changes in style and kind of work are not so frequent.

The production of one of the heads or cylinders illustrated depends, of course, on the number of feeds and the speed of the machine. The speed of the body-size machine—about 18 inches in diameter—is not infrequently as high as 100 revolutions a minute, although 60 revolutions a minute is average practice. The number of feeds varies from four to 10, or even more, according to the kind of work. The production per cylinder ranges from five dozen garments per day to 33 dozen garments per day in actual practice.

Among these products of the machine are ordinary flat cotton underwear, flat balbriggan underwear, flat fleeces, such as Wright's health underwear, wool goods, such as the Glastonbury underwear, fine mercerized linings for gloves, cotton, wool and worsted linings for rubbers and rubber boots, astrachan cloth for the backs of gloves, coarser astrachan for ladies' jackets and men's overcoats, and still coarser furcloth for sleigh robes and rugs, and motormen's coats.

The motor shown in the illustration is for direct current, of the Allis-Chalmers type, but for textile-mill service the so-called induction motors for alternating current are ordinarily used by the Allis-Chalmers Company, the method of application being the same.

Recent bulletins of the University of Wisconsin, Madison, Wis., are "A Comparison of the Effects of Frequency on the Light of Incandescent and Nernst Lamps," by F. W. Huels, B. S., instructor in experimental engineering; "Investigation of Centrifugal Pumps," by C. B. Stewart, C. E., and "Tests on Plain and Reinforced Concrete," by M. O. Withey, C. E., instructor in mechanics.

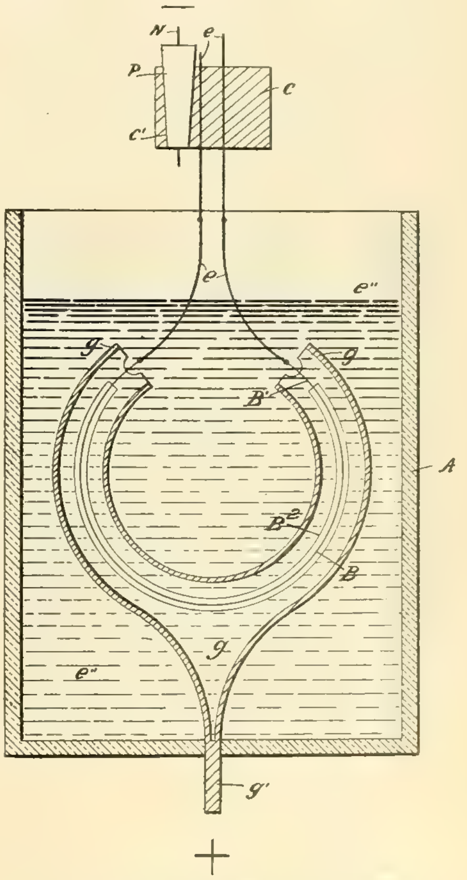
New Processes for Making Metallic and Metallized Filament Incandescent Lamps.

[illegible] common and rarer metals alone and with carbon as a core. There have been granted to him over a dozen American [illegible] principal one will be briefly described below.

These patents are all very broad and cover the use of quite a variety of metals and alloys. In each case, however, the metals are coated singly or in combination on a filament core by an electrolytic process. A number of distinct layers are provided for. Before placing the filament core into the electrolyte, its surface may be prepared for the deposit of the preferred metals, osmium and iridium, by a primary deposit of zinc, which is then amalgamated with mercury. The zinc and mercury so used are subsequently removed by dissolving or evaporating them off.

The diagram of the preferred form of the apparatus used for the electrolytic deposition of the osmium-iridium shows that the two ends of the filament core, as one electrode, are attached to the same pole. The other electrode may be dispensed with in its complicated form, as long as this second pole is immersed into the electrolyte. This electrolyte is prepared by dissolving osmiate of potash with a small admixture of chloride of iridium. It is assumed that the deposition of the two metals is brought about in a secondary reaction, hydrogen being set free and reabsorbed in a double reaction.

One of the features of the invention is the arrangement of a carbon filament to form the nega-



APPARATUS FOR ELECTROLYTIC DEPOSITION OF OSMIUM-IRIDIUM IN LAMP MANUFACTURE.

tive pole in an electrolytic bath in a loop-shape, similar to the shape in which it is to be used in the lamp, without direct connection with the positive pole, such as used in the common flashing process. Importance is attached to the form of the metal used as the positive pole in the bath, by which form the carbon loop (B), (B') is in close opposition or proximity and at mainly uniform distance to and from the plate of metal (g), that acts as the positive electrode or anode, and which

plate is continuous in itself and to the positive pole (g'). (B^2) marks the part of the electrolytic deposit which faces the plate directly, the extreme parts of lighter deposits not being marked specially, but being limited only by the line of immersion (e"). (C') is the connecting plug and (P) is the metallic receiver for the wires (e') and the plug. The coating so produced is said to be amorphous, tenacious and ductile.

When this osmium-iridium filament is set into an exhausted bulb, and the current turned on at the proper moment, even while completing the exhaustion, or when a virtual vacuum has been effected, and when there is carbon present, aside from eventual evaporation of such carbon, a carburization of metal takes place, and it depends on the proportionate thickness of metal and of carbon whether the carburization takes in the entire carbon part, or all of the metal cover, or leaves some carbon, or some metal, yet intact. The best way to produce this carburization is to slowly increase the current passed through the lamp.

To still further improve this filament, Mr. Cazin proposes to place another electrolytic deposit on this metallic cover, and he selects for this purpose a metal or metals of the "rare-metal" class, of which he names 31 members without disclosing the preferred one. The compound filament is entered into the partially exhausted bulb and is then subjected to a carefully controlled current which causes partial or complete oxidation of the outer metallic coat. The bulb is then sealed.

The compound filament then consists of a carbon core covered in turn by a compound of carbon with osmium and iridium, a layer of these two metals, and finally, on the outside, by a coating of rare metallic oxides.

New Printing Telegraph at the United States Capitol.

By Waldon Fawcett.

Officials of the Congress of the United States and all those holding administrative positions at the Capitol at Washington have become enthusiastic advocates of recent years of the advantages of electric power. The current, generated in an up-to-date plant in the basement of the big building, is employed for every purpose to which it is adapted and its use will be still further extended upon the completion of a new plant designed to provide light and power for the Capitol and its two annex structures—the new office buildings for the use, respectively, of the members of the Senate and House of Representatives. The first of these an-

[illegible] Waldon Fawcett.

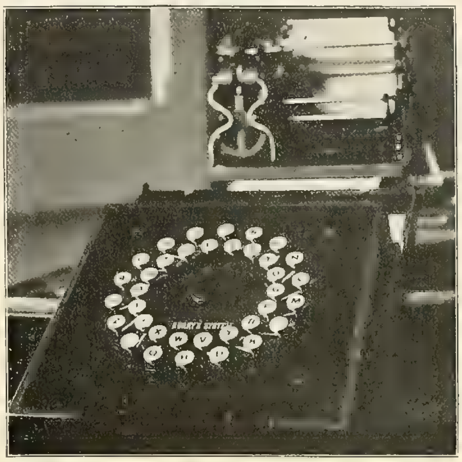
[illegible] OF PRINTING TELEGRAPH AT [illegible] CAPITOL.

nexes—the new $3,000,000 office building of the [illegible] has been completed [illegible] the readers of [illegible] know, is being linked to [illegible] operated com[illegible]

[illegible] operations of a print[illegible] are being [illegible] providing a [illegible] for [illegible] and transmitting the chronicle to points more or less distant. Three views of the present installation are given here- [illegible]

in their private offices, one-third of a mile distant from the scene of activities. At the outset the scope of this new "intelligence transmission system" is limited to the Capitol and the new office building of the House of Representatives, but if the device does all that is expected of it the sphere of usefulness will be extended to include the Senate office building, now under construction, and all the principal government departments, some of them occupying buildings situated several miles distant from the Capitol.

The provision of the new $3,000,000 building south of the Capitol, said to be the largest office building in the world, with offices for the 400 representatives in Congress, was directly responsible for the introduction of this new time-saving



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KEYBOARD OF PRINTING TELEGRAPH AT WASHINGTON.

device. For years past there has been growing realization of the need of some communicative system that would more closely link the various parts of the legislative headquarters, and once provision was made for outside office quarters for the members of the Senate and House of Representatives this need became imperative. Most of the lawmakers will henceforth spend a considerable portion of their time in the private offices or committee rooms of the new office buildings, and it is essential that they have means at hand to keep momentarily in touch with all that transpires on the floor of the legislative chamber to which they are accredited.

Mr. Elliott Woods, superintendent of the United States Capitol, gave much study to the subject and finally decided to make a trial of the printing telegraph as the communicative system most likely to meet the demands at the Capitol. The system as installed consists of a sending station, in charge of an operator, and three receiving stations which are, of course, entirely automatic in their operation. One of the receiving stations is located in the new House of Representatives office building and the others are in the Capitol proper. The system has been purposely restricted in scope until its fitness for the work in hand has been fully demonstrated. Then the number of receiving stations can be multiplied to any extent desired. Upon the formal adoption of the apparatus the base of operations, or sending station, which is now in the basement of the Capitol, will be removed to a room adjacent to the office of the Speaker so that the operator can receive bulletins for transmission with the utmost promptness. The statements to be transmitted by the printing telegraph will be prepared by the journal clerks of the Senate and House of Representatives and nothing will be transmitted by the machine save an official transcript of the proceedings of the two Houses of Congress.

The printing telegraph which has been selected for use at the Capitol is the Burry system, and it has the keyboard arranged with letters and numerals in a double circle. In accordance with the latest approved practice a "dummy" receiving instrument is installed adjacent to the sending apparatus so that the operator has visible evidence at hand of the result of his work and can correct any mistakes or supply any omissions before the error has had time to make trouble. This facility for checking up the work as it progresses is of the highest importance in serving Congressmen who must have information of absolute accuracy.

The messages, which are transmitted simultaneously to any number of receiving stations, are printed in typewriter character on paper of the width of ordinary letter paper. The paper unwinds from a roll and at intervals a section is cut off and bound with its predecessors in a file near at hand. This phase of the operation is of importance in the congressional work, it being designed to have the bound sheets constitute a complete skeletonized record of all that has transpired at the Capitol during the day. Thus, a member arriving at the legislative headquarters late in the afternoon of a day on which Congress is in session can, by glancing through the cumulative bulletins at any receiving station of the telegraph, quickly familiarize himself with all that has occurred up to the minute of his arrival.

The primary purpose of the new system on Capitol Hill is to link the historic building with its two large "additions," but ultimately the receiving stations of the printing telegraph will, if the system is approved, be extended to embrace the White House and the various government department buildings in Washington so that senators and representatives visiting the departments or the executive offices while Congress is in session can keep in touch with developments at the Capitol. With such facilities every member can follow closely the measures in which he is interested and be on hand when a vote is taken.

Arrangement for the Chicago Electric-light Convention.

The exhibition committee of the National Electric Light Association, which is composed of Class D members of the association, held a meeting in the Auditorium Hotel, Chicago, on February 11th for the purpose of inspecting the facilities and general arrangements for the convention, with a view to outlining plans and other details in connection with the manufacturers' exhibits in order that ideas might be formulated and presented to the executive committee at its meeting on Thursday of this week, so that a comprehensive working arrangement could be agreed upon at that time. It is probable that unusually attractive features will be incorporated in the manufacturers' exhibit this year. The exhibition space adjoins the convention hall, similar to the arrangement at Washington, and a separate room is provided for parallel sessions. Mr. Frank H. Gale is chairman of the exhibition committee.

In view of the present size of the association

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RECEIVING STATION OF PRINTING TELEGRAPH AT UNITED STATES CAPITOL.

and its diversity of interests requiring a wide range of subjects, and in order to permit of the fullest discussion under each topic presented, President Farrand announces numerous requests have been received to hold simultaneous meetings on widely different subjects, and it seems wise to try the experiment, he says. This arrangement will permit of specializing by the committee to any degree desired and avoids the necessity for separate organizations, to which the present administration is opposed.

As already announced in the Western Electrician, the next annual meeting on May 19th, 20th, 21st, and 22d, will have headquarters at the Auditorium Hotel, Chicago, where ample facilities for reception, meetings and exhibition purposes, together with accommodations for a large number of delegates, all practically under one roof, are available.

Electrical Work at Lewis Institute.

An educational institution that has been making quiet but steady progress in Chicago is Lewis Institute, located at Madison and Robey Streets. The institute was opened in September, 1896, and early made its influence felt in the educational circles of the West Side. Since its establishment the scope of the work has been considerably broadened so that it is now a coeducational polytechnic school that provides courses of instruction in engineering, mechanic arts, domestic economy and the liberal arts. Instruction is given in both day and evening classes and is of academic and collegiate grade.

The college work in engineering is all day work and has been restricted to a broad training in the fundamentals of all engineering work, with perhaps more stress on the principles of mechanical engineering in particular. It has been thought undesirable, however, to specialize along separate branches of engineering in this work. The course is of four years' duration and includes, in conjunction with college mathematics, chemistry, physics, mechanic arts, English, history and economics, the subjects of applied mathematics, applied electricity, testing of machinery and of materials, machine design and a thesis. This course is said to be so thorough as to justify the granting of the degree mechanical engineer on its completion.

Probably the most important and of late years undoubtedly one of the most popular activities of Lewis Institute has been the instruction in evening classes. During the three terms of the school year 1906-07 the number of students enrolled in evening work was 1,299; during the same three terms the number of day students was 1,122. The courses in the evening classes are especially arranged to meet the needs of those who are employed in the day and represent the results of a careful study of the requirements of journeymen, mechanics, electricians, power plant and locomotive engineers, foremen, shop superintendents, salesmen, bookkeepers, stenographers and others who are eagerly in search of specific knowledge for which they have immediate use. The steady growth of the attendance at these classes shows how well this work is being done.

Of the various courses taught in the evening classes probably the most interesting is the series of courses in electrical engineering. These have been mapped out to cover the fundamental principles of applied electricity and consist of lecture demonstrations and laboratory work. The complete course of study in this branch requires three years, each of three terms—autumn, winter and spring. Each term consists of 10 weeks, with instruction on two or three evenings a week and two hours an evening. In the first and second term the class meets twice a week and in the remaining seven

ONE OF THE PHYSICAL LABORATORIES IN LEWIS INSTITUTE.

terms on three evenings each week. The actual class work for the entire course amounts to 500 hours.

The work given in these nine terms is steadily progressive and each student should complete all of this regular work. However, when a man of some experience presents himself he may be allowed to enter an advanced class to suit the state of his previous electrical training.

The first year's work is devoted to the study of those phenomena and laws of physics that form the foundation of most of the important engineering principles and those of electrical engineering in particular. In each of the first two terms 20 lectures are given on applied physics and 20 mathematical demonstrations of the underlying laws. In the [illegible] divided in the same manner.

[illegible]

DYNAMO LABORATORY IN LEWIS INSTITUTE.

meter, recording wattmeter, discount meter and iron tester are studied. The winter term is entirely given to direct-current dynamos and motors, their characteristics and operation. This is continued in the spring term and the alternator and rotary converter are then looked into.

The third year is spent in the study of alternating currents and alternating-current machinery. In the first term a more extended treatment of the principles and calculations of alternating-current circuits is given. This is followed in the second term by studies of transformers and transmission lines, both single-phase and polyphase. The concluding term is devoted to single and polyphase induction motors, alternating-current generators and methods of synchronizing and operating them in parallel, synchronous motors and rotary converters.

Throughout the course in electrical engineering, and particularly in the treatment of alternating currents, the subject is presented in a clear manner without the use of advanced mathematics. In the laboratory the work has been systemized and facilitated by the preparation of a complete series of forms giving the instructions for the various experiments and affording means for recording all the data and observations to make a complete report on each test, the aim being to teach the students to record all necessary facts that would be required in the preparation of a comprehensive and yet very concise commercial report. These forms have been a great aid to both students and instructors in permitting more time to be devoted to the successful performance of each experiment.

The Institute has a number of lecture rooms especially equipped for demonstration work. This is particularly true of those for the departments of physics and chemistry. The laboratories are well lighted, airy rooms, as can be seen by the two accompanying pictures. The physical laboratory shown is one of those connected with the physics department, where the elementary work in electrical masurements is given. Separate photometric rooms are provided. The equipment of electrical instruments is quite extensive and consists of a variety of types commonly met with as well as a number of instruments of precision. Here are also found an assortment of electrical appliances that form the material for a large number of tests. These laboratories are also provided with distributing circuits, bringing the different currents used in testing to the working tables.

The dynamo laboratory is a room of great interest. Its floor area is 50 by 60 feet. In its equipment [illegible]

phase squirrel-cage motors; one five-horsepower three-phase variable-speed induction motor mounted on a cradle dynamometer, and available as an induction motor, generator or regulator, as a three-phase transformer and as a frequency changer; one one-horsepower variable-speed three-phase induction motor; four 2.5-kilowatt transformers with connections for two-phase three-phase transformation; six five-kilowatt transformers with a wide range of voltages; one 30,000-volt testing transformer; one constant-current series arc transformer with lamps; one constant-current arc regulator; a large number of indicating instruments, potential and current transformers, artificial transmission lines, motor compensators, rheostats, choke coils, condensers, etc. The rotary converters have been found valuable for a great many experiments, as they permit of operation in a variety of ways. The work on them has been found peculiarly suitable as a stepping stone from direct-current to alternating-current machinery.

The dynamo laboratory is provided with a number of switchboards to facilitate connecting up machines for different methods of operating. Direct current is obtained from the generating-plant in the basement which supplies the entire Institute. Alternating current is obtained from the alternators or rotary converters in the laboratory or from outside sources.

The credit for the success of this evening electrical work at Lewis Institute is due to Director G. N. Carman, whose untiring zeal in behalf of the institution accounts largely for its present high standing; to Prof. P. B. Woodworth, professor of physics and electrical engineering, who has taken the most lively interest in the planning and execution of the course; to Prof. H. E. Cobb, and to Assistant Professors F. A. Rogers and J. D. Nies, who have ably carried out and perfected this work that has been of so much material benefit to a large number of electrical workers of Chicago in making clear to them the why and wherefore of electrical practice.

The California Gas and Electric Company, on account of the urgent demand for more current, is expending large sums of money to hasten the completion of the power plant on Deer Creek, near Nevada City. The roads are so bad that it requires 14 horses to haul one joint of the pipe for the large pipe line. Three gangs of men and horses are at work trying to make a solid roadbed. There are nearly one hundred joints of the pipe line still to be laid, and the haul is 15 miles.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

[illegible]

production in 1905. The product came chiefly from Prince of Wales Island, in the Ketchikan district of Southeastern Alaska, where the only two smelters of the territory are located. The copper yield of the ore of this district is only a little over three per cent. The second important copper district of Alaska embraces the country around Prince William Sound. Most of the ore sent out during the year averaged seven to eight per cent. in copper. The third copper region of the territory is along Copper River, in the vicinity of Mount Wrangell, and especially near Chitina River. The ores of this district received considerable attention in 1906. Railroads connecting this district with the coast at Seward and at Valdez will probably be completed soon, and if the deposits of the district develop as favorably as is at present expected, the copper production of Alaska will be so greatly increased as to become an important part of the total output of the United States.

INTERURBAN ELECTRIC railways flourish in competition with steam railroads not so much because rates of fare are slightly lower but because the service is more attractive to the traveling public for short trips—that is, up to, say, 100 miles. One great advantage is the absence of smoke and cinders, making the journey pleasanter; another is more frequent trains, tending to convenience of passengers; a third element in favor of the electric railway is that usual city terminals are so arranged that passengers can board the car nearer their homes and ride closer to their destination than in the case of steam railroads. The tendency and demand of the day are for frequent, rapid service—rapid at frequent intervals rather than one or two very fast trains and a sparse, slow service. The immediate problem of the steam road, as is pointed out by an officer of one of the trunk-line steam railroads, is to provide such service at low cost, else the older railroad must be content to see the business taken by aggressive competitors, who also contemplate attracting the freight traffic. The apparent solution is electrification of existing steam lines for passenger service.

CANADA and the United States are so favorably situated for trading with each other that in spite of a differential tariff in favor of British products the great bulk of the imports of the Dominion are furnished by the United States. The subject has been investigated by an agent of the home government, who finds, among other things, that in 1906 the imports of electrical apparatus from the United Kingdom were valued at $81,412 and from the United States at $3,461,000. This is in spite of the fact that British apparatus pays only 15 per cent. duty ad valorem and the United States productions 27½ per cent. The geographical advantage of the United States is of course great, and this largely accounts for the discrepancy, although it is suspected that apathy of the British manufacturers—the same indifference with which our own exporters are charged in other parts of the world—has something to do with the result. But the great competitor to both American and British electrical goods in this market is the product of the Canadians themselves. Between 1900 and 1906 the value of Canadian-made electrical apparatus more than doubled, and there is no doubt that electrical goods made in Canada will keep on improving in quality and increasing in quantity. This supplying of the home market by apparatus made at home seems to be inevitable to a very considerable degree in Canada, but there is some consolation to Americans in the reflection that the capital represented by the larger Canadian electrical manufacturing establishments is largely American, so that what is lost to this country in exports of goods may be made up to some extent by returns from investments.

ADMIRAL EVANS' voyage is affording an opportunity for demonstrating anew the mutual respect and friendliness that exist between the republics of North America and South America. Closer relations in trade interchanges may happily be one result. [illegible] The manufacturers of the United States are needed in the South and Central American countries, while many of the products of that vast region are indispensable to us. In the exports to our neighbors to the South electrical machinery and appliances form a respectable proportion, particularly to Mexico and Brazil, but this trade is capable of great extension. Therefore, the article on "Electricity in Peru," prepared by Mr. Charles M. Pepper, special agent for the United States government, and reprinted in this issue, is timely and important. Mr. Pepper predicts that electricity will play a continually growing part in the industrial development on which Peru has entered, and concludes with these significant sentences: "Many enterprises are at the stage where they can be carried forward profitably by the utilization of electricity, while to stop means loss. The industrial impulse in Peru is in reality too strong to be checked." It is "up to" the American electrical manufacturers to cultivate this market with intelligence and energy.

WHILE AMERICAN electrical engineers are practically unanimous in the opinion that the disadvantages and complications of long-distance power transmission by direct current greatly counterbalance the benefits to be derived, comparing that system with the familiar alternating-current system, nevertheless the subject is of great interest and worthy of careful study from varying viewpoints. A late contribution to the subject was made by Prof. L. A. Herdt of McGill University, Montreal, who, after a recent visit to France, read a paper on the subject before the Electrical Section of the Canadian Society of Civil Engineers.

Professor Herdt was considerably impressed with the direct-current system. In Europe high-tension, direct-current series systems are in use for some of the longest distance transmissions and some schemes, in which the distances of transmission are 150 miles and over, are considered feasible only by means of direct-current transmission. The high-tension direct-current series system, or the Thury system, is an enlargement of the old Brush series system, with motor-generators substituted for the arc lamps. The generators are connected in series. At the receiving end of the line series-wound motors are connected in series. The current in the system is kept constant at all times, variation of load being met by a change in the electromotive force of the system. When the plant is not running all the machines, generators and motors are short-circuited. To switch in a generator, the machine is run up to speed until it generates the proper line current; the short-circuiting switch is then opened, the generators being then in series with the line. The motors are started in the same way. The short-circuiting switch having been opened, the brushes, which were placed, when standing still, in line with the axis of the poles, so that one-half of the armature conductors are acting against the other half, a position corresponding to no torque on the armature, are slowly rocked forward in the direction of rotation, causing the motor to start and speed up. When at full speed an automatic regulator working on the brush position maintains the speed constant, through a regulation of the counter-electromotive force of the motor. The motors are placed in sub-stations and drive at constant speed generators supplying current for local distribution. In the Moutiers-Lyon plant 6,300 horsepower is transmitted a distance of 112 miles at a potential of 57,600 volts, direct current.

The advantages claimed for this direct-current system are the possible use of much higher voltages than those considered possible with the alternating-current system and doing away with the inductance and capacity effect of long transmission lines. Professor Herdt says that an insulator that will withstand 60,000 volts, working voltage, across the wires of a three-phase line should be able to carry 84,000 volts direct current as the breaking-down voltage for air is determined by the maximum value of the dielectric stress. But, when all is said, transmission engineers in this country will not be apt to discard the revolving-field generator, the static transformer and the comparative simplicity of the alternating-current system for the complications of Mr. Thury's ingenious installation.

Effects of Light Upon the Eye.

The Chicago Section, Illuminating Engineering Society, devoted its last meeting on February [illegible] to a general discussion of the question considered in Dr. H. H. Seabrook's recent paper on "The Effects of Light Upon the Eye," which was printed in abstract in the Western Electrician of February 1st. After the reading of the paper by Secretary G. H. Jones the discussion was thrown open by Chairman J. R. Cravath, who pointed out that illuminating engineers had aimed at results favorable to good vision, which was the primary consideration in any system of lighting. Here was an opportunity to discuss the question with the oculists, of whom there were a number present.

Dr. E. J. Gardiner said that from the practical viewpoint we should always go to nature. Natural light is always the best, since daylight is the normal stimulant of the eyes. There are no ill effects from normal light, as we instinctively get out of a too strong light. He doubted the value of a monochromatic light, as normal daylight is of a composite color. The kerosene lamp was a good and sufficient light so far as its effects on the eye were concerned. As far as color is concerned, the incandescent lamp is very near to it, since its spectrum is almost identical. Why, then, has the incandescent light been so injurious to the eyes?

It is more a question of quantity than of quality of the light. Americans in general are inclined to exaggerate in quantity. For lighting of large interiors the problem has already been largely solved by illuminating engineers through the adoption of cove and other indirect lighting. Successful illumination for close work is difficult, however, and perhaps unsolvable. The bare incandescent lamp exposed to direct vision is most harmful and disintegrating to the eye, especially for desk work, around sewing machines, etc. This is due to the high intrinsic brilliancy of the filament. If this were cut off by ground glass or otherwise so as to diffuse the light and if the impingement of direct rays is prevented the incandescent lamp becomes the equal of the kerosene and Argand burners, which have a large surface of low intensity.

Dr. George F. Suker declared that school children were most in need of attention to correct visual troubles. He would not permit children to study by the ordinary incandescent lamp. A large light surface is necessary. Therefore he favored the use of frosted or ground glass that was thick enough to cut off the heat rays as well as to diffuse the light. These heat rays are not immediately injurious, but their effects show up in the course of time. He has a student lamp with an amber shade and the source of light so high up that it cannot be seen; this gives excellent results. Reflected diffused light is most desirable, also tinted glass, regardless of the color, is better than clear glass.

Usually we have too much light and exhaust the eye by overstimulation. The great prevalence of cataract in India is due to the large number of sun worshipers. Steady observation of arc lamps may produce the same results. The use of lenses often neutralizes troubles from overstimulation of the eye. The younger folks suffer most from poor lights. It is best in our homes to have large areas illuminated so as to have a uniform lighting of each room, as it is desirable to avoid the strain of looking from bright to dark portions. Uniformity of illumination is desirable everywhere and engineers should strive to bring it about by removing the source of light to some distance above and diffusing it.

Dr. H. Gradle stated that while daylight (not direct sunlight) was the most perfect light, it nevertheless varied according to the time of day and year from one to perhaps ten times that intensity that was needed for good observation. The normal eye rapidly adjusts itself to this wide range of illumination, however. With artificial lighting we cannot hope to get the same uniformity and intensity as with daylight. We nearly always have small sources of high brilliancy which should be avoided. Color is secondary to sufficiency of illumination. Intensities of from 10 to 50 candlemeters are required, according to the character of the work to be done. The normal eye does not feel the need of sufficiency as much as the abnormal eye.

Probably the best lighting would be by powerful sources that were entirely screened from view. In rooms where little close work is done, diffused soft light is desirable. In rooms for close work that have additional sources for general illumination the near lights should have opaque reflectors to throw most of their light [illegible] dom placed in the direct line of vision.

Dr. Gardiner spoke of a [illegible] a large study room had formerly been equipped with bare incandescent drop lights without shades or other protection from the students' eyes. The result was that nearly every pupil suffered from eye troubles that were quite a source of revenue to the oculists until these lights were replaced at his suggestion by a system of indirect cove lighting supplemented by about six ceiling hemispheres with ground-glass globes. Since then the eye troubles have disappeared.

Dr. Suker cited a case where a stenographer, using an ordinary desk lamp giving, as she said, ample light, was greatly troubled from fatigue of the eyes and headaches that were entirely relieved by placing the lamp behind and above her so as to cut off all the direct light.

Mr. Cravath referred to the success of several instances of indirect cove lighting and to the utter failure in one noted case. Indirect lighting needs to be as carefully, if not more carefully, planned as the more common direct lighting. The general low efficiency of this system is probably its most serious drawback.

Evolution of the Electric Railway.

The Electrical Section of the Western Society of Engineers held a meeting on February 14th in Chicago, at which James N. Hatch presented an illustrated paper on "The Evolution of the Electric Railway." He traced the development from the first experimental cars run by primary batteries some 70 years ago to the high state of perfection of today. The electric railway of today is really the product of the last 20 years. It has been estimated that the total mileage of electric lines in the United States today would form a 10-track trunk line from New York to San Francisco.

The early experiments of Daft, Edison, Field, Bentley, Knight, Vandepoele, Short and Sprague from 1880 to 1887 were described. No single individual, it was asserted, can be said to have invented the electric railway. Most of these men helped to perfect some feature or other. All the equipments used prior to 1887 were experimental and were superseded. In December of that year 12 more or less successful roads were in operation in this country. The troubles most experienced were from the use of copper brushes, open motors and improper rheostats. These were very severe. The first road to surmount these troubles was that built by Sprague in Richmond, which was opened in February, 1888. This road had its track bonded and used 450 volts on the line. The motors were mounted by flexible suspension on an independent truck and geared to the axles. Fixed brushes were used. After a year or so of overhauling, this line became quite successful and attracted such favorable attention that from that time the building of electric railways became very extensive, and from 1888 to 1894 the expansion of electric lines was phenomenal.

The Intramural Railway at the World's Fair in Chicago in 1893 demonstrated the adaptability of electric service for more heavy railway service, especially on the elevated-railway systems in the largest cities. The elevated roads of Chicago were the first to use the new power. The South Side Elevated Railway was the first to use the multiple-unit system devised for it by Sprague. The use of electric locomotives in the Baltimore and Ohio Railroad tunnel under Baltimore demonstrated the value of electricity for tunnel service, and from this it was but another step further to its use on other sections of heavy railroad work.

The first interurban line was probably that of the Akron, Bedford and Cleveland road, running some 35 miles out of Cleveland, Ohio, in 1894. This was a direct-current line. The use of the rotary converter permitted the generation of power and its transmission as alternating current to a number of sub-stations on the line, and this meant the expansion of the interurban lines to their present great extent. The latest development in this field is the adoption of standard steam-railway practice.

Chairman Roper in opening the discussion stated [illegible] brushes. The first motors were not waterproof and had many burnouts on this account. The early rail-bonds were galvanized iron and gave much trouble. The unfortunate patent litigation between the leading manufacturing companies caused the waste of millions of dollars. Its termination was a great step toward standardization of equipment. The success of electric railroading in all lines undertaken shows that the electric locomotive is here to stay and that the electrification of many sections of steam railroad [illegible]

Rule 13A—Grounding Low-potential Circuits.

The committee on standard rules of the National Electric Light Association early last fall sent out a circular letter to all the members of the association for suggestions on the above subject. Over 100 replies were received, and, taking these as a working basis, the committee formulated a rule which it is hoped will suit all interests.

As this was a matter of great importance, and as it was seen that the enforcement of the rule would have far-reaching effects, a conference to consider the subject was called, and on January 7th a meeting was held in the offices of Messrs. Stone and Webster, Boston, Mass. Representatives were present from the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies, the National Electrical Inspectors' Association and the National Electric Light Association.

The conference approved of the rule as a whole, although a number of slight modifications were made in it. The final draft has been presented to the Underwriters, and it is the hope of W. H. Blood, Jr., chairman of the committee, that the Underwriters' committee will have time to consider and report upon it at the March meeting.

Electric Service Competition in Brazil.

J. J. Slechta, deputy consul-general of the United States at Rio de Janeiro, says that the latest phase of the competition between the Brazilian company and the Canadian-American interests supplying electric power in all of the larger Brazilian cities has resulted in the decision of the former company to construct a rival power plant in the city of Sao Paulo, with the hope of in some way finding a loophole in the monopoly of the street-railway system held by the foreign company. In the meantime the Brazilians propose to construct an electric railway between Sao Paulo and Santos, thus competing with the existing steam railroad and menacing the success of the proposed extension of the Sorocabana Railway, which is controlled by the same group of capitalists interested in the tramway system. The Brazilian company is also making a hard fight to invade the territory of the foreign rival by securing such a legal decision as to their respective rights in the matter as will permit the former to compete with the foreign concern in supplying electric power to the government consumers in the federal capital. Both companies have large waterpower plants adequate in capacity to supply all the electricity needed by the city at the present time.

Production of Coal in the United States.

A production of between 450,000,000 and 460,000,000 short tons of coal in the United States in 1907 is indicated by the returns received thus far by the United States Geological Survey, or an increase of about 10 per cent. over the record-breaking output of 1906, according to Mr. E. W. Parker, coal expert and chief statistician of the Survey. The most notable increase was made in the production of Pennsylvania anthracite, in which a gain of over 20 per cent. was recorded, the shipments reported by the Bureau of Anthracite Coal Statistics indicating a total production for the year of approximately 76,366,000 long tons, or about 85,840,000 short tons. The business depression of a few months ago had no effect on the coal industry. The closing month of the year was one of the darkest in the history of the coal-mining industry, for it witnessed the occurrence of four separate disasters, each in the Appalachian bituminous-coal field. Between 600 and 800 lives were lost in these explosions, all of which occurred within a period of three weeks.

Institute Meeting in New York.

[illegible] hundred and twenty fifth meeting of the [illegible]n Institute of Electrical Engineers was held at the Engineering Societies Building, New York city, Friday evening, February 14th, with President Stott presiding. The secretary announced that 154 associate members had been elected at the meeting of the board of directors.

The papers of the evening were then read by the authors as follows: "The Non-synchronous Generator in Central-station and Other Work," by W. L. Waters; "Some Developments in Synchronous Converters," by Charles W. Stone; "Some Features of Railway-converter Design and Operation," by J. E. Woodbridge.

Announcements were made by the president regarding the annual dinner of the Institute, to be held on February 19th, and the special meeting to be held on March 5th, at which the subject of "Forest Preservation" will be considered.

The papers of the evening were discussed collectively. They deal with alternating-current apparatus and go into the subject of wide variations in methods which are practicable with alternating current and which are not found with direct current.

An abstract of Mr. Stone's paper is given in this issue. Following are extracts from the discussion on the three papers:

F. J. Clark, Long Island City, N. Y.: The paper presented by Mr. Waters advances the conclusion that certain advantages possessed by non-synchronous generators are sufficient to warrant their installation in new plants in place of synchronous generators, in present plants where new units are required, in 25-cycle gas-engine installations and for use with synchronous converters in place of large slow-speed direct-current generators. This proposition is sufficiently radical to call for careful consideration by anyone interested in power-plant work. Speaking from the standpoint of an operating engineer, I must confess to the belief that the author, in his enthusiasm over advantages, some of which must be admitted as important, has failed to realize the weight of certain disadvantages which preclude the use of the non-synchronous generator in large power stations where synchronous generators are now installed. The claim that the excitation of a non-synchronous generator can be controlled from a distant sub-station does not appeal to me as practical. There are a few possible happenings between a sub-station and a power station which would cause either voltage rises or interruptions chargeable to such operation. I believe it is safe to say that the synchronous converter, with its direct-current, engine-driven starting generator, must be located at the power station, and that no advantage obtains. The unequal distribution of load between synchronous turbo-generators produces a flow of magnetizing current where there is a difference in excitation, and a division of current where there is a common neutral bus. There is no hunting and no undue heating; therefore no practical advantage obtains. Under certain favorable conditions on a large system the total power for excitation will be considerably less for non-synchronous generators. When, however, the difference in economy due to the compensating requirements, and the operation of very large units on very light loads is taken account of, the advantage of the non-synchronous generator will not be great or will disappear. The author admits that there must be high speed, low frequency, and low voltage, or the non-synchronous will not compare favorably with the synchronous generator. This limits the comparison and eliminates the advantage of efficiency except in certain particular cases.

It is claimed that the non-synchronous generator possesses the proper characteristics to prevent, or rather lacks those characteristics of the synchronous generator which promote high power surges, resonance, and other electrostatic phenomena. The author assumes that resonance and other electrostatic effects are produced either by short-circuits or faulty sine waves, and that the non-synchronous generator avoids these effects by depriving short-circuits [illegible] high [illegible], and by giving forth only sine waves. While admitting that these are decided ad[illegible] and [illegible] of large installations, I do not believe that generators are ever the primary cause of electrostatic troubles [illegible] line and cable construction, effective lightning protection, the grounded neutral and automatic relays have tended to lessen [illegible] full load is an advantage, if we have (first) the [illegible] higher water rate. The average synchronous turbo- [illegible]

advantages to be of little value. The damping action has a tendency to correct any irregularities of the sine waves of the system, thus preventing harmonics. Turbine-driven direct-current generators have not proved very satisfactory, and it is doubtful if they will ever be used to any great extent. The slow-speed engine-driven sets are efficient for one point of load and very uneconomical when the load varies through wide ranges. The non-synchronous generator and synchronous-converter combination may show sufficient economy to displace engine-driven generators in some stations, and should generally be able to merit adoption when additional power is required.

In systems having long aerial transmission lines, and rather high induction, the synchronous converter would have to be considerably over-excited to produce the necessary lagging current for the generator. If an overload should occur the supply of lagging current would increase, and if the overload caused several circuits to open automatically the induction would instantly fall to a very low value, and unless the power-factor control of the exciting converter were not equally active, there would be a rise in potential in the system. This rise would be aggravated if the exciting converter were situated at a sub-station. In systems having large capacity in underground cables, either artificial induction would have to be provided or the generators and turbines be very large.

Mr. Stone's paper describes the vertical synchronous converter, which appears to possess a number of improvements over the older types. The use of a step bearing requiring oil-pressure lubrication, has been so thoroughly proven practical that we cannot consider it an objection. It appears to me that the greatest objection to this type of machine is the possibility of mechanical damage, due to the magnetic pull of heavy armature short-circuits. The paper presented by Mr. Woodbridge seems to show that the synchronous converters designed by one manufacturer are all right and that those designed by another manufacturer are not. The points are: Six versus three-phase converters, high versus low-armature reaction and compounding. If the efficiency and maintenance of the two types of converters are equal, or nearly so, the operating engineer cares but little about the fine points of phase relations. The value of compounding is generally a hard matter to decide, and I believe we are greatly indebted to Mr. Woodbridge for the clearness with which he has discussed this point.

C. F. Scott, Pittsburg: When a new machine or method is proposed it frequently happens that it may accomplish the specific purpose for which it is intended, but it may involve some incidental feature, as a sort of by-product, which renders the whole inoperative or inadmissible. Mr. Waters not only describes the generator itself, but points out the various advantages over synchronous generators in its construction and also its marked advantages in operation. Instead of introducing objectionable characteristics, it presents many points of advantage on such matters as reduced current on short-circuit, a smooth wave form and a damping action due to short-circuited element, which exerts a steadying and soothing effect throughout the whole system, which tends to prevent hunting and surges. The paper indicates that there should be a considerable commercial field in which this type of generator will have an important application. Mr. Stone presents six methods of voltage regulation of synchronous converters. It may be noted that the alternating-current booster may be provided with either a shunt-field winding or a series-field winding, or both. If a series-field winding carries the current from the synchronous converter, then the compounding may be effected automatically by a practically straight line law over a considerable range. A comparison of the relative characteristics of the several methods of voltage regulation is of interest. In several a mechanical adjustment of the apparatus is necessary. In the case of the transformer with loops the connection must be shifted from one loop to another. In the induction regulator mechanical rotation must take place. The reactance involves no such adjustment. In the methods in which field current is adjusted, the windings may be either shunt windings for hand control or series windings for automatic control. Auxiliary automatic apparatus may, of course, be applied for operating rheostats, regulators and the like. The power factor (i. e., the ratio between true and apparent watts) varies when reactance is used or the methods in which the field poles are divided into parts which are unequally excited. The power factor is practically unaffected when transformer loops, induction regulators or boosters are employed. The wave form is not affected except in those cases where the field poles are divided into two or more parts. The range of voltage variation is relatively small with reactance. It is probably small with the methods in which the field poles are divided into parts, unless considerable variations in power factor or wave form are admissible. [illegible] range may be [illegible] large when other methods are employed.

P. M. Lincoln, Pittsburg: Mr. Stone in his [illegible] treated briefly the so-called split-pole [illegible] first proposed by Mr. J. L. Woodbridge. He still more briefly refers to its characteristics, particularly that of power factor. The first question that arises when contemplating the use of this split-pole rotary is its effect upon wave form. These questions might naturally be put as follows: Will the wave form of the split-pole rotary depart materially from a sine wave? If so, how much will be the departure? Will such deformation, if it occurs, have any bad effect upon the rotary itself or upon any part of the system to which the rotary is connected? It is well known that with a given field form the distributed winding of a rotary converter gives rise to an electromotive-force wave form, which is subject to quite exact determination. The division of the rotary field into sections and the provision of means to excite these sections independently of each other gives control over the field form and therefore over the alternating-current-direct-current voltage ratio. As the field form changes, however, the electromotive-force wave form of the rotary also changes. The user of a split-pole rotary may expect very considerable departures of the rotary wave from the generator wave. The percentage deviation from sine will be considerably greater than the percentage variation in direct-current voltage each way from mid direct-current position when considering a two-part pole rotary, and this form is the only feasible one. Commercial consideration usually calls for a direct-current variation of 10 to 15 per cent. each way from normal. With such a direct-current range a third harmonic under maximum deviation conditions of 15 per cent. is quite possible. Mr. Woodbridge in his paper has assigned five per cent. as the value of the reactance of the armature of a rotary. For third harmonic frequency this value will become 15 per cent. Assuming such a rotary to be directly connected to a very large alternating-current system, a triple harmonic current will result of a volume equal to the full-load current of the rotary. Still higher harmonic currents will flow and the maximum deviation of the current wave will be still greater than that represented by the full-load third harmonic. Mr. Stone states in his paper that the power factor of these split-pole rotaries can be held at unity throughout the entire range of direct-current voltage. Before we can accept Mr. Stone's statement as par value a further explanation of exactly what he means is necessary. If Mr. Stone intends to convey the idea that the field of the rotary can be so adjusted for the current of fundamental frequency, the statement can be accepted. If, however, he means to convey the impression that the ratio of kilowatts input to kilovolt-ampere input can be held at unity, then the statement is far from the truth.

A power-factor meter indicates the phase relation of the current of fundamental frequency to the voltage of fundamental frequency. If currents of higher frequencies and large volume are flowing a power factor of unity, as indicated by a power-factor meter, does not at all mean that the volt-amperes are equal to the watts. When considering the capacity that can be obtained from a given amount of material made up into one of these split-pole rotary converters, we find that for equal outputs the amount of material for the split pole is very largely increased over what it would be ordinarily. The field strengths in these rotaries at the maximum point vary all the way from 10 per cent. to 15 per cent. at the minimum point to more than double that at the minimum point. Since the iron of the armature of the rotary is capable of being worked only to a certain maximum limit it follows that the amount of iron in the armature must be increased with a split pole rotary in approximately the ratio of the minimum field to the maximum field. The original Woodbridge scheme of using three parts makes so great an increase in size and cost of resulting machine as to put it practically out of the question. When we come to considering the relative efficiencies of the split-pole rotary and the ordinary type, we find that the split-pole rotary increases very considerably every item of loss that enters into efficiency. The field loss evidently must be very considerably increased. The iron loss is also very materially increased, particularly at the lower direct-current limits when considering the two-part pole rotary. On account of circulating currents of higher frequencies the armature copper loss is also increased above what it would be with a rotary of normal type. The operation of the two-part pole rotary at the lower range of direct-current voltages gives a result somewhat similar to shifting the brushes backward or forward into the active field. The main difference is that a notch of any desired width can be made in the pole opposite the point where the brush rests upon the commutator. When the smaller pole horn is excited in the same direction as the main pole, the field at the point where the brush rests upon the commutator will be very close to zero. When, however, the small pole horn is excited in a direction the reverse of the main pole horn, the excitation of the small horn is then in the same direction as the pole immediately the other side of the adjacent direct-current brush. Necessarily the field at the point where the brush rests upon the commutator will change very materially, depending

upon whether this small pole be [illegible] in the one direction or in the other. In the [illegible] system circulating currents of the higher harmonics tend to efface themselves. With the split-pole rotary, however, under abnormal direct-current voltage conditions these higher harmonics are apt to be pushed to a point where the currents resulting from them become a very considerable portion of the total current flowing. A system which contains cables always has present the possibility of there being set up a condition in which resonance will take place. The alternative which Mr. Stone has described, namely, a rotary upon which a separate machine is mounted, having the same number of poles as the rotary, has, in my opinion, very decided advantages over this split pole rotary.

C. P. Steinmetz, Schenectady, N. Y.: Regarding Mr. Woodbridge's paper I fully agree with him except that I would rather consider as good engineering not to put the unity power-factor point at half load, but at the higher load, somewhere between three-quarters and full load. This gives you a condition of operation where the wattless lagging current at no load and light load is somewhat greater, but the power factor at no load is better and the overload capacity, stability and reliability is greater. Mr. Stone's paper I do not care to discuss, because when this type of split-phase converter was first brought to my attention I was not favorably impressed with it, but rather expected and anticipated that under preliminary investigation this machine would give wave-shape distortions, would give a poor power factor and poor commutation for the same reason as was so ably explained to you by Mr. Lincoln. When the machine was built and tested I was somewhat surprised that the wave-shape distortion did not materialize and that the power factor was high and the commutation was good. My final conclusion was that even nowadays it is occasionally desirable to check up theoretical reasoning by experimental test, because these two do not always agree; not that the theoretical reasoning is wrong, but because in the premises on which the theoretical reasoning is based some elements which are essential may not have been given the proper weight. I was very much pleased with Mr. Waters' paper, and this type of generator I also believe is in some instances a very desirable type and which I hope to see introduced. It has found its entrance into technical literature, and you will find performance curves of rotary converters operated from induction motors in the literature, and in the standardization rules of our Institute this machine is referred to and the testing methods have been described for ten years. There it comes under the name of induction generator, which in this particular case appears to me far better. This induction generator has not been used to any great extent in engineering practice, due to the limitations imposed by its character. It cannot operate on any kind of load, but requires a load of leading current or consumes wattless lagging current. The proper field for its use is, then, to supply power to synchronous apparatus, motors as well as converters.

The excitation of the induction generator, then, is supplied by the wattless current delivered by the synchronous apparatus or by the cables. If you eliminate the disadvantages due to the possibility of unlimited power, you also eliminate the advantages resulting from an unlimited power supply—that means in the voltage regulation of the system the induction generator cannot be as good as that of a synchronous generator system. You see, in the last resort, the voltage regulation of the system depends on the excitation of the system, on the direct-current supply to feeders. In the synchronous generator, synchronous-converter system, you have as fixed voltage points the generators as well as the receiving converters. In the induction-generator system the only fixed voltage points are the receiving converters, not the generators. They cut down the voltage regulation to one end. You eliminate the trouble of excessive currents, but also you defer to some extent to the regulation. The use of the wattless charging current of underground cables to help out excitation is an assistance, but at the same time is connected with some serious danger—since the voltage depends on the amount of leading current fed into the system, any connecting or disconnecting of synchronous or induction generators changes the voltage of the system by eliminating the require ment for so much exciting current, and any converter change, disconnected or connected, changes the voltage of the system. The voltage operation of the system is taken away from the generating station and located in the converter sub-station. The latter may be, as pointed out by Mr. Waters, a rather serious feature with the generating station designed for complete voltage control. Such difficulties would be natural where induction generators are used together with synchronous generators in the generating station. The use of induction generators to supply synchronous apparatus, when you come to its use in a general system for distribution of light and power, probably 60 cycles, the case stands very much less favorable for the induction generator, because after all what you [illegible] frequency principle, requiring low volt-ampere excitation, an electrolytic cell. The induction generator [illegible] are proportional to the voltage and the voltage of the induction generator is proportional to the amperes excitation, either, if the capacity is too low the induction generator does not excite, does not energize, or if the capacity is sufficiently high it energizes and the voltage builds up until it passes beyond the bend of the saturation, and there the machine becomes stable and is a self-exciting, alternating-current generator, having the same characteristics as the direct-current shunt generator, having indeed a close analogy thereto; that is, the farther you get beyond the bend of the saturation the more stable the machine becomes. Naturally, in heavy overloads, especially in lagging current, it is always liable to cause the induction generator to lose its excitation; that is, to lose its voltage, while the synchronous machine will hold up. That may be an advantage, or it may be a disadvantage. There is, however, one field to which I believe the induction generator is preeminently suited and that is for the parallel operation of water powers with steam power. There is, however, still another field, far broader than anything touched so far, which is a field suited to the induction generator, a field in which only the induction generator can be used and the synchronous generator is out of competition, and that is the collection of small water powers. I thought over that subject for some years, and it is an interesting subject, although nothing has been done so far and will not be done for some time because we are not yet ready for it. After all, if you think of it, at the present time the development of the water power of the country has proceeded only to a very limited extent. We have just touched the supply of power given by the water power of the country. We have just started developing some of the largest powers where the water power is available in the most concentrated form, but there is an enormous amount of power in the country in small creeks and rivers and brooks which is going to waste. There will come a time when the large water powers are taken up and we will have to approach the problem of gathering all these small streams and creeks, and there it is where the induction generator only can solve the problem. The way to solve it, I think, is by building a small stone dam across the creek, just enough to get a head, to feed into a pipe of a few hundred feet long; and you can with a pipe of that length gather a head of some 50 or 100 feet, and the water runs against some cheap form of hydraulic turbine, and the induction generator is directly connected mechanically to the turbine, directly connected to the low-tension side of the step-up transformer, while the high-tension side of the step-up transformer is joined into a line leading along the creek. So you see a number of such stations which would be very simple and cost very little, could be strung along the creeks and rivers, all feeding into the same transmission line, requiring very little attention, water lubricating step of the turbine would take care of that. We could gather all these dozens of hundreds of small induction generator plants, the general power of all of these streams and creeks, into one central collection station by synchronous motors with automatic feed control, and you could supply the power thus generated at whatever points it was required.

Prof. C. A. Adams, Cambridge, Mass.: In regard to the exciter for the induction generator, in the case of the synchronous alternator, the synchronous alternator must carry 44 per cent. of wattless current equally, so that the total capacity of the exciter and that of the induction generator is greater than that of the synchronous alternator by the amount of the exciting current of the induction generator, namely, 10 per cent.

J. R. Bibbins, Pittsburg: Mr. Waters has gone into two developments which present a number of interesting phases. It is true, of course, that the flexible characteristics of the induction type of generator are adapted particularly to prime movers in which the cyclic variation or angular variations is permissible within wide ranges. I think, however, his enthusiasm on the subject has led him to give you perhaps an erroneous impression in regard to what the modern well-designed gas engine can do. The matter of flywheels does not seem to be such a serious one, particularly in regard to cost, as the cost factor of the iron that goes into the flywheel is figured on a different basis from the cost of the iron which goes into the construction of the remainder of the machine.

In a 60-cycle plant of 3,000 horsepower, in which [illegible] springs. The first experiment covered simple, [illegible] chines can operate under these conditions in parallel and stay together, it would seem that there is [illegible] from the modern steam engine.

There is an interesting line of thought in connection with the turbine-driven direct-current unit with a synchronous converter, and, of course, the comparison comes down to the question of a two-unit system with its double electrical losses; that is, of the generator and the synchronous converter versus the single-unit engine-driven system, and finally the [illegible] of relative steam consumption. The thought I have in mind is the different characteristics of a steam turbine and an engine that governs by cutting off as a Corliss. We come to the conclusion that in the comparison of these two type of units, even if they do reach the steam consumption at the point of best economy of the steam engine, there is still a considerable margin on either load, higher and lower, and the with the steam engine, the divergence is considerably more marked in the case of the turbine for the reason that even with the opening of the secondary valve in the steam turbine, of whatever type you may choose, the steam consumption does not come up in an arbitrary curve, but tends to establish itself along the secondary water line, which is again practically straight.

Philip Torchio, New York: I endorse what has been said regarding the use of non-synchronous machines in large power stations where the field does not seem to be very promising. Regarding the surges and the point Mr. Waters makes about the non-synchronous generator reducing the surges, I differ from his conclusions. When the surges on an underground system are due to the rupture—of course, there are surges whenever the load suddenly changes, because the electromagnetic energy pulsates between the electrostatic capacity and the electromagnetic, and surges back and forth—while the circuit is closed these surges are not as large as when the circuit is abruptly opened. If the circuit is open, then all the power that cannot circulate in the circuit must oscillate between electrostatic capacity and electromagnetic capacity, and that is only a question of figuring out, if there were no damping effect due to the resistance of the copper, at infinite voltages. As a matter of fact, we do not get that; fortunately, the circuit-breakers open the current at zero or near zero current. If the circuit-breaker should fail to open the current at zero current I think something would happen. I want to pay a personal tribute to Mr. Stone for the successful effort he has made in developing a rotary converter that has all the good characteristics of the vertical converter presented tonight.

J. B. Taylor, Schenectady, N. Y.: Concerning Mr. Waters' paper on the induction generator, I concede to two advantages, better mechanical construction and less destructive effects on short-circuits. The other points mentioned seem to be more in the nature of disadvantages rather than advantages. The matter of excitation has been already well taken up, and the only other point I want to dwell on is the fact that the claimed simplicity in the generating station has been obtained nearly at the expense of the sub-station. The sub-station must be called on to start up the converters and excite the generators whenever necessary. Just how they know when it was necessary, I do not know. It would probably be a matter of establishing telephone communication and getting the converters underway from storage batteries, which storage batteries are usually installed in order to carry the load in times of emergency and would, therefore, not be in the best condition for carrying the extra load of inverted converters. Then the generating station would have to determine what speed the converter shall run at. If the converters are thrown on on the lagging load, everything would speed up to a dangerous point, as the lagging load on the converter, as we know, results in an increase of speed.

W. L. Waters, Milwaukee: Mr. Stone apparently advocates the use of vertical-shaft rotaries for a number of reasons, but taking the data on these machines as given by him, the reasons do not appear to be sufficiently important for engineers to change their standard type. Taking the 2,000-kilowatt, 250-volt rotary, the speed has been increased about 45 per cent., while the weight has come down about 30 per cent. Then again this increase in speed has only resulted in a reduction

of about 15 per cent. in the floor space. I would point out that these reductions are obtained just as easily in a more recently designed horizontal shaft machine. This vertical type of machine introduces new uncertainties into the design and operation, this uncertainty being specially the case in regard to the vertical footstep bearing. Roller and ball bearings have been tried for a number of years, but, as yet, have never been successful for heavy work; and the alternative of an oil-pressure bearing depends on maintaining a high-pressure oil circulation. The standard horizontal-shaft machine with oil ring bearings has been in service now for a number of years and there is no doubt about its operation. By the adoption of the vertical type of rotary, we are merely introducing extra complication and risks and are gaining practically nothing. Taking Mr. Woodbridge's paper, the question of six-phase vs. three-phase is almost entirely a manufacturer's rather than an operating engineer's question. It is to be decided by which is the cheaper machine in any individual case. The great advantage of a six-phase rotary is, as Mr. Woodbridge has pointed out, that it saves armature copper. At the present time it has been shown that the only way to design rotaries for heavy service is to allow ample copper on the armature, and that it is advisable to design the machine irrespective of whether it is to operate three-phase or six-phase. Further, the question of using the extra three collector rings as balancing rings for the armature is again a manufacturer's question. If we want more balancing rings on a rotary they can be put on without regard to the collector rings. Taking the question of starting rotary converters, if we are willing to endure hunting of the rotary on light loads or on certain conditions of the circuit, then we can run with light dampers and start up in this way. In any case, however, this method is not a good one from the operating engineer's point of view. The two most reliable methods of starting rotary converters are:

(1) An induction motor wound for slightly higher synchronous speed than the rotary and with a high-resistance secondary. The induction motor is thrown directly on the full alternating-current voltage, and as the machine comes up to speed, the main alternating-current switches are closed through a resistance. This resistance limits the synchronizing current and enables the machines to get in step quietly. The resistance is then short-circuited and the induction motor circuit opened.

(2) A small induction-motor-generator starting set installed in the sub-station, this being used to start the rotaries from the direct-current side.

Some Developments in Synchronous Converters.[1]

By Charles W. Stone.

In this country the synchronous converter has become practically an indispensable piece of apparatus, some of the largest lighting and railroad companies being entirely dependent upon it. Abroad the conditions are different, as the motor-generator has been used almost exclusively until within the last few years, when the motor converter was introduced; as is well known, this machine being a compromise between the synchronous converter and the motor-generator.

It may be of interest to give at this time some idea of the increase in capacity of these machines in the last 10 years on one of the large lighting systems, as this will give some idea of the tremendous development in machines of this type. In 1897, on the particular system in question, there was installed less than 1,000 kilowatts total capacity, and the largest machine was 500 kilowatts; on the same system in 1907 considerably over 100,000 kilowatts capacity was in operation, the largest units being 2,000 kilowatts.

Most of the larger systems using synchronous converters operate at 25 cycles, but during the last four or five years many systems using 60 cycles have adopted synchronous converters and have found them very reliable.

I think it can be safely said that 60-cycle synchronous converters, even when used for 600-volt railway work, where the demands of the service are most severe, can be considered thoroughly reliable and successful, machines as large as 1,000 kilowatts being in successful operation.

The general tendency in the design of synchronous converters has been toward higher speeds, which would naturally mean reduction in the space occupied by them, lower first cost, less weight, etc. All these changes result in smaller buildings, cheaper [illegible] lower fixed charges.

As an illustration of the changes that have been [illegible] the 2,000-kilowatt, 25-cycle, 250-volt synchronous converter as originally [illegible] and having [illegible] inches by 204 [illegible] approximately 180,000 pounds, whereas the newer vertical machine is [illegible] at 167 revolutions. The diameter is 182 inches and the total weight about 130,000 pounds.

Vertical Synchronous Converters.

The vertical synchronous converter is so new that it seems advisable to point out some of its essential characteristics. The most novel features are in the shaft and bearings. The shaft, unlike that of the horizontal machine, is stationary; in fact, it is nothing but a pedestal supported and fastened solidly to the foundations. There is only one bearing, which carries the entire weight of the revolving structure. This bearing in the first machine built consisted simply of two cast-iron plates, one of which was fastened to the top of the pedestal, the other being bolted to the spider of the armature. Oil is pumped up through a central hole in the pedestal and forced out between the cast-iron plates, forming an oil film on which the machine revolves, making practically a frictionless bearing. [The first large machine of this type to be put in operation was illustrated and described in the Western Electrician of December 14, 1907, page 462.]

In addition to the main bearing, use is made of the entire length of the interior of the spider for a guide bearing. A cast-iron sleeve lined with babbitt is fitted into the spider to form the bearing surface. As the only weight on this bearing is that due to the unbalancing of the rotating structure, the bearing should last indefinitely. The oil after leaving the top or supporting bearing, passes along the pedestal (thus oiling the guide bearing), down to the pocket at the base of the machine, where it is drained off and used over again. Since the first machine was built, a new type of bearing has been tried, which gives promise of success, although only a few months' experience has been obtained as yet.

A cup-shaped cast-iron piece is fastened to the top of the pedestal and forms a seat for the hardened steel bearing plate and carrier, the steel plate being simply doweled in place. Both sides of this plate are accurately ground, so that it can be reversed in case of any damage to one surface. It can readily be seen that this construction of the two lower members of the bearing makes it self-aligning.

The top part of the bearing is bolted to the armature spider and is similar to the top of the oil-pressure bearing, except that another hardened steel plate is doweled in place on the under part of this casting to form the wearing surface. Between these steel plates is a bronze carrier with a number of hardened steel rollers placed radially, thus forming the roller bearing. Oil is pumped by a small low-pressure pump to this roller bearing and is drained off after passing through the guide bearing in exactly the same manner as with the oil step.

The stationary part carries the field spools and is split vertically so that the two halves can be drawn apart, making the armature accessible for inspection or repairs. This frame is supported on a number of cast-iron pedestals.

By the above construction it will be noted that the field frame is entirely independent of the rotating structure, making it easier to assemble the machine.

The armature being revolved around the pedestal, it is not possible to obtain any end play, as in a horizontal machine. Some means must be provided to make the wear on the collector rings equal; this is accomplished by designing the brushes in such a manner as to make it possible to stagger them, and thus cover the entire width of the collector rings. In addition there are placed on each ring some graphite brushes, which act as lubricants.

It is possible to walk around the machine and see and adjust all the brushes on both the commutator and the collector rings without climbing up on a bearing pedestal or going down into a pit, as would be necessary in a large horizontal-shaft machine. The bearings in the 2,000-kilowatt vertical machine can be taken out, inspected and replaced in a little over two hours, which would hardly be possible in a horizontal machine of the same size.

The construction above outlined makes it possible to build machines occupying minimum floor space; in fact, it has been found possible in stations which have been laid out for 1,000-kilowatt machines, horizontal shaft of the old type, to place a similar number of vertical machines of double the capacity.

Voltage Regulation.

With a synchronous converter, as is well known, it is not possible to regulate the direct voltage of the machine by means of the field rheostat, as is done with a direct-current generator, without changing the power factor, for the ratio between the impressed alternating voltage and the direct voltage is fixed by the design of the machine. Hence, where voltage regulation is necessary, as for lighting work, charging storage batteries, etc., some means of changing the impressed alternating voltage is necessary.

A number of different methods have been used to accomplish this result, which I will describe briefly:

1. On the step-down transformers used with the converter, taps can be placed either on the primary or the secondary side and switches used to transfer from one tap to another. This scheme has many objections, and is seldom used now. If the taps are on the primary, oil switches would have to be used if the voltage were at all high. Such switches would be practically out of the question. If the taps are on the secondary, a dial switch can be used, but only with the smaller size machines, as it is difficult to build a dial switch to handle large currents satisfactorily, except at prohibitive expense. This method is also objectionable, as it means fluctuation in the lights whenever the switch is moved to a different tap.

2. The common way of obtaining control of the voltage in railway work is to insert in the leads from the secondary of the transformer a reactance, thus furnishing a means of changing the impressed alternating voltage. This method, while simple and effective with the limited ranges in voltage required for such work, would not be applicable for large ranges in voltage. Too much reactance may cause pulsation troubles, and it also has a bad effect on the entire system.

3. The arrangement in most general use today is to connect between the secondary leads of the transformer and the synchronous converter an induction regulator, by which it is possible to obtain almost any range of voltage within the capacity of the machine. This scheme of operation is in such general use that it will not be necessary to describe it in detail. The principal objection to this arrangement is that another piece of operating machinery is used with each synchronous-converter outfit, increasing the cost, requiring valuable floor space, and making it necessary to open the secondary leads from the transformer, a serious complication with large low-voltage machines.

4. The next development in this line took place abroad, where an entirely different scheme was used. A few machines of this type have also been built by one of the large manufacturing companies in this country.

This method makes use of an alternating-current booster or bucker, mounted on the same base with the synchronous converter. The field has the same number of poles as the converter, and the armature is mounted on the same shaft as the synchronous-converter armature. Alternating current is generated in this armature, and can be made to add its voltage to or be subtracted from the impressed voltage, according to the direction of the excitation. This booster is usually placed between the collector rings and the main armature of the converter, and the taps from the collector rings are connected to equidistant points of the booster armature; similar points on the booster armature are connected to the synchronous-converter armature, thus placing the two in series, separate and distinct windings for each phase being used.

The principal objections to such an arrangement are that here again we have an additional operating machine, as in the case of an induction regulator. Extra weight is added to the shaft between its points of support. The ventilation of the converter armature and its accessibility are impaired. Any serious trouble with this smaller machine results in the dismantling of the main synchronous converter in order to repair the small booster.

Another way to construct such a machine is to make it a revolving-field machine, mounting the field on an extension of the shaft beyond the bearing of the collector-ring end of the synchronous converter.

As the armature is stationary, the leads from the secondary of the transformer are led directly to this winding, and from this winding to the collector rings of the synchronous converter.

This arrangement has the twofold advantage of being accessible, and not interfering with the ventilation or accessibility of the synchronous converter. This booster can be applied to any standard converter, and, being overhung, it is possible to carry a spare machine, which can be placed in position quickly and without interfering with the body of the main synchronous converter.

5. The next development is very radical and is unlike any of the other schemes used. It was first proposed by J. L. Woodbridge some time ago. It has been known for some time that the ratio of conversion between the alternating-current and direct-current sides of a synchronous converter could be changed by varying the width of the pole face. The Woodbridge method makes use of this idea in a very simple and yet effective way.

Each field pole is divided into three sections, on each side of which are two windings. One of the windings on each section is the main shunt winding, and the other is the regulating winding. All the main windings are connected in series and excited in the ordinary manner. The regulating windings, however, are connected differently. The windings on the two outer sections of all poles are connected in series with one another, and the windings of all the central sections are connected in series with one another, and these two groups are connected in series.

The voltage of the direct-current side of the converter is increased by exciting all the outer sections in a direction to assist the main shunt

[1] [illegible]

field, and the middle section an equal amount in opposition to the main field. If both these windings are excited in the opposite direction, the [illegible] voltage will be lowered.

All that is needed in this arrangement is a field rheostat in the regulating-field circuit in addition to the main field rheostat ordinarily used.

The first question that comes up with this scheme is what effect it has on the power factor. A number of machines arranged this way have been designed and placed in operation. With these machines the power factor can be held constant at all loads, yet all the range in voltage desired can be obtained.

6. Since this method was proposed, another and still simpler method has been brought out. This scheme was proposed by Mr. J. L. Burnham. Instead of making each pole with three sections and with two windings on each, only two sections are used. On each section only one winding is used. The large section corresponds to the main shunt winding on an ordinary synchronous converter, while the regulation is obtained entirely by changing the excitation of the smaller section, exciting it in one direction to boost the voltage, and in the other to lower the voltage.

Anti-hunting devices of many types have been designed and put in operation, most of which have been reasonably successful. The latest, and in many ways the most efficient, form of bridge is formed by placing some copper rods directly through the face of the pole tips, although completely surrounded by the magnetic material.

These rods being placed directly through the pole face, are naturally in the main flux, and consequently form very efficient dampers.

Nothing has been said as yet about transformer connections to be used with synchronous converters. There are many conditions existing in different parts of the country which have made it advisable to use some special form of connection for the transformers, but the general practice is to use the diametrical connection with all six-phase machines. This connection is particularly useful in lighting work, as it provides a ready means for obtaining a neutral. With three-phase converters the transformers are usually connected in delta. In many cases they are connected in Y to obtain a neutral, which can be done if special provision is made in distributing the windings in the transformers.

Mr. Scott at Ithaca.

On February 7th Mr. Charles F. Scott of Pittsburg, past-president of the American Institute of Electrical Engineers, was the guest of honor at the first dinner of the Ithaca section. Approximately 100 local members sat down to the tables. One of the large laboratories was furnished with extra light and proved well adapted for the purpose. During the meal college songs were sung and a general spirit of goodfellowship prevailed. Chairman E. L. Nichols presided and introduced Mr. Scott, who in an informal manner told of his relations with the early and present faculties of electrical engineering at Cornell. He said that it was largely due to the encouragement given by a letter from Prof. H. J. Ryan that he was impelled to urge the formation of university branches. On motion of Prof. F. Bedell telegrams of appreciation were sent to Prof. Ryan, who founded the local section, and to Prof. Wm. A. Anthony who offered the first electrical engineering instruction in this country.

After the dinner Mr. Scott addressed an audience of 225 local members and visitors on the topic "Limitations in High Tension Transmission." In view of the large number of students in his audience Mr. Scott took the occasion to give his views on the recognition of limitations in general, particularly as applied to conduct. He described in detail the experience of a Cornell graduate of the class of 1904 with whom he had come in contact. Mr. Scott emphasized the general relation of technical education to engineering practice, pointing out that such subjects as mathematics must be taught with a view to their application. Mathematics, he said, is a useful tool or it is nothing. Many engineers do not use mathematics in their work because they do not know how. They have studied the subject, but are unfamiliar with the applications.

Mr. Scott showed clearly how development has from time to time depended upon limitations in some part of electrical equipment. For example, the voltage which could be economically developed or the speed at which generators could be operated or the sizes in which transformers could be constructed.

Special emphasis was laid upon the improvement in the transformer by which the range of operation of electric transmission has been enormously extended.

One of the most interesting features of the lecture was the general explanation of how limitations affect design. For example, if a stronger steel could be found, say three times as strong as that now in use, the whole nature of bridge design would be affected. Bridges are now designed primarily to support their own weight; with stronger material they could be designed to carry [illegible] high as may be desirable from other considerations. [illegible]

[illegible] of the Ithaca section.

Reorganization of the Dearborn Drug and Chemical Works.

Robert F. Carr [illegible] the Dearborn Drug and Chemical Works have purchased the holdings of the estate of the late William H. Edsen, who died [illegible] and at a meeting of the stockholders, followed by a meeting of the directors of the company, the following officers were elected: President and general manager, Robert F. Carr; vice-presidents, William B. McVicker (eastern manager), Grant W. Spear, George R. Carr; assistant general manager, J. D. Purcell; assistant secretary and chemical director, W. A. Converse; assistant treasurer, R. R. Browning; superintendent, A. E. Carpenter. Mr. C. M. Eddy's holdings were also taken over, he desiring to devote all of his time to his personal business interests.

Robert F. Carr became connected with the Dearborn company very soon after it was organized, entering the business shortly following his graduation in chemistry from the University of Illinois in 1893. For the last 10 years he has been vice-president and general manager of the company, and during most of that time, especially the last few years, has been actively in charge of the business and organization.

William B. McVicker has been connected with the company for 13 years, having during most of that time been at the head of the eastern department, and for several years he has been second vice-president and eastern manager, having charge of the general eastern offices at 299 Broadway, New York, and the eastern branches reporting to New York, including Havana, Cuba.

G. W. Spear, who is a graduate in mechanical engineering of the University of Illinois, entered the business in 1895. He has been one of the vice-presidents of the company for five years, in charge of the branch offices in the central district of the United States, having his headquarters at the general offices in Chicago.

George R. Carr has been connected with the company since he graduated from the University of Illinois, in chemistry, in 1901. He has occupied the position of assistant general manager of the company for the last four years, devoting his time largely to the railroad department of the business.

W. A. Converse, who was elected to the position of assistant secretary in addition to the office of chemical director, which he has previously held, has been in charge of the laboratories for the last 12 years. Mr. Converse's ability as a chemist is well known. He has been secretary of the Chicago section of the American Chemical Society for a long period. J. D. Purcell, the new assistant general manager, has represented the company in the railroad department for five years. R. R. Browning, assistant treasurer, has held a similar position for some years, having been with the company since 1896. A. E. Carpenter, superintendent, has had charge of the manufacturing department for many years and is the oldest employe in the service of the Dearborn company.

The preparations manufactured by the Dearborn company for the treatment of boiler waters, both in stationary and railroad service, are most generally used. The scientific methods originated by their laboratories of treating each water individually as per requirements after analysis has made it possible for Dearborn preparations to give the highest efficiency with all classes of boiler-feed supplies.

COMMUNICATION.

Mr. Tesla's Work.

To the Editor of the Western Electrician.

I note with interest the article in the issue of the Western Electrician of February 8th, entitled "Mr. Tesla Makes Further Disclosures." I have reason to believe that Mr. Nikola Tesla has already transmitted electrical energy without conducting wires to greater distances than any other inventor of "wireless" that the world has produced. In an interview with Daniel Drawbaugh, inventor of the telephone, some time ago he said that the Hertzian ray, or radio-telegraphy, is old. Mr. Drawbaugh said that the best transmission is through the earth. I have reason to believe that he is right. It seems very clear to me that some inventors are making use of some of Mr. Tesla's apparatus in modified forms.

J. HOLMES WILSON.

Carlisle, Pa., February 11, 1908.

New Lamp Factories of the General Electric Company.

[illegible] devoted to the production of tungsten lamps.

[illegible] ductive facilities of the company now aggregate [illegible] position to supply all demands from customers.

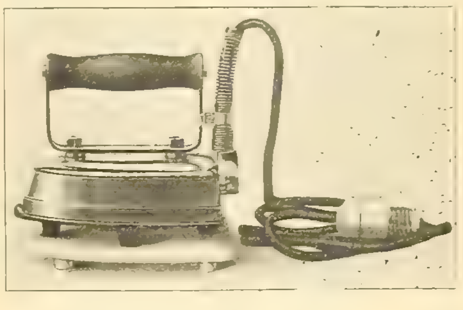
Westinghouse Electrically Heated Sad-Iron.

There is perhaps no form of electrical apparatus that appeals to the housekeeper more strongly than does the electrically heated sadiron. Its universal adoption depends only upon the efficiency and durability of the iron. These two points are prominent in the iron that the Westinghouse Electric and Manufacturing Company is now placing on the market.

In form the Westinghouse electric iron, shown in the illustration, differs only from an ordinary iron in its more symmetrical and attractive appearance, and in being provided with terminals and a flexible cord through which the current is transmitted. In operation it elevates ironing from hot drudgery to a comfortable and pleasant task. Its heating mechanism, which is entirely concealed, keeps the iron at the proper temperature at a minimum consumption of current. It consists of a flat insulated resistance strip clamped by hydraulic pressure between two flat iron plates, forming a solid heating element of high thermal conductivity, and having a large heat-storage capacity.

The design of the element is such that the heat is evenly distributed over the entire bottom of the iron, the edges and point being practically the same temperature as the middle of the bottom. A non-conducting element is used between the top of the iron and the heating unit. This construction results in the top of the iron being cooler than its face. The heating unit is hermetically sealed in its insulation, and cannot, therefore, deteriorate any faster than the iron, as it is not subject to the oxidizing effects caused by contact with air.

The iron is extremely simple and there is said to be absolutely nothing to get out of order or to require renewal. Irons which have been in use continually for the last six years, without cost for repairs, are in as good condition today as ever.



WESTINGHOUSE ELECTRICALLY HEATED SADIRON.

The electrical construction is so simple and durable that there is no reason why it should not last as long as the iron itself.

The terminals are protected by a solid metal guard, and the cord leading from them is securely anchored by a clamp on the handle of the iron. A wire spring which surrounds the cord at this point prevents any sharp bends. A separable plug is provided by which the iron can be connected to any convenient lamp socket without twisting. A small spring attached to the cord takes up all slack and so keeps it from dragging on the clothes or getting in the way of the operator.

The polishing surface of the iron is of highly polished cast-iron, which experience is said to have shown to be the most satisfactory surface for the purpose. The upper portions of the iron have a burnished nickel-plate surface. The handle is of ebonized wood, heatproof and unbreakable. A heatproof stand, upon which the iron should be set when not in use, is provided with every iron. The irons are made to suit all commercial lighting circuits and can be used on either alternating or direct current with equally satisfactory results.

Light and Color in Decoration.

At the meeting of the New York Section of the Illuminating Engineering Society on February 13th Mr. George L. Hunter read an instructive paper entitled "Light and Color in Decoration," in which his conclusions, which he characterized as qualitative, and not quantitative, bore on the production of illumination that is æsthetically satisfactory.

In the start Mr. Hunter expressed admiration for the work that has been done by the members of the Illuminating Engineering Society, saying that a mass of facts is being assembled that will ultimately substitute science for guesswork and experiment in the art of illumination. To no one will these facts be more important than to the decorator and architect. But, Mr. Hunter suggested, without decorative co-operation the full value of this science cannot be realized in practice, as there will be a tendency to accomplish economy and calculate efficiency without achieving beauty and comfort and real efficiency.

Generally, Mr. Hunter said, the word "decorative" is misunderstood, and decorative lighting is too often taken as meaning the employment of highly wrought chandeliers and fixtures, when, in fact, it is simply illumination that is æsthetically satisfactory—the light being so distributed as to avoid violent contrasts of light and shadow, while displaying objects in a manner agreeable to the eye. Lighting to be decorative must be efficient; but it must be more than that. It must be in good taste.

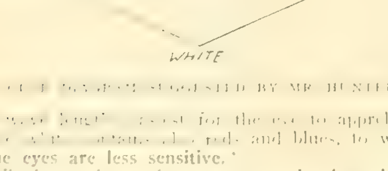
In the last quarter of the nineteenth century the electric light was developed to a point where it is possible to light interiors brilliantly, conveniently, safely and decoratively. In actual practice, however, the possible has seldom been accomplished. The art is still too new and the tools are still too unfamiliar. And progress has been hindered by adages that merely through repetition have come to have authority. Especially is this true in color. For north rooms blue and green are exceedingly agreeable, while reds are disagreeable. The opposite is true in south rooms. Yellow is cheerful in both. North light coming from the sky is bluish, while south light ranges on a bright day from red through yellow to white and back again as the sun sinks in the heavens. In north light, reds look muddy; in south light, blues are apt to be cold.

Color charts are abhorred by Mr. Hunter, and systems of color that deduce quantitative results from qualitative analysis are ridiculous, he said. But the formerly wide acceptance of the famous color or chromatic circle of Chevreul renders it imperative to explain why Mr. Guiffrey, the present director of the Gobelins, where Chevreul had charge of the dyeing for a considerable part of the nineteenth century, speaks of the chromatic circle as "based on empiricism, guesswork and a different visual aptitude in every individual." Chevreul started with red, yellow and blue as primary colors, and by intermixing, and by mixing with black, arrived at no less than 14,400 tones, not to speak of 20 grays, that he called normals.

In his circle red is 120 degrees from yellow, on the left, and the same distance from blue on the right. We need go no further. Such an arrangement is not only not based on the facts; it contradicts them. Red as a form of visible motion is the antithesis of blue. The wave length of red is long, of blue is short. The two colors have nothing common except nearness to black. Beyond red the wave lengths are too long for the eye to apprehend; beyond blue they are too short. Hence darkness beyond both. Darkness alone brings red and blue together; light separates them.

The solar spectrum arranges the colors in order of wave length and tells us that all of them united look white, the absence of color being black. The speaker suggested the accompanying diagram as presenting the facts clearly and truthfully.

The color nearest white is yellow. It is the color of medium wave leng.h, while white is the union of all the visible wave lengths. It contains only



COLOR DIAGRAM SUGGESTED BY MR. HUNTER.

[illegible] wave lengths [illegible] for the eye to apprehend, [illegible] reds and blues, to which some eyes are less sensitive.

Whether colors advance or recede depends on [illegible] find themselves. Against [illegible] at night, lights and light [illegible] light background dark [illegible] each other [illegible] stand out against a [illegible] type [illegible] would [illegible]

[illegible]

there are no hues that by the use of a dominant color cannot be coaxed into propinquity. Hues all look alike on dark nights. Taking the light out of them—or mixing them with black if they are paints—obliterates distinctions. Mixing white with them does the same. Red and green when pure, as in the spectrum, or when nearly pure, as in some pigments, are bitter enemies. But pinks and gray-green dwell together in peace and harmony. Yellow is a most satisfactory dominant on account of its cheerfulness. The most wintry landscape seen through yellow glasses grows warm. Blue glasses produce the opposite effect. Even autumn foliage loses its warmth when viewed through them.

It is the task of the decorator to confirm what is good and correct what is bad in the work of the architect. If the ceiling is the right height for the large rooms on a floor, it is too lofty for the small rooms. How shall we lower it? Light walls recede and dark walls advance. Keep the ceiling and floor dark and the side walls bright. The ceiling and floor will at once approach each other, while the side walls will open out. If a room is too wide and low, give it the opposite treatment. Light the ceiling brightly, and the side walls dimly, and the floor less than usual. But do not overdo the contrasts, and remember that the floor should always be comparatively dark in order that it may seem solid beneath the foot. People slip on parquet floors because the surface looks insecure, rather than because of its slipperiness. The darker its colors and the more intricate the pattern, the more solid will it seem.

The light that reaches the eye directly is not of the slightest use. You don't want to see the flame, you want to see the room and the people in it. Besides, the light hurts the eye, even when reflected from a mirror, and is agreeable only when its intensity has been lessened by reflection from some surface, or refraction through some material that eats up part of it. The reflected light is less in quantity, having lost some of its colors, but the colors that remain are those that identify the thing seen, and make it visible.

In looking over a recently published book on illumination problems, Mr. Hunter said he was surprised not only at the ugliness of the interiors and lighting fixtures illustrated in the chapter on residence lighting, but also at the illustrations appearing in the chapter on demonstration room tests. Of the 26 cases illustrated, the only one that showed an effective light distribution was the one with the bare lamp. In most of the other cases reflectors and refractors of various types have succeeded in taking the light from ceiling and upper walls that can distribute effectively, and in concentrating it on the floor, where it is objectionable. Not that he would deny the value of prismatic shades and globes in many instances—especially where a room is too high and the plane of illumination really needs to be lowered. But often ignorance of the importance of walls and ceiling in light distribution leads to serious and expensive error.

Here comes up the question of the color of walls and ceiling. If they were in black velvet, they could not assist us in the illumination of the room. But if they are in ivory—not white, that is disagreeable to the eye even in the weaker form that we get in reflection from plaster—they will not only distribute the light agreeably and economically, but will themselves be cheerfully visible—which would seem to be desirable.

A small room of good proportions with light walls and ceiling is beautifully illuminated by two 16-candlepower bulbs suspended from the center of the ceiling about six feet six inches from the floor. In large rooms the light of lamps as low as that would strike the eye unpleasantly, especially as their power would of course be greater. Only in rooms with high ceiling where the lamps can be hung high is the use of powerful units permissible.

The candlepower of the light source is directly regulated by the height of the ceiling. The light that blinds the eye at three feet is harmless at nine, having lost eight-ninths of its intensity. In a huge auditorium, lamps of enormous power can be effectively used. In interiors with low ceiling the units must be kept small.

Another way suggested by the speaker of preparing light for the eye is to refract it through frosted or opal or mosaic glass, or through crystal beads or prisms. This turns the lamp from something to be avoided into something that the eye likes to look at, and at the same time it transforms glare into diffused light. The refractors play the same part as ceiling and walls, and would help to illuminate even a room in black velvet. The use-efficiency of a lamp that distributes light cannot be compared on the basis of photometric tests. The light that counts is the light that is actually employed in the revealing of objects to human vision. Mr. Hunter suggested that, for general illumination, three feet, so often employed in photometric tests, is lower than the plane of greatest usefulness for general illumination.

The color of lamp shades and refractors is highly important. Those in golden yellows, ambers and [illegible] are safe almost anywhere. In a red room, [illegible] green shades should never be used, nor red shades in a green room. Whether the room be light, or dark, the material of the lamp standards and fixtures should never be dark enough to contrast strongly with the lights. A chandelier in hammered iron in a classic Colonial room is an atrocity.

In an interior where green and blues abound, as in a palm garden, the hue of the mercury lamp is not unpleasantly noticeable. This emphasized the speaker's contention that strong contrasts in hue or light and shade should be avoided. There does not appear to be anything intrinsically disagreeable about ultra-blue light for the eye that is used to it. Only when accentuated by contrast does it offend.

The development of color by contrast can easily be illustrated in an interior that has dark mahogany furniture with green upholstery and draperies. Put a red shade on the lamp, and the mahogany becomes lighter in tone and less prominent, while the green fabrics become darker in tone and advance toward the eye. Put a green shade on the lamp, the reverse happens, and you have to be careful not to stumble into the furniture. Let who will cry aloud for darkness in decoration, the illuminating engineer should demand light colors, said Mr. Hunter.

The best that can be done in a room with dark walls and ceiling is to use small units, generously distributed and enclosed in globes or crystals that are competent to break up the light and distribute it without mural assistance. To direct all the light to the floor—although this does produce high photometric tests in the plane of illumination—is to apply to general illumination principles that are properly applicable to local illumination only. And even in local illumination, the light reflected from book or embroidery is much more agreeable if it has been subdued before reaching the object illuminated. The printed page that shines beneath the light reflected down from the white polished surface of a tin desk shade is not lighted efficiently, though invariably lighted too much. A smaller amount of light from an opal globe or frosted bulb is infinitely preferable.

Illuminating surfaces are a necessity in artificial lighting. They may glow by refracted light or shine by reflected light, but you cannot get along without them. And the light eaten up by these surfaces is not wasted, unless they are opaque or dark in color and exact too high a toll. If they reflected and refracted perfectly, walls and ceiling and floor would be solid mirrors, reflecting and re-reflecting unshaded flames; this would be the extreme of economy, but it would not be decorative illumination.

Electricity in Peru.[1]

By Charles M. Pepper.

Electrical development in Peru is likely to call for increased purchases of material, notwithstanding the fairly large installations that have been made during the last two years. Hydraulic and electrical engineers the world over are familiar with the power that the Andes waters hold in reserve, but not all of them have kept pace with the recent application of this power and with the prospects for its further utilization. Some of the grander projects will have to wait a further period of industrial growth on the part of the west coast before they can become commercially feasible. Such is the proposed tapping of Lake Titicaca by means of a tunnel through the crest of the Cordilleras, bringing 500,000 horsepower down to the Pacific. This vast volume of power cannot be utilized profitably for many years, though some day it will be done.

Other large projects, particularly in relation to railway traction, manufacturing and mining, are not so remote. The waters of the Peruvian Andes present ideal conditions for transformation into electrical energy in their freedom from ice, brushwood, leaves, etc., and these advantages are fully recognized in all the plans that are formulated. Peru now imports coal to the value of $1,000,000 annually, and it is estimated that 50 per cent. of this amount could be saved in fuel by the use of water through electrical energy. When the Peruvian coal mines are opened up by getting railways to them there will still be economy in waterpower.

Electricity for a Road Over the Andes.

The Central or Oroya Railway, running from Callao, and piercing the wall of the Andes in the Galera tunnel at an elevation of 15,665 feet, with four per cent. grades and numerous zigzags and switchbacks, offers the best opportunity for the application of electrical power for traction on a large scale. This railway, the main sections of which were built by Henry Meiggs in the early '70s, is still both in its engineering features and in its scenic grandeur the most remarkable railroad in the world. Naturally its transformation into an electric line appeals to the ambition of electrical engineers, some of whom have made careful studies at their own expense and prepared elaborate plans. The ampleness of the waterpower in the

[1] From Daily Consular and Trade Report. Mr. Pepper is a special agent of the Department of Commerce and Labor of the United States government. His report is valuable to electrical manufacturers and exporters in the United States, particularly at a time when greater effort is made to extend trade relations with South American countries.

heights of the Andes is easily determined by other questions requiring the judgment of experienced railway men, both in regard to engineering and to the relative economy of steam and electric power in handling traffic, have been carefully tested and with a favorable judgment. Some sections of the line present exceptionally favorable conditions for the economical operation of the road by electricity.

When the group of American capitalists who control the Cerro de Pasco mines offered to lease the Central Railway from the Peruvian corporation their plans contemplated the immediate electrification of the system and estimates had been made for that purpose. The offer was not accepted and the line will continue to be operated by the Peruvian corporation. I am informed that the project of changing the motive power to electricity has not been rejected nor yet has it been definitely determined. It is under consideration in the expert technical examination of the property that is now being carried on with a view to obtaining the funds for the physical rehabilitation of the system that is necessary in order to provide for the increased traffic. Financial reasons may prevent an early change to electricity, yet it is the opinion of those who have given careful attention to the subject that within a few years the change will be made and that the economy of electrical power will be demonstrated.

Electrical Smelting Projected.

Possibly before the Central Railway is operated by electrical traction the mining industry will undergo a radical modification. Electrical smelting is by many experts thought to be on the eve of introduction. The waterpower is as abundant for it as for railway purposes. The Cerro de Pasco Company recently has completed extensive investigations of the power which may be obtained in the regions tributary to its properties, and the results are reported to be satisfactory. Within 36 miles of the smelter an available 15,000 horsepower has been located, while at a distance of 55 miles and an elevation of 10,000 feet there is 25,000 horsepower. The transmission is said to present no serious difficulties, and when detailed estimates of cost are completed it is possible that definite steps will be taken for the installation of a great electrical power plant.

At Rio Blanco, 80 miles from Lima, on the Central Railway, the Boston capitalists who are erecting a big smelting plant, in order to take care of the ore in the neighboring districts, have about 3,000 horsepower available and are installing machinery for utilizing 400 horsepower when the smelter begins operations in April. The most successful mining installation up to the present time is reported to be that of the Inca Company, in the Santo Domingo gold fields of Southern Peru. An electric plant of 400 horsepower, which was brought out and set up at some distance from the mine, where there was sufficient waterpower, is said to be giving good results in working the ores on a larger and cheaper scale. In the department of Ancachs, which is the chief mining province of the country, some installations of small electric-power plants are in prospect, and this is regarded as a promising field. The lack of railway and other means of transportation renders freights expensive, but this is no more burdensome for electrical machinery than for other kinds of mining machinery, and the saving to be effected in working the mines justifies the expense.

Trolley Roads and Electric Lighting

The future of the trolley tramways has definite bounds, since Peru has only a small number of cities where street-car systems are required, and most of these are already provided with trolleys or have contracted with them. Lima and Callao made the change from horse cars some years ago, and their local systems and the lines joining them are electric lines. One steam railway between Lima and Callao, which is controlled by the local trust or Associated Electrical Companies, will have its motive power changed from steam to electricity and be used for freight. The largest extension is of the lines between Lima and the residence suburbs and bathing beaches on the seashore, the most important of which is Chorrillos. A parallel and competing line between Lima and Chorrillos, which depends on steam instead of on waterpower for its motive force, was built and is operated with very unsatisfactory results to the stockholders, though recent extensions are said to improve the outlook for reducing the deficit. Ancon, a seaside resort 30 miles from Lima, which has also the facilities of a commercial port, may have the steam railway replaced by the trolley. In the towns of Trujillo and Chiclayo in Northern Peru existing electric systems are being extended, while the trolley may also be introduced in Paita and Piura, but for many other towns the single mule tramway supplies all the necessary facilities for passenger traffic. At Arequipa in Southern Peru an extension of the use of electric power is under way.

A few municipalities are not yet provided with electric lighting, but most of those have made provision for its introduction. Growth in the use of electric lights for private purposes in Lima and the [illegible]

[illegible] Some of the larger [illegible] plantation [illegible] tive on this point and stay by the English steam plow, which has been in use for a generation.

Electricity for Domestic Purposes.

The minor application of electricity, such as to domestic use in cooking, etc., has been introduced in Lima with passably encouraging results. An electric cooking stove has had some sales at the hands of a persistent dealer. The high price of coal renders its use economical. Telegraphic and telephone apparatus have a good market, since these systems are regularly being extended. The government follows a definite plan in extending the telegraph lines. The local Italian hospital obtained its electrical appliances in the United States.

The leading electrical enterprise in Peru at the present time is that known as the trust or the Associated Electrical Companies. This association supplies the power for all but one of the tramway systems of Lima and Callaó, the electric lighting, and a variety of industrial purposes. The total available energy is to be about 17,000 horsepower, consisting of a central installation at Yanacoto of 8,000 horsepower, 5,000 at Chosica, 800 at Santa Rosa, 400 at Piedra Liza, and 2,500 steam power in reserve. The consumption in 1907 was 7,400 horsepower for power and 3,300 for lighting. The Rimac River and its affluents are the source of these combined installations. Two miles from Chosica, which is 30 miles from Lima, a cement dam, headgates and canal were built to divert the waters of a stream called the Santa Eulalia to the Rimac at a point about two-thirds of a mile higher. At this point a concrete dam and gates are located which divert the waters of both rivers into a canal a mile and a quarter long. The canal has a grade of 1½ per cent. From the reservoir two steel pipes of 1½ meters diameter each and 670 meters long lead to the station. The effective head is 47 meters. Here five double-nozzle, double-wheel Peltons, direct connected to General Electric revolving-field, three-phase generators produce 4,000 horsepower. The velocity of the water as it strikes the wheel is 1,800 meters per minute. From the switchboard the voltage is raised to 35,000 volts and transmitted to Lima over a double set of transmission lines. At the chief station in Lima this high voltage is reduced to 2,300 for distribution.

Hydro-electric Plant.

Just below the bridge at Chosica a third dam has been built, and the river is again taken for the third station at Chacra Sana farther down the river. At the side of the dam three gates having their tops level with the crest of the dam lead the water to the canal. In the dam, just below the entrance gates to the canal, is located an all-steel gate, having its bottom two feet below the canal gates. This is to remove the immense quantities of sand and rocks that the river carries during high water. In three other places along the canal are located settling chambers and waste gates to remove automatically the sand and gravel. This canal is three miles long, 1¼ miles being in earth and the remainder having cement walls and floors. The gradient is three feet per thousand.

From the reservoir a steel pipe line six feet in diameter and 400 meters long carries the water to the station. The effective fall is 79 meters. At this station larger units are located, each of 2,500 horsepower, two of which are in operation, the third of 3,000 horsepower, which will be installed, giving a total capacity for the station of 8,000 horsepower and 12,000 horsepower for the two hydro-electric stations. These two stations operate in parallel, or in synchronism with the Lima generating stations. The Chacra Sana station is constructed of solid concrete with concrete block trimmings for the doors and windows and steel roof, entirely fireproof. It is 10 by 48 meters. From the transformer room 50-foot steel towers carry the transmission lines.

The Lima receiving and generating station has two 750-horsepower waterwheels that operate under a head of 24 meters. A reservoir and steel pipe line, the same size as the Chosica No. 1 station, has an automatic relief pipe 70 feet high and 5 feet in diameter that takes care of any sudden closing of the turbines, thus relieving the pipe line and wheels of dangerous strains. The steam section consists of seven engines and boilers with an aggregate capacity of 3,000 horsepower.

From the general station at Lima all public and private circuits, power circuits and railroad circuits are controlled by a switchboard with automatic switches. For the public street lighting 10 circuits supply current to 400 of the latest type enclosed [illegible]

[illegible]

[illegible] petitor through its local representatives.

The prospective application of electricity on a large scale [illegible] to the Central Railway and for the Cerro de Pasco mines and smelter [illegible] described, but there seems to be a more immediate application for light manufacturing. [illegible] horsepower on five power circuits is now furnished by the Trust to the cotton mills, flourmills, biscuit, chocolate and cigar factories of Lima and vicinity. Coal is expensive fuel for the local industries, and it has been demonstrated that with the waterpower which is available electric force can be furnished cheaper.

Most of the electric companies have their own agents and representatives in Peru and no suggestions therefore are necessary as to the means for reaching this market. The point on which I would lay stress is that electricity in all its forms will play a continually growing part in the industrial development on which Peru has entered, and the local conditions are such as to assure that the present world-wide monetary stringency will not seriously interrupt this development. Many enterprises are at the stage where they can be carried forward profitably by the utilization of electricity, while to stop means loss. The industrial impulse in Peru is in reality too strong to be checked.

"Auricura-phone" for Defective Hearing.

A practical new use for the telephone made possible by the great development in the telephone art is its adaptation as a means for overcoming defective hearing. An efficient device for this purpose is that recently evolved by the International Telephone Manufacturing Company, and known as the "auricura-phone." The instrument was one of the attractions at the Chicago Electrical Show during the convention of the International Independent Telephone Association.

It may be said that the auricura-phone is to the hearing what spectacles or opera glasses are to the sight, and it is one of the most scientifically designed devices for overcoming impaired hearing ever produced. The instrument is made in three parts—the transmitter or "sound-receiver," the receiver or "reproducer" and the battery. The battery is a four-volt midget cell of the same type as used with pocket flashlights. A neat case is provided, containing the necessary cord-connecting terminals, all arranged so that the battery may be readily changed. A regular stock battery is employed, which may be secured from any electrical supply store, the only renewals required. The reproducer is a neatly designed, compactly constructed watch-case receiver. It contains a substantially made switch for disconnecting the circuit at will to avoid all unnecessary use of the battery. The case of the reproducer is provided with a lug to which a lorgnette handle may be attached, if desired, or a head band may be used, if preferred. The proper cord-connecting terminals are provided so that the reproducer may be readily disconnected and conveniently carried.

The sound-receiver is a very accurately and substantially constructed International telephone transmitter enclosed within a small hard-rubber case. The case is provided with a neat catch that it may be fastened to the wearer's clothing. There is a lug which forms a block for the connecting terminal, and a base by which the sound receiver may be permanently attached to the battery case.

The sound receiver is built of the very best grade of material obtainable for the purpose and with the highest class of workmanship throughout. All parts are made with the most modernly designed tools and machinery to insure absolute uniformity and permanency of proper adjustment.

It is adjusted to such a degree of sensitiveness that sound is said to act upon its diaphragm as readily as upon the drum of a healthy ear. This enables it being carried by a gentleman in the coat or vest pocket and by a lady under the waist. Concealing the instrument in this manner in no way affects its efficiency any more than the drawing of a cap over a healthy ear. The reproducer being accurately balanced in adjustment with the sound-receiver, any distant sound acts upon the diaphragm of the latter as readily as upon the drum of a healthy ear, and greatly magnifies the volume of the sound and directs it close into the ear, making the auricura-phone a most scientifically correct aid to defective hearing.

CORRESPONDENCE.

Continental Europe.

Paris, February 4.—A large hydro-electric plant has recently been placed in operation in the Auvergne region of France, at Sauviat. Power is obtained from the Dore River and its affluent, the Miodex. The head of water is 29 meters. The turbines and alternators, placed on horizontal shafts, are of the Francis type and are made in Switzerland. The alternators have rotating fields and are 1,000-horsepower machines, three-phase, 11,000 volts and 50 cycles. They also were made in Switzerland. The arrangement is such that steam engines may be coupled to the generators in time of low water. Power is transmitted on three pole lines at 11,000 volts.

In Sweden the government has ordered for the plant at Trohattan two hydraulic turbines, each of 12,500 horsepower. These large machines are of Swedish make. They will develop the power at a head of water of 30 meters.

The electric-railway line from Naples through the Pompeiian Valley will be 42 miles long. The line is finished for a distance of 15 miles. Two trolley wires are used, and the car motors are operated at 750 volts direct current. Each car has two trolleys and is provided with two Westinghouse motors of 75 horsepower each.

From Russia it is reported that greater activity is shown in the production of copper. The output in 1907 was the greatest on record in that country. It is said that a group of copper producers will establish large electrolytic copper works, probably at Moscow. It seems likely that in the future the quantity of copper available for export from Russia will be greater than in the past.

The Danish "wireless" inventor Valdemar Poulsen is said to be engaged in the construction of a wireless-telephone station at Lyngby, five miles from Copenhagen. This is to be connected with a similar station at Esbjerg. Ultimately Mr. Poulsen hopes to establish wireless-telephone service between England and Denmark. The inventor devotes his attention to both telegraphing and telephoning by wireless, and says that by the former he is enabled to transmit at least seven times as many words in a given length of time as can be done by the Marconi system.

The Swedish government has introduced a bill in the parliamentary body providing for a loan of 5,000,000 kroner ($1,350,000) for the development of the telephone service.

In their attempts to formulate a theory of magnetism in accordance with modern views of electricity, both Thompson and Voigt encountered the difficulty that there must be a resistance to the translation of electrons in orbital rotation. By considering the effect of electromagnetic induction upon revolving electrons, Langevin overcame this difficulty, and arrived at a theory which agreed with all the phenomena observed in diamagnetic and paramagnetic bodies. Weiss has recently extended this theory to ferro-magnetic bodies. An important contribution to a fuller theory has now been made by Z. Thullie, who bases his calculations upon the general assumptions of Voigt, but supposes that the magnetic field impressed upon the substance is generated within a time which is of the order of magnitude of a single revolution of an electron round its positive atom. This allows of a much more accurate investigation, and closely touches magneto-optic phenomena. The final result of the somewhat elaborate mathematical investigation seems to be a complete vindication of Langevin's theory. Diamagnetism is thought to be a fundamental property of all matter, and Weber's and Ampere's molecular currents are best represented by electrons in orbital motion. A. de C.

Great Britain.

London, February 7.—An agitation is being set on foot in London to suppress the use of sky signs, or advertising signs, and as the majority of these are now electric signs, considerable attention is being drawn to the agitation on the part of electric supply authorities and the electrical industry generally. In the minds of many people the numerous electric signs which are to be seen throughout London after dark are a relief from the general melancholy appearance which would otherwise prevail, and this movement at the hands of certain gentlemen of apparently most esthetic tastes can only [illegible]. Representations are [illegible] London County Council as the [illegible] sky signs act, but the [illegible] will not [illegible] the time [illegible] to play the part of the passive resister.

[illegible] already [illegible] of the com[illegible] a joint [illegible] the undertakings of these

companies as one concern, a number of other companies have promoted another bill with somewhat similar objects, although the general tenor of this bill is not on quite such ambitious lines. Without going into too much detail on the general question, there would appear to be every possibility of the discord between the companies once again defeating the object in view; in fact, quite a new complexion is now placed upon the whole controversy in the face of which some government action may be anticipated. The split between the existing companies certainly makes the position of the proposed new company for giving the same facilities a very much stronger one.

The dispute as to the suitability of the Dolter surface-contact system of electric traction for the city of Oxford is continued this week by the reply of the engineer of the contracting company to the somewhat scathing report of the city's consulting electrical engineer. This reply produces figures to show that the current consumption upon the Dolter system at Hastings is as low as upon any overhead trolley system, and he also lays stress upon the fact that after having laid this system down at Hastings at its own expense the contracting company has had it taken off its hands by the operating company with a clean certificate granted by the Board of Trade. The company's engineer further flatly denies many of the statements made to the corporation, with whom the next step now rests.

The various opponents to the draft regulations issued by the Home Office concerning the use and application of electricity are now busy putting their houses in order for the inquiry which commences in March. Already the Municipal Electrical Association and the Association of Municipal Corporations have decided to appear by counsel, so that it may be stated that the whole of the corporations of the country at all interested in the electric-supply business are opposing. The companies take a common stand with the municipalities on the matter, and as the various associations of Chambers of Commerce have also joined in the fray, the commissioner, Mr. James Swinburne, will have plenty to do to reconcile the various interests and preserve at the same time the dignity of the government department concerned.

The London County Council has let the contract for the conversion to electric traction on the conduit system of the most important lines now running by horse traction in the north of London. The contract has gone to the well-known firm of Dick, Kerr & Co. at about $270,000. Among the other firms tendering was J. G. White & Co., but their tender was about $20,000 higher.

The report of the inspector of the Board of Trade who inquired into the circumstances surrounding the collision upon the Metropolitan Railway last year, for which a signalman was indicted for manslaughter and acquitted, has issued a very strong report. His conclusion is that the collision was caused by forgetfulness on the part of the signalman in the first place, and later by some illegal tampering with the electrical interlocking of the signaling apparatus. It is well for the signalman that this report was withheld until after the criminal proceedings were completed.

After a continual warfare since the opening of the municipal telephone exchange at Hull the National Telephone Company and the corporation have agreed to intercommunication between the two systems.

A very promising report has been issued by the directors of the Yorkshire Electric Power Company for the half year ended December 31, 1907. This shows that, compared with a deficit of nearly $6,000 for the last half year, there is a profit of over $4,000, which all but suffices to pay the mortgage debt on the undertaking. From the figures of total connections and the various authorities which are coming on to the mains there is every indication that the Yorkshire power scheme will be the first, after Newcastle, to get upon its feet.

The spirit of co-operation is about. Following upon the action of the London electric supply companies to promote a joint electrical exhibit at the Franco-British Exhibition as a counterblast to a similar proposal by the gas companies, an endeavor is being made to bring the London municipal electric supply authorities together in a similar manner.

The Marconi company announces the acceptance of private messages for transmission by wireless telegraphy at last. G.

New England.

Boston, February 8.—The contract between the Edison Electric Illuminating Company and the city of Boston has been scrutinized by the Finance Commission appointed last July to institute an inquiry into departmental economies, and as a result this commission has recommended its cancellation and the substitution of a new contract more up-to-date in its provisions. The old contract was made in 1904, and it appears that mercantile concerns are now obtaining more advantageous terms, on account of the progress made since that time in reducing the cost.

The Edison company has expressed its willingness to agree to a new arrangement at regular contract rates, and it is calculated that the saving to the municipality on this basis will be nearly $50,000 per year.

The electric lighting and power companies of the state are opposing a measure introduced this year in the state Legislature, providing that they shall make a flat rate to all customers. The Edison company of Boston is prominent in this opposition, because of the effect that such a regulation would have upon its immense wholesale business in the city of Boston. It is urged, on behalf of this and other companies similarly circumstanced, that they should be permitted to differentiate in the matter of rates between large and small customers, because of the difference in cost to them of supplying the electric current under such conditions. It is claimed that the present system is as near perfection and as just to all concerned as any that can be devised at the present time. The Edison Company has issued a statement describing its plan of adjusting charges to cost of supply, which is a very logical reply to the contention of the promoters of the bill.

Other electric-light producing companies are in accord with the Boston company in maintaining that there should be a difference between the rates charged what may be termed wholesale and retail consumers. The controversy is attracting much attention among consumers of electricity throughout the state, many of the consumers classed as "retail" being conspicuous advocates of the flat rate. A number of Boston storekeepers have joined the ranks of the petitioners for the proposed legislation.

E. Moody Boynton, inventor of what is familiarly known as the "bicycle-railway system," has encountered a serious setback at the hands of the Massachusetts Railroad Commission. In order to raise funds for his proposed railway, to be known as the Boston, Quincy and Fall River Bicycle Railway, Mr. Boynton desired to issue stock to the amount of $500,000 and bonds to an equal amount, to be used for the sale of the patent rights, by which means the amount necessary to equip the projected road would be provided. This proposition, however, was negatived by the commissioners. Mr. Boynton contends that the legislative act under which he is proceeding makes it obligatory upon the commission to grant his request, and it is understood that he will carry the matter to the Supreme Court.

N. Fletcher Curtis & Co. of Providence, R. I., bankers and brokers, and promoters of a number of electric-lighting companies in New England and New York state, suspended payment February 3d.

The annual dinner of the Massachusetts Street Railway Association, held at Young's Hotel in Boston, February 12th, was addressed by P. F. Sullivan, his subject being "The Necessity of Increasing Fares."

A bill is pending in the State Legislature to increase the penalty for theft of wire or power from electric public-service companies to $1,000 fine or four years' imprisonment, or both fine and imprisonment. B.

New York.

New York city, February 15.—The new through-train service on the Brooklyn Bridge is considered a failure in the report of Chief Engineer Seaman to the Public Service Commission. He recommends the restoration of the old shuttle-car system. He says it is impossible to carry as many passengers over the bridge in the through elevated trains as on the old shuttle trains. This is due to the fact that the elevated cars can at most accommodate only 100 passengers, while 150 passengers can easily be accommodated on the old cars.

The Public Service Commission of the Second District gave hearings this week in Albany, Watertown, Niagara Falls and Rochester on many complaints and applications having to do with railroads. Commissioners Stevens, Keap and Sague will devote three days in Niagara Falls to hearings in the Common Council chamber on the petition of the Niagara Falls Lighting Company for authority to issue $100,000 capital stock, to mortgage for $500,000 and to issue $300,000 bonds under the mortgage, and also for permission to construct an electric-light, heat and power plant in the city of Niagara Falls.

At the recent meeting of the Technical Publicity Association in this city the speakers held to the topic of "Mail Order Avertising," and there was a general discussion. Addresses were made by Mr. R. F. Bieber and Mr. W. H. Ingersoll. The members present represented the following: A. Allan & Son, John A. Roebling's Sons Company, Yale & Towne Manufacturing Company, Lidgerwood Manufacturing Company, Sprague Electric Company, R. R. Almond Manufacturing Company, General Electric Company, Crocker-Wheeler Company, American Locomotive Company, A. S. Cameron Steam Pump Works, American Brake, Shoe and Foundry Company, New York Telephone Company, Westinghouse Electric and Manufacturing Company, New York Edison Company, J. G. White & Co., Chas. A. Schieren & Co., M. H. Treadwell Company, Jos. Dixon Crucible Company, American Goetze Gasket and Packing Company.

Electric companies in this city have been re-

quested by the Public Service Commission to report the types, capacities and number of meters they have in use and also to tell of their method of [illegible] furnished by the commission are intended to bring out every detail as to meters, their operation and testing meters. The questions in the blank form [illegible] testing. W.

Eastern Canada.

Ottawa, February 15.—The Toronto street railway reports net earnings for last year of [illegible] per cent on the common stock.

The Toronto Electric Light Company's report for the year 1907 shows larger earnings, larger net profits and larger balance carried forward to profit and loss than in 1906. The income for 1907 was $1,030,710 and the net profits were $387,7[illegible]. The increase in earnings during the last year is said to be partly due to Niagara power and partly to the increased business done.

At last year's session of the Legislature the government of Nova Scotia assumed control of the rates chargeable for furnishing electric energy throughout the province. The law in that province now requires that all schedules of rates shall be filed in the office of the provincial secretary and that no changes can be made to the same without the sanction of the government. The right of hearing is given to any city, town, firm or individual affected, and thus the public is protected, in a large measure, from any excessive or improper charge.

It is stated on reliable authority that William Mackenzie of the Toronto street railway is negotiating for the Electrical Development Company of Toronto, and that there is a decided probability of its passing to his control at an early day. It is said to be the intention to electrify the Canadian Northern line in the province of Ontario and to supply power to municipalities through the Ontario government's hydro-electric commission. It is also understood that the Ontario government could get this concern, including the Development company's plant and the transmission line, on reasonable terms if the government concluded to purchase.

The latest announcement in the shipping world in Canada is that the Canadian Pacific Steamship Company's vessels in the Atlantic service will be equipped with Marconi wireless apparatus. The Marconi wireless commercial service is now in operation from Montreal to Britain. It is the intention of the company to extend the service to other commercial centers in Canada, where offices will be opened within the next two or three months.

The Shawinigan Water and Power Company owns one of the finest waterpowers in the Dominion at Shawinigan Falls on the St. Maurice River, 90 miles from Montreal. The present development has a capacity of about 60,000 horsepower, of which 30,000 horsepower is furnished in the form of waterpower to mills situated in close proximity, the remainder being distributed in the form of electrical energy. As 80 per cent. of the revenue is derived from the sale of electricity the policy of the company in future will be to make no more contracts for the sale of waterpower. At the present time a further electrical installation of 11,000 horsepower is nearing completion. As the development work provides for a total production of 100,000 horsepower the electrical capacity can be increased at any time to that amount at much less proportional cost. The company has two main transmission lines and a very wide market for its electrical product. W.

Indiana.

Indianapolis, February 15.—Construction work on the Gary and Western Traction Company's street railway has been suspended. The franchise requires that the line be completed by March 8th. The United States Steel Corporation is said to have obtained the controlling interest in the company, and it is said that it will complete the line.

Victor R. Coon, representing Louisville men, is promoting an electric railroad from Greensburg to Madison by the way of Napoleon, Osgood and Versailles. If this line is constructed it will afford Indianapolis direct connection with Madison and the Ohio River.

The Fort Wayne and Wabash Valley Traction Company has found it necessary to put on four additional through limited cars between Fort Wayne, Indianapolis and Lafayette. It is claimed that no electric road in the country is giving better service than this line at present.

Injunction proceedings have been filed against the Terre Haute, Indianapolis and Eastern Traction Company by the city attorney of Terre Haute to prevent the company from operating cars from Indianapolis over Terre Haute streets. When the Terre Haute, Indianapolis and Eastern Traction Company leased the Terre Haute Light and Traction Company's property it carried with it the franchise right to operate city cars, but the interurban company has no franchise separately which will permit the running of Indianapolis cars on the city tracks.

C. D. Emmons, general manager of the Fort Wayne and Wabash Valley Traction Company, has been appointed a member of the committee to investigate and formulate [illegible] of [illegible] employés. [illegible] will [illegible] Anderson.

The [illegible] Company [illegible] has been appointed receiver [illegible] Electric Light Company. The [illegible] recently expended [illegible] equipping the plant [illegible] the cause of the present [illegible].

[illegible] the [illegible] has introduced a bill [illegible] the Hydro-electric Company to construct a power dam in White River, near the city of Decker, to generate electricity. [illegible] Rash, of [illegible] president of the company proposing to develop this power.

A company has been organized in Evansville headed by John H. Tekoppel, Henry Drier and Anton Willis, to construct a waterworks and electric-light system in the territory west of Barker Avenue and north of Decker Road in Evansville.

The Electric Construction Company of Muncie has filed articles of incorporation. The company proposes to do a general electrical construction business as well as carry a large supply of electric goods. C. C. Radabaugh, who was with the General Electric Company for many years, is to be general manager of the company. S. S.

Illinois.

Peoria, February 15.—The Gas and Electrical Device Company of Rockford has been incorporated with a capital of $100,000 to manufacture and sell gas and electrical devices. The incorporators are T. W. Pitcher, C. Carson and R. F. Locke.

The Mississippi Valley Railroad Company, with principal office in Monmouth, has been incorporated with a capital of $5,000 to construct an electric line from Monmouth to Oquawka. The directors are headed by George M. Jamison of Oquawka.

H. H. Matlock of the Central Union Telephone Company of Springfield, with his wife, has left for San Antonio, Tex., where they will remain till about May 1st.

The United Electric Light Company of Gillespie will install a day circuit in that city and Benld on the 1st of March, for a motor load.

Capitalists from Evansville, Mount Carmel, Lancaster and Olney met at Graysville this week and decided to incorporate the Evansville, Mount Carmel and Olney Interurban Company under the laws of Indiana. Eden Knopp of Olney is president and C. W. Courter of Mount Carmel, secretary. The company will build an interurban line from Evansville, Ind., to Olney, Ill. The Business Men's Association of Olney has guaranteed to secure the right-of-way through Richmond County.

Besides carrying the mail on the Peoria-Bloomington line the Illinois Traction Company is carrying pouches from East St. Louis to Springfield, Springfield to Decatur, Decatur to Danville, and from this city to Springfield.

Directors of the St Louis, Terre Haute and Quincy Traction Company held a meeting in Quincy this week and negotiations for purchasing the two interurban lines between Roodhouse and Virden and from Virden to Taylorville were consummated, and the line will be operated by the new company. The company has secured the best part of the right-of-way between Quincy and Taylorville and expects to commence the construction early this spring.

The Brinkerhoff ordinance which has been before the Springfield City Council was up again this week and was laid over for a week. The company proposes to erect a modern heating and lighting plant and is asking for a franchise.

The first caisson of the Illinois Traction Company's new bridge across the Mississippi at St. Louis has reached bedrock.

The Illinois Traction Company is preparing to open the new shops at Decatur the first of the week. These are the new central shops and are the largest the company has. They are arranged to handle the work with the least possible cost. In addition to the shops the company has a large yard that will be of material advantage in handling the work. V. N.

Pacific Slope.

San Francisco, February 12.—The incorporation of the San Francisco and Bay Counties Railway Company this week by leading stockholders in the San Francisco, Oakland and San Francisco Railway Company is the preliminary move in the extension of the Key Route interurban system from the present terminus in Oakland and to various other points on the eastern side of San Francisco Bay, the construction of about 60 miles of electric road being involved.

Another electric railway between San Francisco and San Jose will be constructed about the same time that the Key Route extension is built. The Peninsular Railroad Company, controlled by the Harriman interests, has just completed its plans and will begin construction at once.

Guy C. Earle, vice-president of the Great Western Power Company [illegible]

[illegible] B. [illegible] Company [illegible] Redding [illegible] through [illegible] Thomas B. Walker [illegible] The company has practically completed its plant and transmission line [illegible] through the Walker property.

The Pacific Light and Power Company reports total earnings for the year 1907 of $1,281,055; total expenditures, $867,912, and profits, $413,142. The total actual investment of the company is placed at $7,2[illegible]3,274.

The Home Telephone Company of San Francisco has filed an application for a building permit for the construction of a [illegible]-story office building on the corner of Grant Avenue and Harlan Place, to cost $175,000.

The board of trustees of Redding, Cal., has awarded to the Northern California Power Company a contract to furnish 33 arc lights for the City Hall on its bid of $208.05 per month. The bid of the Shasta Power Company was $43.95 per month higher.

Secretary A. W. Smith of the Northern California Power Company states that the electric generating and hydraulic machinery for a 2,000-horsepower plant to constitute the company's initial installation at Cow Creek has been ordered for June or July shipment.

The Simmen Automatic Railway Signal Company, maker of electrical devices, will remove its shops from Los Angeles to Perris, where extensive tests are to be made on the line of the Santa Fe Railroad.

The Nevada-California Power Company is preparing to extend its transmission line from Tonopah to Manhattan in the state of Nevada, and a branch line to the mining camps at Round Mountain will also probably be added.

P. E. Hall, Jr., of Everett, Wash., has been made manager of the Montesano Light and Water Company of Montesano, Wash.

The Entiat Power Company has been incorporated at Wenatches, Wash., by A. B. Gray, L. D. Barash and J. H. Allen, with a capital stock of $200,000, for the purpose of developing power on the Entiat River. The power developed will be used largely for pumping water from the Columbia River for irrigation purposes.

The City Council of Wallowa, Wash., has granted a franchise to the Wallowa Mercantile Company to erect an electric-light and power plant in that place.

H. V. Gates of Hillsboro, Ore., president of the Prineville Light and Water Company, states that a power plant to cost $150,000 will be commenced at Lava Falls this spring.

The owners of the El Salto 100-ton mill at El Salto, near Chihuahua, Mexico, are preparing to put in a 600-horsepower hydro-electric plant to furnish power and light at various mines and at the mill. A.

PERSONAL.

Mr. John Z. Murphy, chief engineer of the Chicago Railways Company, has been appointed by the directors of the company as its representative on the Board of Supervising Engineers, Chicago Traction.

Mr. George Weston, prominent in engineering circles, has been chosen by the Chicago Council committee on local transportation to prepare a report on elevated-railway Loop problems and to act as engineering adviser to the committee.

Mrs. N. W. Storer, wife of the division engineer of the railway department of the Westinghouse Electric and Manufacturing Company at Pittsburg, died recently. The bereaved husband and four young children will receive the sympathy of many friends in the electrical industry.

Mr. S. P. Grace, chief engineer of the Bell Telephone Company of Pittsburg, has been elected a director of the Engineers' Society of Western Pennsylvania. This society now numbers nearly a thousand members and is a very important factor in the industrial development of Pittsburg.

The resignation of Mr. R. A. Hunter, as superintendent of the Merchants' Mutual Light and Power Company of Santa Barbara, Cal., took effect February 1st, when William R. Vick of Los Angeles, formerly with the Los Angeles Gas and Electric Company, took charge of the company's affairs. Mr. Hunter during his incumbency of nearly two years has made many friends and has steadily advanced the interests and influence of the company and greatly widened its scope of business. His

passing from that position will be regretted by many. He will remain in Santa Barbara for several months, and may later take a position with one of the lighting companies of San Francisco.

Mr. Charles H. Davis has resigned his position as district sales manager of the Chicago office, Nernst Lamp Company, and after March 1st he will be located with the Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa., as manager of the Electric Railway Details Department.

A dispatch from New York says that Mr. John F. Randolph, private secretary of Mr. Thomas A. Edison and treasurer of the Edison Manufacturing Company, committed suicide in Orange, N. J., on February 17th by shooting himself in the head. No cause is known for the deed and it is thought that he was temporarily insane.

Prof. D. C. Jackson of the engineering department of the Massachusetts Institute of Technology has been engaged by the Massachusetts Highway Commission, which exercises supervision over the telephone business in that state, to report upon the telephone situation in the commonwealth, with special reference to the practicability of obtaining a reduction in rates and a higher efficiency in service. Professor Jackson was a member of the committee which recently investigated the telephone situation in Chicago.

Announcement is made of the engagement of Miss Nora Stanton Blatch, granddaughter of Elizabeth Cady Stanton, to Dr. Lee De Forest, the "wireless" inventor. The wedding will take place on February 25th. Miss Blatch graduated from the civil-engineering course at Cornell in 1905, when 21 years old, being the first woman to enter that department. Soon after her graduation she was engaged to design structural-iron work for the American Bridge Company. She was elected a member of the American Society of Civil Engineers. Last year she took the examination for engineer of the Board of Water Supply in New York city and received the appointment.

ELECTRIC LIGHTING.

John T. Burke has been granted a franchise for an electric-light plant in Columbus, Neb.

The Aguilar Light and Power Company of Aguilar, Colo., has been incorporated with a capital of $25,000.

The Cohasset (Minn.) Hardwood Manufacturing Company has been granted a franchise for an electric-light plant.

The Auburn Mutual Electric Light, Power and Heat Company will soon begin the erection of concrete poles for its wires.

A correspondent of the Chicago Daily News suggests that a bill for electricity may well be known as "the Charge of the Light Brigade."

The Kentucky Heating and Lighting Company of Louisville has awarded a contract to F. A. Clegg & Co. for the erection of its proposed electric power plant.

George Boosier is installing an electric-light plant on his factory grounds in Corning, Ark. He has purchased the light plant of E. V. Sheeks and will install a new generator and other machinery.

The Amarillo (Tex.) Street Railway Company has been granted a franchise for the establishment of a light and power plant. The machinery, including engine and dynamo, will be installed soon.

The city of Baltimore, Md., has some $5,000 to be used in securing more brilliant lighting for Baltimore streets, the Central Business Men's Association being especially interested in the movement.

As a basis of determining rates, the physical value of the Madison (Wis.) Gas and Electric Company's system has been estimated by Professor Pence and his statistical assistants and is placed at $693,964, according to a report filed by the engineer with the secretary of the Railroad Commission. This figure represents not what it would cost to build a new plant equally as good as that now in existence, and a separate set of estimates is reported to show what a new plant would probably cost, the conclusion being about $100,000 more than the [illegible] for the "present condition" value.

ELECTRIC RAILWAYS.

The [illegible] and Hot Springs Street Railway Company [illegible] S. A. Bradford [illegible] president, [illegible]

The [illegible] Street Railroad Company [illegible] electric light to [illegible]

The Bow River Collieries Company of Lethbridge [illegible] to build a road [illegible] provides for the building of a telephone system in connection with the railway. B. C. Moore, Lethbridge, Alberta, is interested.

A peculiar accident happened on the Metropolitan "L" road in Chicago on the evening of February 14th. One of the main feeder cables supplying the main section of the road east of Marshfield Avenue became grounded during a storm through a cracked insulator, which therefore formed a "dead" short on the line, and it was impossible to keep a circuit-breaker closed on the panel supplying this section. After persistent search the faulty spot was discovered and the trouble removed within a few minutes. This trifling defect had, however, tied up the traffic of some 1¾ miles of four-track road for nearly two hours.

The General Electric Company, Schenectady, N. Y., in Bulletin No. 4544 describes the present design of switchboards for railway use. Although each panel is an independent unit and may be ordered separately, the panels are especially designed to be used together to form switchboards. The bulletin covers several classes of panels, all of which are for 600-volt, continuous-current railway service with the negative bus grounded. The following types are described: Generator panels, including circuit-breakers and equalizer switch panels, rotary-converter panels, feeder panels for one circuit, feeder panels for two circuits with one ammeter per panel, and feeder panels for two circuits with two ammeters per panel.

The Pueblo (Colo.) Chieftain says that Mr. N. Douthitt, who has been making arrangements for the construction of an electric interurban railway from Pueblo to Fowler, Colo., is planning for the extension of the road west to Canon City and south to Trinidad. Eastern capital is said to have been interested in this important project in the development of the Arkansas Valley. The Pueblo and Arkansas Valley Electric Railway Company, owned largely by Kansas City men, is said to have given Mr. Douthitt authority to proceed with the plans. Rights-of-way have been secured and everything is ready for the construction of the road from Pueblo to Blende, and the survey has been completed to Fowler.

The principal feature of the new power house of the Mobile Light and Railroad Company, Mobile, Ala., which is rapidly nearing completion, will be an electric generating unit of 1,200 kilowatts output on normal load, delivering direct current at 550-600 volts. This company, under the efficient control of Mr. J. H. Wilson, president and manager, has had a very prosperous period and is now making a large number of improvements to the system, including eight miles of new track recently laid with heavy rails, and the addition of a line of large double-truck cars. The new power plant is a modern one in every respect, having an overhead system of coal handling, and boiler equipment of the most improved design.

PUBLICATIONS.

An attractive calendar with a pretty picture on a background representing the bark of a tree has been issued by the Duncan Electric Manufacturing Company of Lafayette, Ind., manufacturer of alternating-current and direct-current wattmeters, lightning arresters, ammeters and voltmeters.

An interesting article on the manufacture of clay conduits in the January issue of Brick has been reprinted by the Clay Product Company. It treats of he essentils of a perfect conduit, its application, and gives an excellent illustrated description of the plant of the Clay Product Company at Brazil, Ind.

The General Electric Company, Schenectady, N. Y., has perfected an improved type of switch indicator known as the SI-104, which is described and illustrated in Bulletin No. 4563. Among the improvements to be found in this switch indicator is mentioned a resistance amounting to double that of the operating coils that is thrown in series with them when the indicator is in the "clear" position. This arrangement, while securing a strong and positive pull in the "clear" position, introduces a great economy in current consumption.

The electrical department of the Art Machinery Company, 217-221 Fulton Street, Brooklyn, N. Y., has issued a booklet illustrating and describing the Economy electric soldering and branding irons. All irons are constructed to meet the necessary requirements of the Board of Fire Underwriters and fire department, being made of the best-approved material.

In many isolated plants the conditions make it desirable to use a circuit-breaker on the switchboard in place of the combined lever switch and fuse which has been generally used on this type of panel in the past. This demand has caused the General Electric Company, Schenectady, N. Y., to standardize a line of panels for small plant work of this character, and these panels are described in Bulletin No. 4558, recently issued. The panels provide for controlling 125-volt generators of from [illegible] to 200-kilowatt capacity and 250-volt generators of from 10 to 240-kilowatt capacity, and are made for controlling from two to six-feeder circuits.

SOCIETIES AND SCHOOLS.

The first annual dinner of the engineering department of the University of Vermont was held February 11th, with upward of 100 students, alumni, faculty and special guests present.

A meeting of the New England Section of the Illuminating Engineering Society was held in the Edison Building, 39 Boylston Street, Boston, February 18th. Mr. L. W. Marsh of the American Luxfer Prism Company read a paper on "Daylight Illumination."

On February 18th the Chicago Section, A. I. E. E., held a meeting to consider a paper on "Some Recent Improvements in the Mechanical and Electrical Equipment of the South Side Elevated Railway," prepared by Garrett T. Seely, engineer maintenance of way.

The New York offices of the Underwriters' Laboratories, Inc., have been moved from 29 West Thirty-ninth Street to the twelfth floor at 135 William Street, where the offices of the National Board of Fire Underwriters are also located. Mr. George E. Bruen, employed in an engineering capacity by the National Board, will take up the laboratory work in connection with his other duties, and has been appointed engineer for the Underwriters' Laboratories, Inc., to have charge of the business of that corporation in and around New York city.

At the meeting of the Armour Institute of Technology Branch of the American Institute of Electrical Engineers on February 6th an interesting paper on "Train Lighting Systems" was read by M. Gilmore, in which he pointed out the relative advantages and disadvantages of the head end, straight storage and axle car-lighting systems. A special meeting on February 13th was held for the discussion of the recent Institute paper on engineering education. The regular meeting of February 20th was set apart for a paper by T. W. Simpson on "Heavy Electric Railway Practice."

MISCELLANEOUS.

The report of Stone & Webster for the year 1907 covers 30 public-service properties under their management. Gross earnings of all the properties is reported to be $14,996,712. Operating expenses were $9,793,314. Interest charges of $2,317,752, and dividends amounting to $1,304,406 left a surplus for the year of $1,581,240. During the year 1907 185,694,152 passengers were carried on the lines of the companies, which comprise an equivalent total of 861 miles of single track.

The Electric Operating Construction Company of 49 Wall Street, New York, has completed the financing of the Arizona Power Company, a 7,500-horsepower waterpower development near Prescott, Ariz. William P. Bonbright & Co. of 24 Broad Street, act as fiscal agents, and Viele, Blackwell & Buck are the consulting engineers. The Electric Operating Construction Company will itself manage the construction, and its chief engineer, R. S. Masson, has located at Prescott to direct the work.

Low-pressure air compressors, rated from 0.88 pound to four pounds per square inch and from capacities of 750 to 10,000 cubic feet of free air per minute, are included in the line of centrifugal air compressors which have been developed by the General Electric Company, Schenectady, N. Y., and are described in bulletin No. 4564. These machines are similar to the well-known centrifugal pump in both appearance and operation and consist essentially of a rotating impeller surrounded by a suitable casing with an intake opening at the center and a discharge opening at the circumference. Compressor sets are furnished, driven by Curtis steam turbines, direct-current motors and induction motors.

TRADE NEWS.

The Cady-Frazer Company has engaged in the electric-wiring business in Fremont, Neb.

The Herald Electric Company of St. Louis has been incorporated by C. G. Harrington and others.

The Second Hand Electric Machinery Company of Kansas City, Mo., has been incorporated with a capital stock of $10,000.

Crespo y Hermano & Bro., Truxillo, Honduras, Central America, want power equipment for a sugar mill. They have facilities for a waterwheel 16 feet in diameter and 12 inches long. The company has only wood and petroleum at 110° and 115°, and wants to know the best power equipment to use.

An American consul in the East Indies reports that a firm in that locality is in a position to do business in electrical supplies, and would like to correspond with manufacturers of electroliers, electric fans, etc. The current used is alternating, 110

volts and 50 periods. Refer to File No. 1883, Bureau of Manufactures.

The Beaver Electric Construction Company of Chicago has been incorporated, capitalized at $5,000. The purpose is to construct and install electric heating, lighting and water apparatus. W. K. Lowrey, M. L. Rosenbaum and L. M. Cahn are the incorporators.

Messrs. H. A. and O. R. Johann of Pekin, Ill., under the firm name of Johann & Johann, cable experts, are prepared to do aerial, underground, submarine and conduit construction and furnish plans, specifications and estimates. They can complete telephone cable construction from exchange to pole terminals and install apparatus and attend to troubles.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 3 p. m. on March 17th for the installation of a conduit and electric wiring system for the Federal Building at Los Angeles, Cal., in accordance with drawings and specifications, copies of which may be had at the office mentioned or at the office of the superintendent of construction, Los Angeles, Cal., at the discretion of the supervising architect.

At the request of a number of creditors a synopsis of the plan of readjustment of the debt of the Westinghouse Electric and Manufacturing Company, an outline of which was presented in the Western Electrician of February 1st, has been sent out by the committee having the matter in charge. Accompanying it is a letter in which the attention of creditors is called to the importance of an immediate deposit of their obligations to the end that the plan may be declared operative without loss of time and the termination [illegible] effected. The time [illegible] deposit [illegible] March 1, 1908.

BUSINESS.

The annual report of [illegible] for 1907 showed an increase in [illegible] 27 per cent., notwithstanding a falling off in the last quarter, owing to the slowing down of construction work. There has been a marked [illegible] of orders, however, since the first of the year, the figures for January showing a large increase over the corresponding month last year.

The General Electric Company is furnishing the entire electrical equipment for the Tajo mines in the Rosario district of Mexico. The order includes a three-phase, 60-cycle, 2,300-volt, revolving-field generator of 150 kilowatts capacity, nine oil-cooled type H transformers, three 440-volt, form K, induction motors of 15, 35 and 75-horsepower capacity with starting compensators, two-circuit feeder panel, complete lightning-arrester equipment and the necessary supplies of wire, insulators, etc.

Allis-Chalmers Company declares that purchases of motors for uses in varied lines of industry have continued practically without abatement throughout the recent period of depression. Motor drive is now being adopted everywhere, and the company has, within a week, sold machines ranging in capacity from one to 200 horsepower, to a long list of users, including the Procter & Gamble Company, Cincinnati; Fenton Dry Cleaning and Dyeing Company, Cincinnati; Chicago Belting Company; Standard Chair Company, Union City, Pa.; Buffalo Copper and Brass [illegible]; [illegible] Coal Mining Company, [illegible] Pa.; [illegible] Pulp and Paper Company, [illegible], and many other [illegible].

[illegible] the country is action taken by the Chicago, St. Paul, Minneapolis and Omaha Railway to [illegible] the equipment [illegible] shops at St. Paul, Minn. To provide additional power now needed there the company has purchased a tandem-compound engine to be [illegible] connected to an electric generator of 300 kilowatts capacity. This machine is now being built at the West Allis works of Allis-Chalmers Company.

President H. M. Hirschberg of the Excello Arc Lamp Company, New York, visited Chicago last week, primarily on a wedding trip and incidentally to establish his western headquarters in Chicago, which are now in charge of George W. Armstrong. The Excello Arc Lamp Company during the last six months has so rapidly increased its western business, and the prospects for a still further introduction of the Excello lamp in the West are such, that the establishment of a western department, with headquarters at Chicago, became almost imperative. Mr. Armstrong's co-operation in President Hirschberg's aggressive and businesslike policy throughout the East had not a little to do with the company's marked success with New York as a center. As a consequence President Hirschberg appointed Mr. Armstrong to have full charge of the western business. The Excello company has taken offices and a commodious storeroom in the Electrical Building on Jackson Boulevard, where a large stock of lamps will be kept always on hand.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 11, 1908.

878,496. System for Controlling the Motion of Electrically Operated Elevators by Means of a Switch. William Baxter, Jr., Jersey City, N. J. Application filed May 21, 1902.

A car switch has means constructed to divide a current into branches and to vary the strength of the branch and main currents independently. A controller mover is adapted to vary its torque and angular position in concordance with variation in the currents transmitted to it; variations in the branches being in accordance with the angular movement, variations in the main current being in accordance with the torque required of controller-mover armature.

878,498. Swinging Electric Bracket. John F. Brown, Toledo, Ohio. Application filed July 8, 1907.

The stationary part of the joint has two contentric conducting rings forming terminals of the connecting wires. The swinging arm has two fingers contracting with these rings.

878,499 and 878,500. Device for the Inspection of Car Wheels. Charles Browning, Jr., Sacramento, Cal. Applications filed December 18, 1906, and March 15, 1907, respectively.

The device consists of a special track section provided with means for testing the vertical wear and thickness of wheel flanges. Electrical connections are arranged between the testing means and a means for recording the test results. The second patent covers a modified form of the device.

878,513. Yielding Matrix for Sound Records. Victor H. Emerson, New York, N. Y., assignor to the American Graphophone Company, Bridgeport, Conn. Application filed June 29, 1905.

A thin and comparatively flexible electro-deposited matrix for a sound-record has a backing of yielding material therefor.

878,520. Means for Tying Wires to Insulators. Lewis W. Gerdon, Meadville, Pa., assignor of one-half to Edwin P. Barnes, Cleveland, Ohio. Application filed October 14, 1907.

A tie for binding the line wire to the insulator consists of two loops each of which completely encircles the insulator, the loops crossing each other and the line wire where the line wire is in contact with the insulator.

878,525. Electric Installation Working with Turbo-dynamos and Accumulators. Max Grob, Winterthur, Switzerland. Application filed August 22, 1906.

An automatic electromagnetic device having a solenoid in a controlling circuit, and a spring-actuated movable core is connected mechanically to a turbine-controlling device and to a connecting switch, so that when the electromagnetic device is energized or de-energized, the opening and closing of the turbine-controlling device is effected simultaneously with the operation of the switch for the closing or breaking the connection between the dynamo and the battery.

878,551. Protecting Hood for Spark Plugs. David B. Mills, East Orange, N. J. Application filed February 2, 1906.

This hood for a plug terminal has an open end to receive the terminal and a passage through its wall for a conductor, and a bushing-like projection surrounding the passage provided with a hollow recess, near one end of which the passage opens. The hood can be removed from the plug by a direct pull.

878,586. Push-button Switch. Herbert C. Williamson, New York, N. Y. Application filed May 17, 1906.

The switch is mounted in a receptacle containing a supporting plate with a ratchet, an oscillatory pawl plate, a contact bar and co-operating contacts, and an oscillatory releasing plate arranged to release the pawl plate.

878,588. Insulated Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed July 27, 1906.

This joint is made by first setting up in spaced relation the rails and rail joint members to form a mold having a molding space between the rails and members, and then casting plastic insulating material in the molding space to form an integrated body of insulation therein. (See cut on next page.)

878,591. Switch Device. Karl Abel and Friedrich Pervesler, Vienna, Austria-Hungary. Application filed January 25, 1907.

A switch or pole changer comprises opposite pairs of spring contacts mounted on the base, spring contact strips secured intermediate of the opposite pairs of contacts, the opposite ends of each spring strip extending over contacts of opposite pairs, and push buttons mounted over the strips, each button extending over two spring strips, whereby two spring strips are brought into contact with a pair of contacts by depressing a single button.

878,617. Apparatus for Applying Insulation to Electrical Conductors. Louis W. Downes, Providence, R. I. Application filed June 15, 1905.

A carrier has means for rotating the same about the wire, and means mounted upon and movable on the carrier for applying fiber to the surface of the wire during rotation of the carrier.

878,629. Electric-mercury-motor Meter. Jacob H. Hodde, Springfield, Ill., assignor to the Sangamo Electric Company, Springfield, Ill. Application filed March 16, 1907.

There is in combination with a body of mercury and a spindle rotating therein a washer of non-amalgamable material loosely surrounding the spindle at the point where it enters the body of the mercury, the washer being provided with an amalgamated under surface. (See cut on next page.)

878,633. Key Socket. Harvey Hubbell, Bridgeport, Conn. Application filed March 5, 1907.

The socket comprises an insulating block having a recess with inclines at its base, a plate in the circuit covering one of the inclines, a shaft and a contact plate carried forward by the shaft and having contact springs engaging opposite inclines, so that each quarter turn of the shaft will alternately open and close the circuit. The connections between the shaft and contact plate have operative engaging means which coact to permit advance of the contact plate only when the shaft is in one of two diametrically opposite positions relatively to the plate.

878,634. Socket-shell-cap Fastening. Harvey Hubbell, Bridgeport, Conn. Application filed September 5, 1907.

A shell has in one side a key recess, an outwardly projecting locking lug contiguous to the upper edge and to the recess, and a number of circumferential ribs. The cap has at its lower end an internal circumferential groove, the lower wall of which is provided with recesses to receive the ribs freely, and a hole above the groove which receives the locking lug with a snap engagement.

878,646. High-potential Insulator. Fred M. Locke, Victor, N. Y. Application filed April 18, 1904.

This is a wall insulator comprising concentric tubes of unequal lengths, each of the tubes being provided with an abutting offset. Spacing rings of less length than the tubes are placed between the intermediate portions thereof.

878,653. Trolley Pulley. Emanuel J. Matthews and Robert C. Gruwell, Stockton, Cal. Application filed September 26, 1906.

This is a combined over and under-running trolley. A series of arms is mounted on a shaft on each side of the lower pulley. A small roller is journaled on the outer end of each of the arms. Two metal plates, joined together by cross bars, have small flanges on their lower edges, on which the rollers bear.

878,656. Trolley Wheel. Joseph T. Mishler, Johnstown, Pa. Application filed August 10, 1907.

Three grooves are formed on the wheel surface, the central one being the deepest. At diametrically opposite points the outer grooves are spirally joined to the central one.

878,661. System of Electrical Distribution. Robert S. McLeod, Manchester, England. Application filed July 11, 1904.

A booster, the armature of which is connected in series with a storage battery across the mains, and an exciter are driven by a motor. The exciter field is energized by a magnetizing force proportional to the main current and to the main voltage, and the booster field is energized by a magnetizing force proportional to the exciter voltage and to the difference of voltage between the mains and the battery.

878,679. Support for Insulators. William N. Smith, Yonkers, N. Y. Application filed April 28, 1906.

The insulator pin has a transverse base with a perforation receiving a U-bolt that straddles the cross-arm to which it is held by a bottom cross-plate clamped by the nuts.

878,688. Electric-heated Hand Molder for Filling Shoes. Andrew Thoma, Cambridge, Mass., assignor to the North American Chemical Company, New York, N. Y. Original application filed March 5, 1906. Divided and this application filed June 11, 1907.

A handle is provided with a flat, hollow blade of heat-conductive material, having a curved underside for smoothing purposes and a flat spoon-like top side for applying purposes, and electrical heating means between the two sides.

878,708. Heated Steering Wheel. Charles Berg, New York, N. Y. Application filed March 25, 1907.

The wheel has a hollow rim, an insulating core therein, a heating coil on the core, another heating coil enveloping the first coil, and means whereby current may be supplied to one or both coils.

878,710. Electrical Vapor Apparatus. Hugh L. Campbell and James L. Watts, Nashville, Tenn. Application filed February 18, 1907.

The apparatus consists of a vessel, metallic electrodes to create an electric arc therein, a reservoir communicating with the vessel and having discharge means including a respirator, and a pump contained in the reservoir and connected with the vessel for forcing air into it and from the latter to the reservoir. (See cut next page.)

878,756. Controller. Walter J. Warder, Jr., Chicago, Ill., assignor to Roth Bros., Chicago, Ill. Application filed May 13, 1907.

The controller arm is actuated from a distance through a pedal and connecting rod operating a ratchet-like device.

878,760. Apparatus for Massaging the Hearing Organs. Adolphe Zünd, Paris, France. Application filed March 4, 1907.

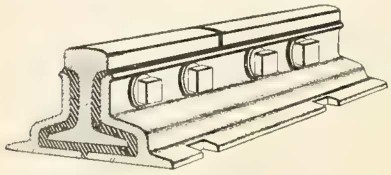
This apparatus consists of an electric vibrator comprising an electromagnet and sonorous blades in combination with contact-breaking means, an adjustable carrying device for the contact points, by which device the length of the vibrating portion of the blades may be regulated, and a diaphragm in proximity to the blades for reinforcing the sound produced thereby.

878,779. Party-line Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 22, 1904.

A harmonic ringing system is described in which each sub-station has a shunt around its bell, and this shunt is kept open by a harmonic device actuated by current of proper frequency only.

878,791. Supervisory Apparatus. Konrad Friedlaender, Berlin, Germany. Application filed January 31, 1906.

In an alarm system there is in combination with an alarm an emergency index, a glow-lamp in proximity thereto, means for keeping the lamp at a dull red heat, means for causing the lamp to light up when the alarm device is operated, and contact mechanism in an independent circuit for controlling the alarm device. Under normal conditions the lamp indicates that the alarm circuit is intact and when the alarm is operated the lamp illuminates the emergency index.



NO. 878,588.—INSULATED RAIL JOINT.

878,797. Telpher. Henry M. Harding, New York, N. Y., and Charles M. Clark, South Orange, N. J. Application filed April 13, 1905.

In this telpherage system the telpher has a motor and the hoist has a separate motor. Each motor is controlled by a switch operated by a stop in the travel of the other motor.

878,816. Sleeve for Joining Wire Ends. Francis W. Maxstadt, Los Angeles, Cal., assignor to Frank B. Cook, Chicago, Ill. Application filed November 7, 1904.

A wire connector consists of a piece of sheet metal having its side edges bent toward each other and turned inwardly toward the longitudinal axis of the connector, the edges being brazed together and forming a longitudinal rib for holding separate the contained wires.

878,836. Securing Device for Trolleys. Eberle D. Trickey, Blanchester, Ohio. Application filed April 17, 1907.

A frame has bearings in which are mounted two shafts provided with horizontally disposed arms at their upper ends, which arms normally extend over the trolley.

878,855. System for Controlling the Operation of Electric Motors. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed July 10, 1905.

The motor is started from a distance through an electromagnetic switch. The controller has an overload release, which cannot operate in starting, however. (See cut.)

878,870. Insulator Support. Thomas J. Creaghead, Covington, Ky. Application filed May 19, 1902.

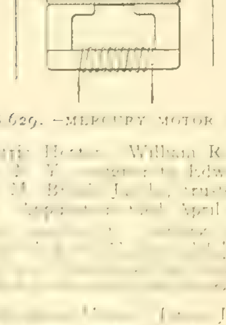
This metal insulator support comprises a stem provided with longitudinal strengthening ribs and a transverse web to which the ribs extend, a thimble of soft metal or other material molded about the web and portions of the ribs, whereby the thimble is secured against rotary movement and vertical displacement, and means for securing the stem to a cross-arm.

878,877. Electric Clock. Nathan Friedman, New York, N. Y. Application filed November 2, 1906.

In this clock there is an electric motor with a large armature shaft and a pinion mounted thereon, the shaft being larger in diameter than the pinion for preventing backward rotation of it by power applied to the pinion. A winding shaft has gearing connecting it to the pinion.

878,894. Signal System for Electric Railways. Charles F. Pike, Philadelphia, Pa., assignor to Charles F. Van Horn, Philadelphia, Pa. Application filed October 19, 1901.

Insulated contact portions separate the railway into blocks and are connected to adjacent track blocks through low resistances. Translating devices are adapted to work on the drop in potential around the resistances, and have partial circuit connections with the contact portions together with means for completing the circuits upon the passage of a car.



NO. 878,629.—MERCURY MOTOR METER.

[illegible] Electric Heater. William R. Whitehouse, Brooklyn, N. Y., assignor to Edward F. [illegible] [illegible] Jr., trustees, Philadelphia, Pa. Application filed April 22, 1907.

[illegible]

[illegible] April 26, 1906.

[illegible]

external source to the commutator and collector rings alternately. The stator winding is short-circuited upon itself on a definite line.

878,935. Magneto-electric Igniter Device for Explosive Engines. Otto Carlborg, Providence, R. I. Application filed March 11, 1907.

A continuously revolving driving disk has a number of evenly spaced divisions adapted to be operatively engaged by a crank in a successive manner and so arranged that the armature of the magneto generator will be vibrated quickly and intermittingly a short angular distance a corresponding number of times during each revolution of the disk, the armature remaining in stationary position immediately succeeding each vibratory movement.

878,949. Electric-wire Insulator. John H. Hanson, Chicago, Ill. Application filed January 12, 1907.

The body of this cross-over insulator has a central separating portion provided on opposite faces with overhanging heads, covering only diagonally opposite areas of the respective faces, the pair of heads protruding from one face being located at substantially right angles to the pair of heads of the other face. The heads of each face are separated along an intervening line by an entrance groove and along a line at an angle to such entrance groove, providing complementary portions of a wire receptacle.

878,952. Electrically Heated Soldering and Branding Iron. Harry Hertzberg and Maurice J. Wohl, New York, N. Y., assignors to Abbot Augustus Low, Horseshoe, N. Y. Application filed April 5, 1907.

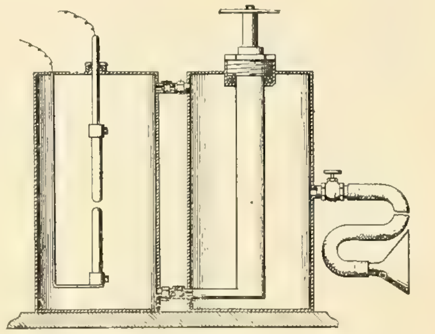
A chambered mass of metal has a number of electrical heating elements therein and a wedging means for clamping the individual heating elements into contact with opposite walls of the chamber.

878,961. Controller for Electric Motors. Pearl N. Jones, Pittsburg, Pa. Application filed August 12, 1907.

Two current regulating drums have their shafts geared together through an idler, so as to permit joint or independent operation of the drums.

878,963. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed February 3, 1906.

In telegraphing with true reversals the transmission line has a main battery and each station is equipped with a local battery, a transmitting key, a polarized receiving instrument and means to connect the line either directly or with the interposition of the local battery to the key.



NO. 878,710. ELECTRICAL VAPOR APPARATUS.

879,032. Automatic Brake-setting Mechanism. William P. Byrd, Baltimore, Md. Application filed August 1, 1907.

Electromagnets are arranged to release a latch and deliver a blow on the operating lever for the air valve and thus apply the brakes.

879,033. Insulator for Electric Wires. John Caldwell, Philadelphia, Pa. Application filed August 7, 1907.

The insulator has a groove at right angles to its length, the bottom of the groove forming the three faces of a triangle. A line wire is held against one of the straight faces of the bottom of the groove, and a tie wire engages the other two faces and is fastened about the line wire.

879,034. Trolley-pole Controller. John J. Coit, Venice, Cal. Application filed October 17, 1906.

The trolley base contains two air cylinders, with their pistons connected with a stem carrying a rack which engages a gear sector at the bottom of the pole. The valves are arranged to keep the elevating pressure on except when the wheel leaves the trolley, then the depressing action sets in.

879,035. Cable Terminal. Frank B. Cook, Chicago, Ill. Application filed May 28, 1906.

This cable terminal comprises a sheet metal distributing plate, sheet metal channel portions secured thereto in a vertical position, sheet metal rings mounted to the channel portions, and protective apparatus suitably mounted around the sheet metal rings.

879,039. Pressure-indicating Device and Alarm Signal. John H. Dixon, Pittsburg, Pa. Application filed April 7, 1906.

A pressure gauge and alarm signal has a bellows and a member controlled thereby with an indicator coacting therewith. An adjustable contact is extensible within the reach of the member and has a normally inactive electrical circuit connected between the contact and the member.

879,041. Massage Apparatus. Charles E. Egan, Petersburg, Ill., assignor to the Egan Electric Massage Vibrator Company. Application filed January 26, 1906.

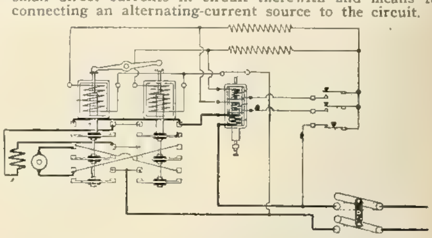
[illegible] the vibrating armature.

879,046. Electrically Heated Sadiron. Harry Hertzberg and Maurice J. Wohl, New York, N. Y. Application filed April 5, 1907.

A chambered metallic body has a bottom member, a number of electrically operating heating elements in the body, and means within the body for clamping the heating elements into close contact with the bottom member.

879,061. Rectifier for Alternating Currents. George W. Pierce, Cambridge, Mass., assignor to the Massachusetts Wireless Equipment Company, Boston, Mass. Application filed January 11, 1907.

A rectifier and measuring instrument consists of a mass of carborundum, calibrated measuring devices operated by small direct currents in circuit therewith and means for connecting an alternating-current source to the circuit.



NO. 878,855.—MOTOR-CONTROL SYSTEM.

879,062. Rectifier and Detector. George W. Pierce, Cambridge, Mass., assignor to the Massachusetts Wireless Equipment Company, Boston, Mass. Application filed April 5, 1907.

A rectifier for oscillatory currents and receiver for wireless telegraphy consist of a conductive oxide of titanium between two electrodes.

879,068. Insulator for High-tension Currents. Louis Steinberger, New York, N. Y. Application filed August 12, 1907.

This insulator comprises a body, a plate mounted thereon and provided with a tubular portion for receiving a conductor, and clamps fitted into the tubular portion and provided with apertures through which a conductor may be threaded.

879,073. Telephone and Station Apparatus. Nuchim L. Weingott, Warsaw, Russia. Application filed December 30, 1907.

The station contact apparatus consists of movable contact parts operable by the key and stationary contact parts, the last named being connected to the wires of the telephone system.

879,083. Electric Incandescent-lamp Luminant and the Process of Manufacturing It; 879,084, Manufacture of Filaments in Electric Incandescent Lamps, Process and Product; and 879,085, Filament in Electric Incandescent Lamps and Its Manufacture. Francis M. F. Cazin, Hoboken, N. J. Applications filed November 30, 1903, May 31, 1904, and June 2, 1904, respectively.

These filaments consist of a metallized carbon-fillet, the metallization consisting in an electrolytic deposit of different metals, of which those in contact primarily with the carbon are party inter-impregnated with the carbon, and those on the surface coated with oxide, all of which metals have a high point of fusion, the inner ones having more and the outer ones less affinity for oxygen.

879,117. Rectifier and Detector. George W. Pierce, Cambridge, Mass., assignor to the Massachusetts Wireless Equipment Company, Boston, Mass. Application filed April 5, 1907.

This is a modification of No. 879,062, in which crystalline telluride of silver is used.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 17, 1908:

446,417. Conduit Electric Railway. E. M. Bentley, New York, N. Y.
446,418. Electric-line Switch. E. M. Bentley, Boston, Mass.
446,419. Electric-railway Conduit. E. M. Bentley, Boston, Mass.
446,420. Contact Device for Electric Railways. E. M. Bentley, Boston, Mass.
446,424 and 446,425. Telegraphy. R. G. Brown, Brooklyn, N. Y.
446,428. Contact Trolley for Electric Railways. J. B. Cahoon and I. F. Baker, Lynn, Mass.
446,459. Electric Arc Lamp. J. A. Mosher, Abilene, Kan.
446,475. Electric Railway. N. Seibert, Malden, Mass.
446,483. Electric-railway Conductor. E. Thomson, Lynn, Mass.
446,480, 446,491, 446,492, 446,493 and 446,494. Electrical Measuring Instrument. E. Weston, Newark, N. J.
446,509. Electric Lock. E. J. Colby, Chicago, Ill.
446,515. Electromagnetic Cut-out. L. Gutmann, Pittsburg, Pa.
446,527. Secondary Battery. A. M. F. Laurent-Cely, Paris, France, and I. A. Timmis, London, England.
446,547. Pipe Wrench. W. E. Goodnow and H. R. Margason, Columbus, Ind.
446,613. Controlling Switch for Electric Railways. F. B. Rae, Detroit, Mich.
446,614. Telephone Call. D. H. Rice, Lowell, Mass.
446,623. Electric Switch. G. R. Lean, Boston, Mass.
446,655. Electric Conductor Connection. H. Arld, Nuremberg, Germany.
446,660. Carbon for Electric Lamps. W. H. Burns, Los Angeles, Cal.
446,661. Magneto-electric Machine. G. P. Clarke, New York, N. Y.
446,666. System of Electric Lighting. T. A. Edison, Menlo Park, N. J.
446,667. Locomotive for Electric Railway. T. A. Edison, Menlo Park, N. J.
446,668. Electric Arc Light. T. A. Edison, Menlo Park, N. J.
446,669. Manufacture of Filaments for Incandescent Electric Lamps. T. A. Edison, Menlo Park, N. J.
446,[illegible]. Electric Fire Engine. M. W. Dewey, Syracuse, N. Y.
446,[illegible]. Electric Call Bell. D. H. Rice, Lowell, Mass.
44[illegible]. Induction Coil. J. H. Brown, Chicago, Ill.
44[illegible]. System of Electric Call. J. B. Currier and D. H. Rice, Lowell, Mass.
446,8[illegible]. Electric Regulating Clock. D. Van De Plancke and G. Van De Plancke, Courtrai, Belgium.

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Recent Extensions and Improvements on the South Side Elevated Railroad.

During the last five years extensive improvements have been in progress on the South Side Elevated Railroad in Chicago which will be completed early this spring by the opening of the Stock Yards branch. The new work consisted, briefly, of the following: Extensions to Englewood and Normal Park, to Kenwood and to the Stock Yards; construction of a third track for express service; construction of additional yards for the storage of cars; addition of 150 new cars; and increased facilities for the generation and distribution of power. When fully completed the system will consist of 46.13 miles of single track, including yards and sidings, more than double the original mileage.

NEW BRANCHES.

Englewood. — The Englewood branch leaves the main line at Fifty-ninth Street and Prairie Avenue and runs west and south to Sixty-third Street and Loomis Boulevard. At Stewart Avenue a branch runs from this line to Sixty-ninth Street and Hamilton Park Boulevard.

The steel structure of this branch has been built according to the standard adopted for all the new construction work. The rights-of-way of three steam railroads are crossed by double track through truss spans with riveted connections. The track construction follows in general the standard adopted on all the elevated lines in the city, except that screw spikes have been used to secure the track rail.

All junctions and terminals have been equipped with interlocking plants to control the switches and signals. At Sixty-ninth Street is located a mechanical interlocking plant, all the rest being electro-pneumatic installations built by the Union Switch and Signal Company. With the completion of the Stock Yards branch, there will be in all a total of 11 electro-pneumatic interlocking plants in service and five mechanical plants.

Kenwood.—The Kenwood branch extends east from Fortieth Street and Indiana Avenue to Forty-second Street and Oakenwald Avenue. Just east of Prairie Avenue the two tracks leave the steel structure and pass on to the right-of-way of the Chicago Junction Railroad Company, which is elevated between concrete retaining walls from this point [illegible] A. S. C. E. standard, laid on six by eight-inch oak ties, spaced 22 inches center to center. The bal[illegible]tinuous rail joints were used.

The stations are interesting in that they are built beneath the tracks, both of the elevated railroad and of the third track used by the Chicago Junction Railroad for freight traffic. The interior of the station is finished with white plaster. A large skylight located over the center of the station between the tracks furnishes sufficient light to make these stations very light and attractive. The station platforms are built entirely of concrete, the canopy being supported by steel posts and framework. Exterior and interior views of one of these stations are shown herewith.

At Lake Avenue the tracks leave the Chicago Junction right-of-way and continue on a steel structure east and south to the terminal at Forty-second Street.

Stock Yards.—The Stock Yards branch is being rapidly pushed toward completion. At Indiana Avenue and Fortieth Street connection is made with the main line, and from that point a double-track steel structure runs west to Exchange and Centre avenues in the Yards, where it terminates in a single-track loop, one mile long, built on Exchange Avenue, Packers Avenue, Forty-fourth Street and Centre Avenue.

The structure is of the same general design as that in Englewood. From Wentworth Avenue west to Wallace Street the two elevated tracks are built directly over the Chicago Junction tracks, being supported on cross-girders that span the right-of-way of the railroad, the columns being located at [illegible] Wayne Railroad, while the elevated-railroad tracks [illegible]

[illegible]

The third track for express service extends along the main line from Forty-third Street to Twelfth Street. Northbound express trains now utilize the middle track from about 7 to 9:30 a. m., and southbound express trains from about 4:50 to 6:30 p. m. The trains attain a maximum speed of 35 miles per hour and make the run between Congress Street and Forty-third Street in about 10 minutes, which is at the average speed of 26.3 miles per hour. The construction of [illegible] work was very slow and expensive. It involved shifting all the [illegible] building[s] every station, moving the platforms, and at several places shifting the entire structure to suit local conditions.

It was decided to make the widened right-of-way an unobstructed public thoroughfare, which meant the removal of the old station buildings. To gain the requisite 14-foot headroom below the track for a station building it was necessary not only to introduce through girders but to raise the structure at each station an amount varying from 3½ to 5 feet. This is the cause of the summit in the track at each station from Thirty-ninth Street north to Eighteenth Street. More rapid acceleration and stopping of trains was not primarily considered in this connection. The structure was elevated the full length of the station platform to the full height of the raise, the grade of the approaches being 1¼ per cent.

ELECTRO-PNEUMATIC BLOCK SIGNALS.

To give protection to the large number of express trains running at a high rate of speed on the middle track, a system of electro-pneumatic block signals has been installed by the Union Switch and Signal Company. The blocks have a maximum length of 1,400 feet, with shorter blocks where the speed is reduced at curves and near terminals. These signals consist of dwarf signal-stands of the same design as those at the interlocking plants. The signal arm is held in a clear position, when the block is not occupied, by the action of compressed air, and when the air is released the arm

Typical Platform on the Kenwood Branch.

Interlocking Signal Tower at Junction of Englewood and Normal Park Lines.

New Storage Yards at Sixty-third Street, Showing Trolley Construction.

RECENT EXTENSIONS AND IMPROVEMENTS ON THE SOUTH SIDE ELEVATED RAILROAD IN CHICAGO.

moves to the horizontal or danger position by the action of a heavy coiled spring.

The signals are governed by track circuits. One track rail is insulated both from the structure and the opposite track rail, and it is divided into sections by insulated rail joints. The other track rail is a common ground for the return propulsion current and for the signal circuit. The insulated rail is connected to a six-cell storage battery through proper resistances, and through a relay to the signals governing the section. The difference in potential between the two rails is about five volts, and when a train passes an insulated joint and enters a block, it short-circuits the two rails, and the signal goes to danger. As long as any pair of wheels is in the block the signal remains at danger, and as soon as the rear end of the train passes the insulated joint at the end of the block, the relay picks up and the signal at the entrance to the block clears. The signals are so connected up that failure of either the storage-battery current, or the air pressure, will throw the signals to danger.

STORAGE YARDS.

Until the construction of the new extensions, the only storage yard for cars was at Sixty-first Street. This yard was a wooden structure and had trackage for only about 180 cars. It has been replaced by a yard of steel construction on concrete foundations. On the Englewood branch, a steel yard, five tracks wide, extending from Centre Avenue to Loomis Boulevard, has been built with a capacity for 100 cars. For the protection of cars from fire in the yards three fire cars have been built and equipped. In the Sixty-first Street yard a four-inch water main, with frequent standpipes, extends the length of the yard. This is connected to an electric fire pump, located in the shop, that may be started at a moment's notice and a pressure of 60 pounds per square inch afforded.

A steel yard with a capacity of 42 cars has been built at the end of the Kenwood branch at Forty-second Street. The yard for the Stock Yards branch, also of steel construction, will be located at Union Avenue, south of Fortieth Street, and will allow the storage of 60 cars.

To provide additional facilities for the storage of cars on the main line, a large tract of land south of Sixty-third Street, between Calumet and Prairie avenues, was purchased. On this track room for over 280 cars has been provided. All the tracks are laid on the surface, connection with the elevated structure being made by a concrete and steel incline across Sixty-third Street. The tracks for storing cars are all located east of the incline track. To avoid the expense of third-rail construction along the numerous switches, an overhead trolley is installed over part of the yard, as shown in the picture. Just south of Sixty-third Street a large area has been reserved for the con- [illegible]

The space west of the incline track is used for the storage of track material and coal. A connection has been made with the Lake Shore and Michigan Southern Railroad, over which all material and coal can be switched into the yard and then transferred to any point by an electric locomotive. Room is afforded for the storage of from 10,000 to 15,000 tons of coal. This coal is unloaded from the cars by a revolving locomotive crane operated by steam. It will operate a 10-ton load at 12-foot radius and a 3½-ton load at 30-foot radius. The clam-shell bucket has a capacity of 1½ yards and will handle one ton of coal at each operation. The tracks are so arranged that the crane can unload from the railroad car and either dump the coal on the ground or load it into the elevated railroad's coal cars. During the elevation of the Chicago Junction Railroad tracks at Fortieth Street all the coal for the power house was delivered in this manner for a period of several months.

REVOLVING ELECTRIC CRANE TRANSFERRING COAL FROM STEAM CARS TO THE ELEVATED CARS.

CARS.

The present equipment of the road consists of 400 passenger cars and 14 work and coal cars. Originally 180 trailer cars were hauled by steam locomotives, but in 1898 the road was electrified and 150 of the old trailer cars were converted into motor cars. These cars were equipped with two GE-57 motors, placed on one new motor truck, one of the old Baldwin trailer trucks being retained. The Sprague multiple-unit system of control was adopted, this being the first time that the multiple-unit system had received a practical test. From 1900 to 1903 70 additional cars were purchased, equipped with GE-73 motors of 75-horsepower capacity each and with the Sprague system of control.

In 1905 the last lot of 150 cars was ordered, and these have all been put in service. The electrical equipment consists of two Westinghouse-121 motors, rated at 90 horsepower at 550 volts. The control system is the Westinghouse multiple-unit system. The trucks were manufactured by the Baldwin Locomotive Works, one motor being installed on each truck of the car.

Although these two systems differ so radically in their method of operation, the new equipment has been so designed that the two classes of cars work together perfectly, and it makes no difference how many cars of any one system are in the same train with cars equipped with the other system.

POWER HOUSE.

All the power necessary for the operation of the road is generated at the power plant at Fortieth and State streets, being aided by two storage-battery installations, one at Fifteenth and State streets and the other at Sixty-first Street and Calumet Avenue. The power plant is located very nearly at the center of distribution of the road as a whole, being four miles from the Loop and five miles from the end of the Englewood branch.

In 1905, to obtain the room necessary to extend the plant, the Chicago City Railway car barn at Thirty-ninth and State streets, was purchased, and the elevated company now owns the entire block from Thirty-ninth to Fortieth streets between State Street and the elevated structure. Two new vertical 2,000-kilowatt generating units and eight additional 500-horsepower boilers were added. The total capacity of the power plant at present is 11,700 kilowatts rated capacity, or 17,550 kilowatts on a two-hour rating.

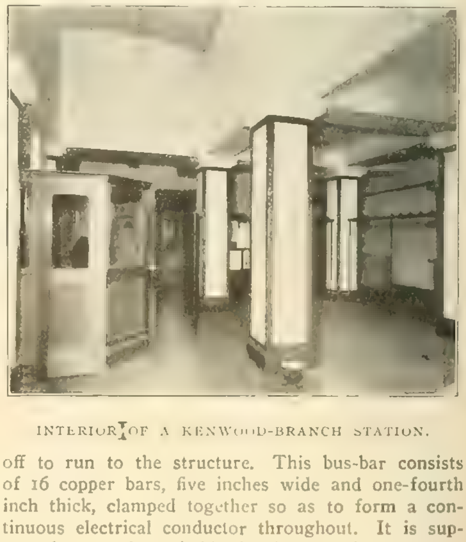
A detailed illustrated description of all the mechanical and electrical features of the entire plant may be found in the Western Electrician of December 1, 1906. There are a few features in connection with the switchboard and feeder installation and the manner of equalizing the generators that are of special interest:

The old switchboard was of the double-polarity type. On the switchboard were located the positive, negative and equalizer switches, thus necessitating that all these cables from each generator be brought to the switchboard as well as the feeders be taken away. When the extension of the power house was decided upon, the installation of the two new units made it necessary, with the old switchboard, to run 20 1,500,000-circular-mil cables to the board, besides the new feeders required to distribute their output. The distance from these generators to switchboard, and the changes necessary to install them, made it very expensive. After making a careful estimate of the cost to connect the new generators with the old switchboard and of installing a new switchboard of the single-polarity type, it was found that there was very little difference in cost, while the advantages were all in favor of single polarity; so it was decided to install the latter type. With the old arrangement the machines were equalized on the positive side; with the new or single-polarity type of switchboard, the generators are equalized on the negative side, only the positive leads being taken to the switchboard.

Only one polarity (positive) is found on the back of the new switchboard. The frame of the switchboard being insulated from ground, a man can work upon the back of the board with maximum safety.

The positive cables run from the switchboard through the cable gallery beneath to a duct line built along the north wall of the old building. This duct line consists of vitrified-clay conduit, laid in concrete, and runs through the east wall of the station building to a positive-cable house built directly under the west elevated track. The cables are lead-covered, with paper insulation from a point four feet below the switchboard floor. These lead-covered cables are attached to equalizing bus-bars in the cable house—one bar for each of the four sections of the road. To these bus-bars are attached 1,000,000-circular-mil, triple-braided, weatherproof cables, which run up and pass out through the sides of the cable house through bituminized-fiber conduit, and thence up to the cable box on the structure. There are no negative conductors in close proximity to the positive cables. Each cable is tested for any leakage of current once each day.

A negative bus-bar for the generators, composed of copper bars five inches wide and one-fourth inch thick, extends the full length of the power house, insulated and supported on the same racks as support the equalizing bus-bar for the generators. At a point near the division between the old and new buildings, the main negative bus-bar branches off to run to the structure. This bus-bar consists of 16 copper bars, five inches wide and one-fourth inch thick, clamped together so as to form a continuous electrical conductor throughout. It is supported on racks suitably insulated and passes out through the east wall of the basement in a tunnel to a negative cable house located 24 feet north of the positive cable house. This bar then rises up, passes through the east wall of the terminal house and thence up and extends along the under side of the track stringers. Seventeen 1,500,000-circular-mil cables are there attached to the bar by lugs clamped securely. These cables extend in both directions a distance of about 300 feet and are connected to the structure by a total of 136 4/0 compressed terminal bonds.



INTERIOR OF A KENWOOD-BRANCH STATION.

STORAGE BATTERIES.

A new building was constructed at Fifteenth and State streets, with concrete and steel floors and

roof, fireproof throughout. The old Twelfth Street battery was removed to the upper floor and enlarged by the addition of new plates to a capacity of 1,200 kilowatts and on the lower floor was installed a battery of 1,000-kilowatt capacity, in tanks of sufficient size to admit of increasing it to 2,000 kilowatts for one hour. These batteries, as well as the one at Sixty-first Street, were purchased from the Electric Storage Battery Company of Philadelphia.

The booster is a motor-driven, specially wound machine, built by the Western Electric Company. Its output is guaranteed to be 3,000 amperes continuously at 125 volts, with an overload capacity of 25 per cent. for one hour and 87½ per cent. momentarily. The batteries have a normal discharge rate for one hour of 4,000 amperes and a momentary capacity on swings of over 5,000 amperes. Each battery has 275 cells; the voltage of each cell is not to exceed 2.5 volts, nor to fall below 1.6 on discharge.

The operation of this battery is a great aid to the power station. It has a capacity sufficient to practically supply the peak load of the north end. In its operation it varies from a discharge of 5,500 amperes to a charge of 2,000 amperes, making the station load for the north end practically uniform.

The storage battery at Sixty-first Street is located on the ground floor of the south end of the car-repair shops. It was originally installed in 1898, and during the last year was rebuilt and is now practically a new battery. This battery is used in connection with a motor-driven booster, manufactured by the Western Electric Company. The booster has a guaranteed output continuously of 1,600 amperes at 70 volts, and a momentary load of 3,000 amperes at 60 to 110 volts.

Feeder System and Bonding.

The positive feeder cables are carried in a cable box between the tracks. The feeder system is divided at the power-house switchboard into four sections: First, the main line north of Thirty-ninth Street; second, the main line south of Thirty-ninth Street, including Englewood; third, the Kenwood line, and fourth, the Stock Yards line. The third rail is fed at each station through quick-break switches, in such a manner that the third-rail carrying capacity is utilized for the purpose of conducting the power. On the main line the third rail is 40 pounds per yard.

The feeders running north from the power house are eight in number, with a total carrying capacity of 9,000,000 circular mils, all of copper, partly bare and partly with weatherproof covering. By reason of the installation of the enlarged storage battery at Fifteenth Street, it was not necessary to increase the feeder capacity on the north end.

The feeders running south are nine in number, with a total carrying capacity of 11,500,000 circular mils. All of these are copper except two, which were installed the last year. These are aluminum, with triple-braided weatherproof covering, each with a carrying capacity equivalent to 1,500,000 circular mils in copper.

On the Englewood branch the feeder cables are entirely of aluminum. The joints in the cables are made by slipping aluminum sleeves over the two ends to be joined and compressing the sleeve with a hydraulic press of 25 tons capacity. This pressure is sufficient to make a perfect union between the metal of the cable and of the sleeve.

The steel structure is used in connection with the four running rails, as a conductor for the return current. Each track rail is connected to the structure every 400 feet by one 4/0 capacity compressed terminal bond. It is necessary to bond the steel structure at each expansion joint.

On the Kenwood branch the cables are run in a wooden box built on top of the south retaining wall. At the street crossings each cable is drawn through bituminized-fiber conduit that is attached to the girders by iron clamps. The cables are two in number, both of copper, 1,000,000-circular-mil capacity, one ending at Vincennes Avenue and the other extending to the yard at Forty-second Street. A heavy third rail, 80 pounds per yard of ordinary commercial steel, was installed to reduce the feeder capacity required as much as possible.

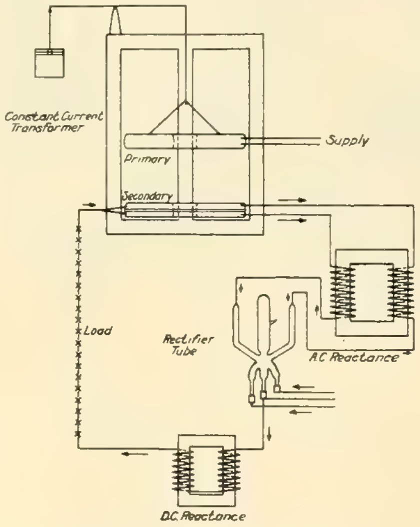
The manner of connecting the feeders to the third rail is as follows: At each station is located a switch box mounted on a concrete base, through which enter five conduits. The third rail is broken opposite each box on each track, and each end is connected to a bus-bar in the switch box through a quick-break 1,000-ampere switch. The bus-bar is connected to the feeder [illegible] and [illegible] In [illegible] fed [illegible] a feeder, and yet any section may be cut dead by opening one switch at each end.

At the crossover between Vincennes Avenue and Grand Boulevard there is an outrider in the third rail located between the Chicago Junction track and the elevated tracks. To lessen the danger to trainmen from the [illegible] has been installed, through which this outrider is fed.

The third rail is supported by a vitrified-clay third-rail insulator designed by Mr. Charles V. Weston. These insulators have been used on the road several years with excellent results.

The structure, track and stations were designed and constructed under the direction of Mr. C. V. Weston, then chief engineer of the company. The additions to the power house, feeder system and storage-battery installations were planned and constructed under the supervision of Sargent & Lundy, as consulting engineers.

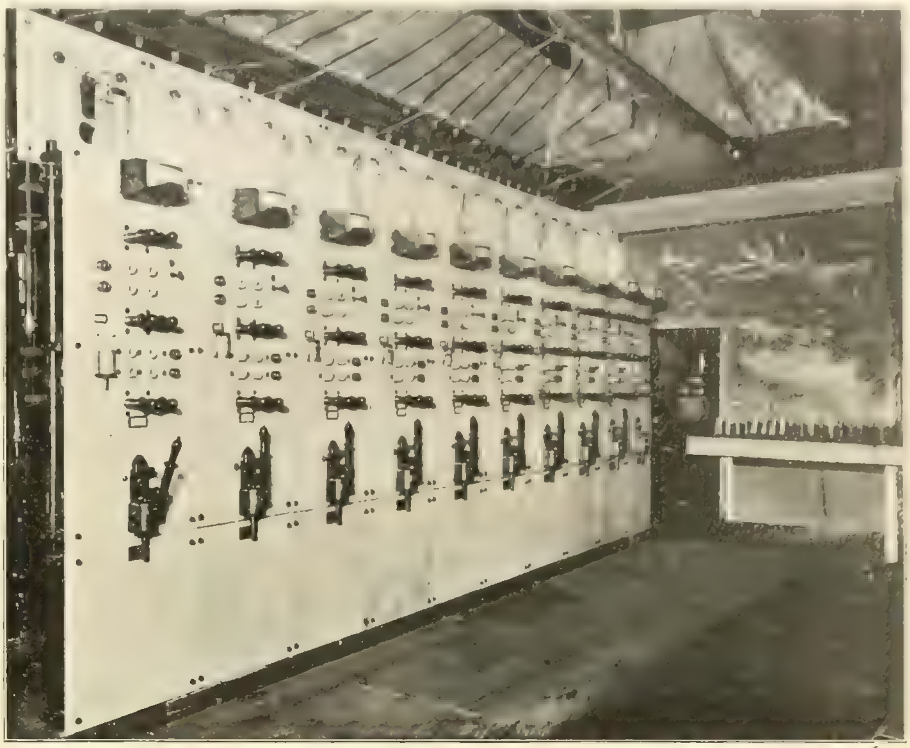
The foregoing facts in regard to the recent improvements on the South Side Elevated Railroad are abstracted from a paper read before the Chicago Section of the American Institute of Electrical Engineers on the evening of February 18th by Garrett T. Seely. Mr. Seely is engineer of maintenance of way of the elevated railroad company and has had much to do with the successful execution of these improvements.



CONNECTIONS OF MERCURY ARC RECTIFIERS AND ARC LAMPS IN PORTLAND.

Mercury Arc Rectifiers in the Portland Lighting Plant.

[illegible]



MERCURY ARC RECTIFIER SWITCHBOARD IN PORTLAND GENERAL ELECTRIC PLANT.

fier, indicating the arrangement of the constant-current transformer, the primary connecting with the current supply and the secondary with the load and rectifiers. This rectifier is constructed for transforming the single-phase, constant-potential alternating current into constant direct current for the operation of continuous-current series arc lamps.

As is well known, these simple devices replace the motor-generator set, usually consisting of a Brush arc dynamo driven by an alternating-current synchronous motor. At the Portland plant in Oregon the switchboard, equipped with series arc mercury rectifiers, controls 750 out of 1,200 four-ampere luminous arc lamps. It will be noted that each of the 10 panels is equipped with a rectifier tube at the top, an exciting transformer, an ammeter and transfer buses. All but the first tube are shown in operation and therefore do not show clearly on account of the bright light. There is an air duct communicating with the blower for cooling the rectifier tube, and an oil switch is provided on the primary side of the transformer.

The rectifier proper consists of an exhaust glass vessel or tube having five electrode branches and a large condensing chamber radiating from a common cathode chamber at the center. The three bottom branches contain mercury in contact with wires sealed into the ends of these branches, and wires terminating in graphite electrodes are sealed into ends of the two upper branches on either side of the condensing chamber.

As seen in the drawing of connections of the rectifier tube to the alternating-current source and direct-current load, the cathode is connected to the middle of the constant-current transformer secondary through a reactance and the load in series, while the working anodes are connected to the other terminals of the secondary through other reactances. By this arrangement the alternating current impressed upon the tube results in unidirectional current impulses through the tube to the direct-current load, the tube allowing current to pass through it in the positive direction only, the cathode, connected to the center of the secondary winding of the transformer (through the load), being always the negative terminal of the tube, and the two ends of the transformer secondary functioning alternately as the positive terminal of the tube in accordance with the alternating polarity of the secondary. The two lower electrodes on [illegible]

[illegible] cathode are starting anodes and are connected to the alternating current supply through a small low-potential exciting transformer, not shown. It may be stated that the set is started by shaking the tube slightly, causing the mercury in the lower electrodes to make and break contact and start an arc, which is maintained from the exciting transformer. The switch in the primary of the main transformer may then be closed, thereby applying high potential to the main anodes, and the rectification of current immediately commences.

It is said that these General Electric series rectifiers each has a capacity for 75 four-ampere luminous arc lamps. These lamps require between 75 and 80 volts each, the starting voltage, however, running up to nearly 90, and the lamps feeding at 110 volts.

It is maintained that the apparatus is designed to regulate from one-half load to full load, the current on short-circuit rising to between 50 to 60 per cent. above normal, which will not injure the outfit if not kept on for too long a period. It is asserted that the efficiency of the 75-light rectifiers is about 90 per cent at full load, whereas the efficiency of a motor-generator set of similar capacity at full load is approximately 80 per cent.

Central Power Station for Large Chocolate and Cocoa Mills.

The establishment of Walter Baker & Co. at Dorchester, Mass., a suburb of Boston, embraces a number of mills engaged in the manufacture of chocolate and cocoa products. They are located at the crossing of Washington Street and the Neponset River, about six miles from the center of Boston, and embrace plants on opposite corners of the street and the stream, known as the Baker mill, the Webb mill, the Pierce mill, and others. These mills are large plants in themselves, which have, until recently, been operated by independent steam plants. In each case the engines were pairs of horizontal simple condensing and non-condensing engines, supplied with steam by horizontal return tubular boilers, but it was some three years ago decided to have an economical central plant. For [illegible] power station has [illegible] all of the mills as [illegible] which a maximum of economy and reliability might be attained.

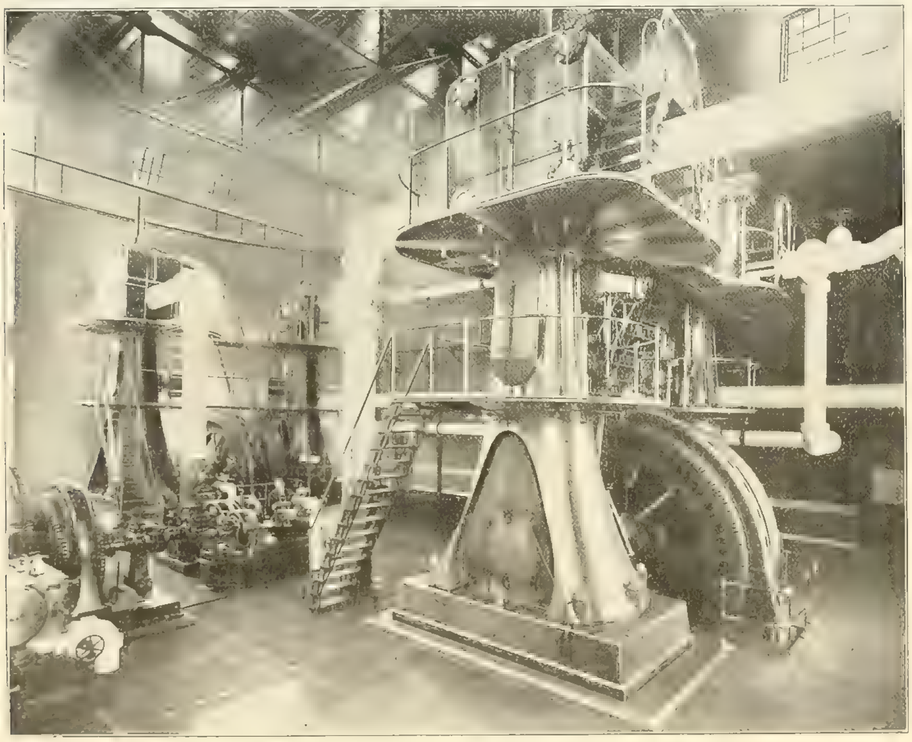
[illegible] located apart from the mills, situated on the north bank of the Neponset River, upstream from the mills, where the [illegible] machinery.

The plant is laid out on the cross-boiler-room principle, with a 60 by 80-foot main engine room and a 57 by 96-foot boiler house, extending at right angles from one end. It is constructed of brick on concrete foundations throughout, and has a wooden roof supported on steel trusses. The architectural treatment of the exterior is simple, yet productive of pleasing results, a feature of which is the liberal provision of windows for interior lighting. For the handling of machinery a 10-ton hand-operated traveling crane of 59-foot span covers the engine room.

The plant has been designed for an ultimate capacity of 2,800 horsepower in boilers, and 1,750 kilowatts in electrical generating machinery. The two large units, shown in the accompanying illustration, are vertical cross-compound engines, built by the Allis-Chalmers Company, which have 22 and 48-inch cylinders with 48-inch stroke. They are both direct-connected to 750-kilowatt alternating-current Allis-Chalmers generators, which are mounted alongside of the 15-foot flywheels on the engine shafts. The smaller generating units consist of simple horizontal 18 by 26-inch engines, direct-connected to Allis-Chalmers 125-kilowatt alternators.

There are, in addition to the above, two steam-turbine generator sets of 50 kilowatts capacity each, which, together with a motor-generator set of equal capacity, are utilized for excitation purposes.

The large engine units are supplied with steam by eight-inch connections from the boiler-room main, while the small horizontal units have five-inch connections, and the turbines three-inch connections from the basement steam main. The larger units exhaust to the condensing units in the basement and the small engines to the low-pressure main in the basement. A noteworthy feature of the engine installation is the use of reheaters for compound engines, which are supplied with heat by the hot gases passing from the boilers to the stack.



CENTRAL POWER STATION OF THE WALTER BAKER MILLS

The condensing equipment consists of two surface condensers, one serving for each of the compound-engine units, to which circulating water is supplied from the Neponset River by two electrically driven centrifugal pumps. The condensers have separate $5\frac{1}{4}$ by $4\frac{3}{4}$ by 5-inch duplex condensation pumps, located in a pit under the hot wells, which deliver to the feed-water heater in the pump room. Each condenser is operated with a dry-vacuum pump, which draws from the top of the condenser casing through four-inch lines and discharges through a common four-inch line ending in the circulation-water overflow outlets.

The generating machinery is now all in place, but, owing to the present requirements of the mill, [illegible] generating capacity has been installed. The latter consists of vertical fire-tube boilers in 200-horsepower units, for which space has been provided in the boiler room for two rows of seven on either side, facing a central firing floor. Of these, five are installed on each side at the end of the boiler room nearest the engine room. Special features of the steam plant are the use of the vertical fire-tube boilers, hot-gas reheaters for reheating the intermediate-stage steam from the compound engines, and flue-gas economizers. The main engine room, which is 60 by 80 feet in size, has a headroom under the roof trusses of 40 feet to provide for vertical engines and the traveling crane above, and a basement with 10 feet minimum headroom, accommodating condensing equipment and piping.

The boiler-feeding equipment consists of two duplex outside end-packed feed pumps, a Cochrane feed-water heater and purifier and a Sturtevant economizer, all of which have been installed of sufficient capacity to provide for the total projected boiler plant of 14 boilers. A feature of the water connections to the boilers is a cold-water main paralleling the ring feed main, from which a connection is made to each boiler for purposes of washing out and for filling up after washing, consisting of a two-inch branch with stop and check valves; it is supplied directly from the city water main.

The high-pressure steam-piping system consists of an eight-inch ring main in the boiler room, with four-inch supply connections from each boiler, and has delivery connections to the main engines in the engine room, to the auxiliary machinery in the basement and to high-pressure delivery lines to the mills. The exhaust piping of the plant is simple. For the large engines there are direct 22-inch connections from the low-pressure cylinders through the floor to independent surface condenser units in the baseemnt, in each of which connections there is an automatic relief valve, delivering to 12-inch lines to a common atmospheric riser and exhaust head above the boiler-room roof.

The Allis-Chalmers generators deliver three-phase, alternating current at a potential of 600 volts, at which voltage current is transmitted directly to the mills for power and lighting purposes. The power feeders and the machines are controlled from a blue Vermont marble switchboard 60 feet in length, which contains panels for the generators and feeders, and totalizing-instrument panels. All circuits to the different mills have recording meters for measurement of the power supply to each department separately.

The mills are operated entirely by induction motors, of which there are about 100 installed, ranging from 1 to 75 horsepower, and arranged for both individual and group driving. The lighting is done on the two-wire system at 110 volts, the voltage being reduced from the power feeder lines by transformers at each mill. The power feeders are carried to the mills through a steel bridge to the Baker mill, from which they pass over a bridge across the river to the Webb mill and through a subway some 200 feet in length under Washington Street, to the Pierce and other mills.

The power plant and the new power and lighting equipment of the various mills were designed and the construction superintended by Mr. F. W. Dean, mill engineer and architect, of Boston, Mass., formerly of the firm of Dean & Main.

The St. Louis Electrical Show.

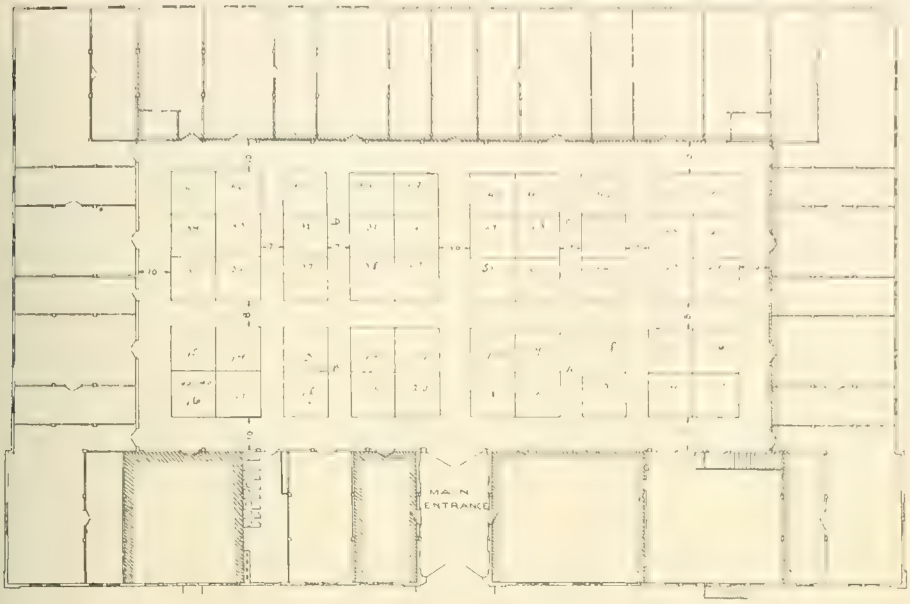
The Trades Exposition Company, 618 Mermod-Jaccard Building, St. Louis, Mo., announces that the greatest enthusiasm and good will is manifested by all interests of the great Southwest in the first annual electrical show to be given in this territory. The show will be held in the New First Regiment Armory, St. Louis, April 18th to 25th. Many buyers from Missouri, Kansas, Arkansas, Oklahoma and Texas will be present.

The designing architect, Mr. F. C. Bonsock, is preparing plans for elaborate decorations and illumination. The large armory affords ample and convenient exhibit facilities and the management has fixed the low figure of $1.50 a square foot for exhibit space, including the booth work and lighting. The accompanying diagram shows the floor plan.

A large number of prominent exhibitors have contracted for space, assuring an attractive show. The Union Electric Light and Power Company of St. Louis will make a comprehensive and beautiful display of all kinds of electrical devices and lights and the United Railways Company of St. Louis will join with the St. Louis Car Company in making an exceptionally attractive display. The Bell Telephone Company of Missouri will also make a complete display of its various departments and

demonstrate its operating method. Another prominent St. Louis company which will have a large exhibit is the Wagner Electric Manufacturing Company. The Meier Dental Manufacturing Company of St. Louis will have a large room fitted up and will demonstrate a number of electrical devices. Among others are Dr. Haverstick, the St. Louis Brass Company, Frank Adams Electric Company, C. F. Birtman, the Electric Sign Writer Company, and many other large exhibitors from out of St. Louis.

Herman J. Riffel, electrical engineer, of Cleve-



FLOOR PLAN OF FIRST REGIMENT ARMORY, ST. LOUIS.

land, has been engaged to conduct a series of interesting experiments and show electrical novelties. The famous Missouri First Regiment Band, with Charles Legman as director, will furnish music during the show. Miss Lucile D'Alberti will be the soloist.

Synchronizing and Equalizing of Alternators Operated in Parallel.

A rather simple method of ensuring the proper operation of alternators in parallel has been invented by Prof. Morgan Brooks and Milton K. Akers of the department of electrical engineering, University of Illinois. This method is of service in connection with the parallel operation of any kind and type of alternating-current machines. For the sake of simplicity of explanation the main features of the invention will be described here only as applied to single-phase generators.

The several objects aimed at in this method of connecting generators (which is covered by patent) are to obtain approximately and automatically any desired distribution of load currents among a number of coupled alternating-current machines, without the employment of centrifugal and other mechanisms; to provide for self-synchronizing such machines, both on coupling and during operation while coupled; to permit the transfer of surplus energy from a machine of high excitation to a machine of low excitation automatically, thereby improving the power factor of the system, and correspondingly increasing the capacity for the load current; to diminish hunting and racing; to eliminate difficulties from differences of wave form; to be able to include and exclude from the circuit one or more machines, and cause those in use to properly and automatically divide the load among themselves, and to operate successfully machines at different distant stations in parallel with proper division of the load currents automatically.

The essential feature of the system is the insertion of a current transformer in each phase of each machine, the secondaries of the several corresponding transformers being connected in series. These compel a proper division of the load. Reactance coils are also provided in each machine circuit for self-synchronizing purposes.

The diagram shows five alternators connected to the bus-bars (B) and (C) in parallel circuits. They may be of diefferent sizes, as indicated. (D^1), (D^2), (D^3), (D^4) are transformers, whose respective primary coils are (P^1), (P^2), (P^3), (P^4), the first of which is in series with a group composed of the generators (1) and (2), and the others of which are in series circuit with the re-

[illegible] ondary coils individually.

The transformers are designed to carry in their primary circuits currents in direct proportion to the full load current of each machine, or group of machines, as the case may be, and in their secondary circuits a single current alike in all transformers. When proportional currents are naturally [illegible] are non-inductive, since in their primary coils are the proportional currents for which they are designed, and the secondary coils, being all designed for the same current, are not only connected in a corresponding direction, but are in a closed circuit. Under these circumstances practically no electromotive force exists at the terminals of the transformers. Any change of the current from a single machine, as, for example, the generator (3), without a corresponding change in the other generators, is opposed by the reaction of the primary coil of its transformer (D^2). If, however, the current through this last-named primary coil does change, it causes, through the connected secondaries of the transformers, a corresponding change in the current from all the other generators, approximately restoring the proper proportion of load currents. Similarly, any change of excitation or of driving force in one generator thus affects all generators. The useful result is the securing of an average electromotive force and an equalization of power. The transformers are therefore so connected as to be approximately non-inductive so long as the desired division of load current exists, but automatically inductive when the proper division is disturbed, whereby a satisfactory approximation of balance of the load current is restored.

The non-inductive connection for balanced circuits is intended to apply specifically to the fundamental frequency of the current in any apparatus controlled, but will also apply to higher harmonic frequencies, provided these higher harmonics are similar in the several machines. Different higher harmonics, and harmonics in different phase relation to the fundamental, producing that difference in wave form which is often a source of trouble in operating, become opposed by the relatively high inductance of the transformers for such unbalanced harmonics, and are checked thereby.

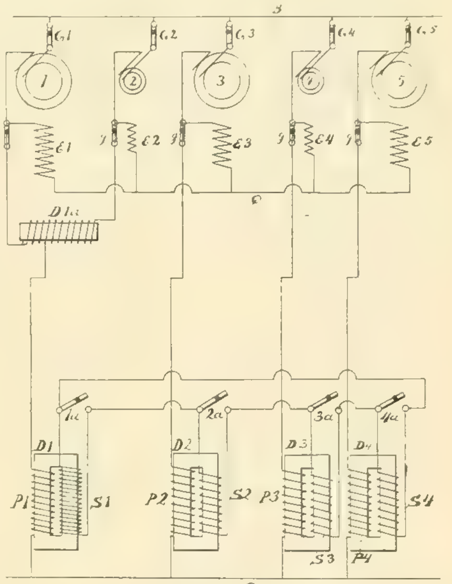
At (D^{1a}) is an auto-transformer, one portion of the coil of which is in series with generator (1), while the other portion is in series with generator (2). This auto-transformer is for action between the two generators (1) and (2), while the transformer (D^1) is for action between these two generators (1) and (2), considered as a group of generators, and the other generators individually.

By simply closing the short-circuiting switches (1^a), (2^a), (3^a) and (4^a) the alternating-current generators (3), (4), (5) and the group (1, 2) may be placed in the ordinary parallel circuit connection without securing any balance of the load. The primary coils are all thereby rendered completely non-inductive for any value of current whatever, and their circuits have merely the almost negligible resistance of the coils. The core

[illegible] is not necessary in practice. There is secured, how- [illegible] rigid requirements in large or small plants.

[illegible] scribed, the alternating-current generators are apt to fall out of step with one another, unless connected together rigidly. To maintain them in step while independently driven there are provided reactance coils (E^1), (E^2), (E^3), (E^4) and (E^5), preferably without iron cores, and connected in series with the respective machines between the extra or synchronizing bus-bar (Q) and line busbar (B). The reactance coils also serve to synchronize the generators during the process of coupling them in parallel. These coils should be so designed as never to allow excessive current to flow between the generators, even at opposition of phase, and yet to permit enough current to synchronize a generator to be connected, and to maintain it in synchronism. An impedance for these coils which will allow about half the full-load current to flow on applying the full generator voltage, has been found satisfactory.

In normal operation, the cross currents are confined to these self-synchronizing reactances, since the impedance of the balancing transformers is entirely too great to allow sufficient cross currents to flow for maintaining synchronism under ordinary conditions. The current required in these synchronzing coils may be determined by an ammeter. Under favorable conditions, the synchronizing currents in these coils may be reduced to a negligible quantity, insuring the highest efficiency.



SYNCHRONIZING AND EQUALIZING OF ALTERNATORS OPERATED IN PARALLEL.

They should not be cut out of circuit after the machines are coupled, for they not only synchronize on coupling, but during operation after coupling.

Growth of Lettuce Hastened by Electric Light.

From Minneapolis, Minn., comes a report of some interesting tests made by H. F. Hughart, a gardener of Minneapolis, who is said to have shown remarkable results from the effect of electric light on vegetation. Recently Mr. Hughart planted a bed of lettuce plants two inches high. At one end of the bed he placed an arc light which was turned on each day at sunset, one-half the bed being shielded from the light by a curtain.

A few days ago an investigation was made and it was found that in the dark bed the lettuce was 7½ inches high, while that under the electric light was 8¾ inches. The heads under the influence of the electric light weighed 40 per cent. more than those grown with only the sun's rays for light. Classes in botany at the Minnesota State University are interested in the experiment, and tests will be made with other plants.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

[illegible] New York [illegible]

[illegible]

[illegible]

[illegible]

Iowa Street and Interurban Railway Association (annual convention), Savery Hotel, Des Moines, Iowa, April 23d and 24th.

Missouri Electric Light, Gas and Street Railway Association, Marquette Hotel, St. Louis, April 23d, 24th and 25th.

National Electric Light Association (annual convention), Auditorium Hotel, Chicago, May 19th to 22d.

THE RECENT meeting of street railway officials of New England clearly foreshadowed a general movement on the part of such trolley lines in the New England states as find it impossible to make both ends meet with a five-cent fare, to raise the limit one cent for long hauls in sparsely settled communities. The advances already made have been appealed to the Railroad Commission, and the indications are that every instance of a raise in rates will be hotly contested, so firmly is the five-cent fare idea fixed in the customs of the people who travel on the electric roads.

WHEN THE Eiffel Tower was built as a Paris exposition attraction in 1889 the most far-flung imagination could not have conceived of its use in the transmission of wireless-telegraph messages over distances of hundreds, perhaps thousands, of miles. For a number of years there was talk of tearing down this famous monument. Art lovers denounced it as a blotch on the municipal landscape. Now, however, every effort will be made to render the tower permanent. It will be painted at regular intervals and reinforced whenever need be. This is due to the fact of its unrivaled advantages for supporting the aerials for radio-telegraphic transmission. About two years ago the French war minister obtained from the city of Paris authority to establish an experimental wireless station on the tower. Experiments have been carried on ever since, mostly by army engineers. For several months past Paris has been in constant communication with all frontier posts and also with ships in various parts of the Mediterranean, including those off the coast of Morocco. The tower receives daily dispatches from Casablanca, which, in the ordinary course of events, would have required two or three days for transmission, but which are now received instantly. The arrangements for the wireless station have been of a rather temporary character hitherto, but it is now proposed to place all sending and receiving instruments in an underground chamber a hundred yards or so from the foot of the tower. This chamber will be constructed about a little courtyard open above. From the middle of it will rise an aerial connected 50 yards above ground with the four antennæ running to the top of the tower. The Hertzian waves will be propagated from a special mast rising from the top of the tower a thousand feet from the ground. When these improvements are completed it is expected that messages will be transmitted for still greater distances, perhaps across the Atlantic.

THE partnership plan of street-railway operation as provided in the Chicago traction settlement ordinances may prove an excellent one, and its main features might well be taken into consideration in other cities where franchise negotiations are in progress, especially where the subjects of municipal ownership enters into the situation. The settlement ordinance has now been in force on the South Side lines in Chicago a little over a year and the first liquidation comes with the report of the City Railways Company covering 11 months of 1907, beginning February 1st. For this period the city's share of net earning, being the 55 per cent. provided by the ordinance, is $633,831.33. This substantial figure, together with the extensive improvements already effected and those planned, is satisfactory to citizens and city officials alike, and more than gratifying to the men responsible for the settlement plan. That the company is pleased with the results is evident from a statement in President Mitten's report, viz., "It is a source of gratification that as the provisions of the settlement ordinance, by which the city participates in the net earnings of the company, become more generally understood, the public, as well as the city authorities, are showing an increasing willingness to co-operate with the management in removing obstructions to rapid transit and in such of its other undertakings as have clearly for their purpose the improvement of the service."

The Chicago Railways Company, covering the North and West Sides, has only just accepted the ordinances, but if the South Side results may be taken as a basis it is reasonable to expect that the city will realize $1,500,000 as its first year's share of the earnings of both companies. It only remains now for the two companies to co-operate in the way of through routes and other improvements provided by the ordinance. So far the Board of Supervising Engineers has done excellent work.

THE increasing use of electrical means for the rapid transportation of the United States mails is shown by the statement that at the end of the last fiscal year there were 487 electric and cable routes in operation, with a length of 6,343.89 miles, and an annual travel of 11,302,554.95 miles. The annual rate of expenditure, exclusive of the item of $172,600 for the Chicago underground electric service, was $614,007.39. This is said to be an increase in the number of routes of 5.87 per cent., in length of 5.47 per cent., and in the annual travel of 1.69 per cent. The readjustments of compensation under the provisions of the law authorizing increases where the quantity of mail is large and the number of exchange points numerous, and upon routes where weighings have been ordered have proceeded, resulting in a net increase of compensation of $55,861.15. The clause in the post-office appropriation act providing for this service contains the provision that $172,600 of the sum appropriated be made available for the purpose of covering the cost of mail service by underground electric cars in the city of Chicago. This service was contracted for under authority of the act of March 3, 1905, and will expire June 30, 1908. It is suggested by the postmaster-general that in connection with the appropriation that authority be given to contract for this underground service for a term of four years.

THE REPORT of the United States Patent Office, abstracted in another column, shows that the year 1907 was the most bounteous year ever experienced by American inventors. The number of patents on inventions issued was more than 15 per cent. larger last year than in 1906, which had been the largest year till now. Commissioner Edward B. Moore calls attention to the fact that "the business of the Patent Office has always been very sensitive to any disruption or embarrassment in the commercial world, as has always been evidensed by a great falling off of the business of the Office. There is nothing in the past year to indicate, so far as the affairs of this Office are concerned, that any real depression in business or financial disquietude has existed." This is but another evidence of the temporary influence of the recent financial flurry and shows the solidity of our industrial conditions.

The increase of business in the Patent Office is in spite of the fact that the work is very much in arrears, as it has been for years. There has been much difficulty due to the comparatively low salaries offered for examiners. In the last five years over one-third of the force has resigned to accept better positions. One large electrical manufacturing company alone has in its patent department 12 or more men who were formerly examiners in the Patent Office. Eligible men that have passed civil-service examinations have not ben numerous enough to fill the vacancies. An increase in the force and increase in compensation to keep the men after they have become valuable are evidently needed to bring the work up to date. The Patent Office is supported by the fees of inventors and, with the exception of eight years since 1837, there has been an annual surplus of receipts over expenditures, which has accumulated to a total surplus of $6,706,181.64 the first of this year. Inventors have, therefore, a right to expect more expeditious treatment by the expenditure of some of this net balance for an enlarged and better force. In view of the size of this surplus, the recent curtailment of the Official Gazette to the publication of not more than five claims, as was announced in the Western Electrician of November 30, 1907, seems also unjustifiable. Even with the increased expenditures involved, a sufficient surplus would still remain to provide for an adequate new building for the Office, as has been repeatedly urged.

Public Service Dinner of the Institute.

The annual banquet of the American Institute of Electrical Engineers was held at the Waldorf-Astoria in New York city on February 19th. The banquet was called the "Public Service Dinner" and the topic of public service in its broad sense was discussed. Two of the speakers, Mr. Theodore P. Shonts and Dr. C. P. Steinmetz, were unable to be present, but the subject was very thoroughly covered by the other able speakers who responded to their toasts at considerable length.

President Henry G. Stott acted as toastmaster and the dinner was an elaborate and substantial one, served amid beautiful surroundings. The seating arrangement was in groups of eight persons to each table.

Having completed the social part of the programme, Mr. Stott called the company to order at 9:30 to take up the topic of the evening, "Public Service." Mr. Stott himself gave a pleasing and instructive talk on the subject of the evening as it relates to the Institute. He thought that possibly we have reached the extreme where the liberty of the individual is being changed to a state control of almost everything, and he considered it within the province of the Institute to have at least one meeting for the discussion of the public service question, and such a meeting may be arranged in the near future.

The first speaker was Walter G. Kerr, who responded to the toast, "The Ethics of Public Service." In the course of his excellent talk he said that there can be no doubt that the public service commissions have power to do much good. To be effective they must be supported. To be supported they must be right—the real thing. A public commission, like the public press, should not merely follow the throng and echo public sentiment through its mire and into its errors, but should be a strong factor in creating and correcting and guiding it aright. The firmness to tell people that what they ask is unreasonable or impossible is as necessary as to insist upon the public serving corporations giving the best service within their power. Such commissions must seek the truth, the whole truth and nothing but the truth, and then effectively command the public serving corporations to give the people what they pay for, all that they pay for, and nothing that they don't pay for.

"The ethics of this whole subject," said Mr. Kerr, "is merely to be right. Ethics is a thing you cannot get away from. We may talk about competition all that we please, but in the last analysis it will be found that the evils of competition are, as a rule, greater than their benefits. It will, however, be noted that competition, as a means of controlling the ethics of public service, is the argument largely used by the theorist, who is useful only when properly restrained; by the reformer, who is helpful when not taken too seriously; by the grafter, who is innocuous only when in jail; by the kicker, who is suggestive but ineffective, and by the ignoramus who is the really dangerous man. We have theoretical ethics and practical ethics. The theoretical relate to the exact measures of right and wrong; the practical relate to the possible and the impossible."

Theodore P. Shonts was next on the programme, having the toast "The Electric Railways and the Public," but he was unable to be present and Frank W. Stevens, chairman of the Second District Public Service Commission of New York, took up "State Control of the Public Service Corporations, Past and Present." Mr. Stevens went into an historical review of the control of corporations. Granting, he said, that the public service corporations should be controlled and regulated, in one particular or many, the question arises at once, Can it be done effectually by the Legislature? It cannot be done—everybody agrees to that—the Legislature is not organized to investigate individual questions. It meets for the purpose of passing general acts and must trust to some other power to enforce these acts, while the regulation of public-service corporations demands that someone should pay attention to the business every minute and investigate and remedy specific troubles wherever they may require correction. Everything relating to governmental matters should be supported on just principles; and what is the principle which justifies a commission, which justifies this public regulation? It is just the same principle which justifies every law which is passed by the Legislature, which is in any manner enacted for our guidance and control. Everything that an individual has, from his pocketbook to his life, is [illegible] deal and equal rights to all mankind under its supervision.

The toast "The Electric [illegible] Companies and the Public," was responded to by [illegible] P. Huntley of Buffalo. Mr. Huntley believes the people are fair, and when they understand the facts they do not willingly work harsh injustice. The danger lies in the lack of knowing the facts. Ignorant criticism, no matter how sincere it may be, is futile. The public, not knowing the full essential details, may have come to look askance at many public service companies. The companies in turn may have been more reticent and reluctant to discuss the details of their business in the face of suspicious or hostile, malicious criticism. Right here is where the Public Service Commission steps into the breach. On the one hand it can learn the details of the business of electric companies. It can get absolute facts. It can point out any conditions requiring remedy or improvement and require such to be made. It can ascertain for itself the cost of manufacturing the energy which the companies market in the business of electric distribution. It can see at first hand the items of plant, maintenance, distribution, operation, depreciation, obsolescence and taxation. It can invoke the aid of those who are well equipped technically in the art and reinforced by years of experience. All this it can do on the electric companies' part. On the other hand it can tell the people just what the facts are; it can dispel erroneous ideas in the public mind and correct mistaken notions in the popular viewpoint. It can work exact justice, protecting the people from any injustice on the part of the companies, and protecting the companies from any wrongful criticism, misguided clamor or gross injustice on the part of the people. With this knowledge at hand, gradually the manufacturer and the consumer—the electric company and the citizen—will come to mutually understand the full facts, and when that is done it is probable that most of the troubles that now harass any electric company will be at an end.

The next toast was "The Technical Press and the Public," responded to by T. Commerford Martin of New York city. "The technical journal," Mr. Martin said, "has but one aim, but one commission in life, and that is to cultivate the truth and to give the facts, and it serves the interests of both its public and the public by telling its public how to improve its service to the other public." He deplored the existence of the type of daily press known as the yellow press, and regards it as a great misfortune that the technical press cannot reach a larger proportion of the greater public in order to correct the injury that is thus done to the public-utility corporations, and more particularly to the technical staffs which serve them and which underlie their every operation. Discontent is fostered with our methods, our motives and our apparatus, and discontent is focused in every possible manner upon the accidental poor working of five minutes in the twenty-four hours and the utter disregard of the loyal, faithful, self-devoted sacrificing service of the electrical men during the other twenty-three hours and fifty-five minutes. A turning point has come, and, probably under the new regime with public-service commissions, we shall enjoy a better appreciation and a more cordial treatment; at least, the public has ceased to be alarmed.

As stated, Mr. Steinmetz was unable to be present and his toast, "The Engineer and the Public," was passed.

Before adjourning, Mr. Stott thanked the dinner committee for the very complete arrangements, and also thanked the Commonwealth Edison Company of Chicago, the Edison Electric Illuminating Company of Boston, the Edison Electric Illuminating Company of Brooklyn, the Philadelphia Electric Company, the New York Edison Company and Messrs. Sibley & Pitman, who were responsible for the decorations.

The Washington, Baltimore and Annapolis Electric Railway Company has opened its new 14-mile interurban line from Annapolis to Washington. The line from Academy Junction on to Baltimore will be completed within a few weeks.

Omaha Electrical Show.

It is planned [illegible] Omaha, Neb., April 13th to 18th, under the [illegible] Association. The show will be held in the Auditorium, [illegible] Space will be sold, including booth construction [illegible]

F. A. Nash, president of the Omaha Electric Light and Power Company, is president of the Trades Association; I. B. Zimman of the same company is contract agent for the show, and J. M. Gillan, Fifteenth and Howard streets, Omaha, is manager. There are 70 central stations in Nebraska, 190 in Iowa and quite a large number in the Dakotas, all convenient to Omaha. These, with a large popular patronage, should make the show a success.

New Electric Club in Chicago.

A new Chicago organization having as its object the advancement of the social and commercial interests of its members was organized recently at the Grand Pacific Hotel. It is to be known as the Electric Club and has been incorporated under the laws of the state of Illinois. Men engaged in any branch of the electrical industry or any of its more closely allied industries are eligible to membership. Many of the representative electrical men of Chicago are identified with the club, as indicated by the following list of officers:

President—C. A. S. Howlett of the Western Electric Company.

Vice-president—A. L. Millard of the Westinghouse Electric and Manufacturing Company

Secretary—S. M. McFedries of A. L. Schureman & Co.

Treasurer—W. P. Crockett of W. P. Crockett & Co.

Directors—P. R. Boole, Electric Appliance Company; J. G. Pomeroy, Adams Bagnall Company; F. Skeel, Crouse-Hinds Company; George Cutter, Cutter Company; F. P. Vose, attorney.

Weekly meetings will be held at 12:30 promptly on Wednesday of each week. At present the meetings are held in the German Room at the Grand Pacific Hotel. At these meetings speakers will be provided to give 15-minute talks on some topic of general interest to members

At the next meeting there will be a discussion of the question, "Which is the most important in the sale of goods: the salesman or the house?" P. R. Boole, salesman of the Electric Appliance Company, will take the side of "the house" while Francis Raymond of the Sheldon School of Salesmanship will take the side of "the salesman."

At near future meetings talks will be given by F. N. Jewett, F. P. Vose and G. P. Nichols. The entertainment committee will provide entertaining features occasionally.

There is at present no initiation fee and the yearly dues are nominal.

Meeting of the N. E. L. A. Executive Committee.

A meeting of the executive committee of the National Electric Light Association was held at the office of the association in New York city on February 20th, when details of the Chicago convention, to be held in the Auditorium Hotel, May 19th to 22d, were decided upon. The various committees presented their plans, which were approved, and they give assurance of an enthusiastic and well-attended convention. The following members of the committee were present: Dudley Farrand (president), W. C. L. Eglin (first vice-president), Messrs. Arthur Williams, Charles L. Edgar, Charles R. Huntley, Louis A. Ferguson, Frank M. Tait, A. J. DeCamp and W. W. Freeman (secretary).

Frank H. Gale and Walter Neumuller, chairman and secretary, respectively, of the exhibition committee, presented their plans, which were approved. The large hall in the Fine Arts Building, adjoining the Auditorium and on the same floor as the convention quarters, will be used for exhibits. This hall is to be systematically arranged and beautifully decorated according to plans prepared by D. H. Burnham & Co., and will be a feature of the convention.

The programme committee is now at work completing the programme. Entertainment features were left in the hands of the local committee. Much satisfaction was expressed by the executive committee regarding progress made in various ways since the last meeting, and a number of important

matters bearing upon the work of the association were discussed and will find expression at the Chicago convention.

For the annual banquet the new ballroom of the Annex will probably be used. Aside from the commodious convention quarters proper the sixth-floor banquet hall and other convenient rooms have been engaged for auxiliary meetings.

Applications for membership to the number of 30 Class A and 24 Class B were approved.

B. J. Arnold's Report on New York Subway Cars.

After exhaustive investigation of the congestion in the New York subways, Bion J. Arnold, consulting engineer for the Public Service Commission of the First District, New York, has made a report of seventy-one printed pages on "The Subway Car." He finds that the delays that most limit the capacity of the subway are due largely to the extensive use of the privilege of transfer from local to express trains and vice versa. This results in considerable crowding during rush hours at the express stations and necessitates average stops of 55 seconds for the express trains at these stations, which disarranges their schedule time. A curtailment of these transfer privileges would probably not be tolerated by the passengers, so an improvement of the exit and entrance facilities of the cars is required. The present cars have one door at each end on each side of the car.

The merits of five types of cars were considered: (1) Cars with a central side door and end doors; (2) cars with two quarter side doors; (3) cars with three doors near center; (4) cars with multi side doors, and (5) cars with double doors near ends. The adoption of side doors was not recommended because of the numerous curved platforms which leave a gap between their edge and the car sides; this would be a source of danger and cause delay in taking extra precautions to see that all are safe before the train starts. Mr. Arnold therefore recommended the use of the last type of car, which provides separate doors for entrance and exit and necessitates the least radical change from the present construction.

Chicago City Railway Report.

The annual report of the Chicago City Railway Company for the year 1907 shows increased earnings and a higher value of plant. A separate report is made for the 11 months of the year beginning February 1st. This covers the period of operation under the new franchise ordinances.

The income account showed that the gross receipts for the year 1907, January excluded, were $7,562,694.16. The total expenses were $6,410,272.66, leaving the net earnings for 11 months $1,152,421.50 on a property valuation fixed by the board of supervising engineers of $28,168,980.58. Of this income the city's 55 per cent share is $633,831.33, and the 45 per cent. share to the company, $518,589.67, or a percentage of income on the property valuation of 6.33.

Extensive improvements are shown in President Mitten's report, including the reconstruction of about 32 miles of track, the purchase of 300 new pay-as-you-enter cars and the construction of three modern new sub-stations. It is stated that about $6,000,000 will be expended in rehabilitation under the direction of the Board of Supervising Engineers this year. The city's share of the income and the general progress toward improved service under the new franchise are considered satisfactory by members of the Council. Now that the North and West Side companies, under the new Chicago Railways Company, have accepted the settlement ordinance, through routes and other improvements all over the city are possible.

Railroads Ask Delay in Nine-hour Demand.

It is said that many of the steam railroads have petitioned the Interstate Commerce Commission asking an extension of the time of the going into effect of the nine-hour law, which applies to railway employes who have the direction of the move- [illegible] closing of a large number of stations. One road says in the petition that in order to comply with [illegible] bers as will enable it to comply with the act.

Rubber-covered Wires and Cords for Electric Light and Power Circuits.

After extended conferences with the representatives of manufacturers of rubber-covered wires and cords and following notices sent all manufacturers utilizing the services of Wire Inspection Bureau, the Underwriters' Laboratories of Chicago gives notice that it has withdrawn from its affiliation with that Bureau. Mr. W. H. Merrill, manager of the Laboratories, gives notice that reports of Wire Inspection Bureau will not be accepted by the Laboratories after Saturday, February 29th. Stamps or labels issued by Wire Inspection Bureau and attached to rubber-covered wires, or cords, after that date, will not be endorsed and should not be recognized as having been affixed under the supervision of the Laboratories, representing insurance interests.

During the progress of negotiations resulting in the action reported, inspection departments, users and manufacturers have requested the inauguration of a system of testing, inspecting and labeling insulated wires and cords at factories which would receive the Laboratories' endorsement. The conduct of such a service, along the lines established by the Laboratories for a number of other industries, is under consideration.

Iowa Street and Interurban Railway Meeting.

The 1908 convention of the Iowa Street and Interurban Railway Association will be held in Des Moines on April 23d and 24th. An excellent programme has been prepared and the convention is to be a very interesting one.

Ample space will be provided free for those in the trade who desire to make exhibits. The association, in conjunction with the Iowa Electrical Association, has rented the ballroom of the hotel, which will provide ample accommodaion for exhibitors. Allotment of space will be secured through application to W. G. Owen, general superintendent of the Des Moines City Railway.

Entertainment features will be taken care of by officials of the Des Moines City Railway Company, the Interurban Railway Company and the Des Moines Edison Light Company.

It has been decided to drop one paper from the usual number on the programme in order to get more value from the discussion rather than crowd in too many numbers. There will be a paper on "Reinforced Concrete in Electric Railway Construction" by N. M. Starke of Des Moines, Iowa. Mr. Starke is a concrete specialist and has to his credit much notable construction in this line. "Depreciation" will be handled as a paper by L. D. Mathes of Dubuque. A paper will be read by Arthur W. Gross, general claim agent of the Omaha and Council Bluffs Street Railway Company, entitled "Claims—Methods of Handling Same by Electric Railways." "Advertising by Electric Railways" will be a general discussion. The subject is not assigned to an individual, but a number of members will be prepared to discuss the same. P. P. Crafts of Clinton, Iowa, will read a paper on "Handling Fares on Interurban Railways."

The officers of the association are: President, F. J. Hanlon, Mason City; vice-president, P. P. Crafts, Clinton; secretary and treasurer, L. D. Mathes, Dubuque.

To Provide Greater Safety on Interurbans.

A conference of about 100 officials, general managers, superintendents and train dispatchers of the interurban railways with the Indiana Railroad Commission in Indianapolis, February 18th to draft operating train rules with a view of bringing about greater safety in travel, resulted in the appointment of committees to carry out the work designed by the commission. President Hunt of the commission said that from reports made by the inspectors there seemed to be quite a variety of methods and systems in practice on the various electric roads and that there seems also to be a deplorable lack of uniformity, and in some cases no rules at all. President Hunt urged the traction men present to call to their assistance the best talent at their command so as to bring about the desired results.

Alexander Shame, chief inspector, pointed out briefly the observations made which, in his judgment, require correction in order to bring about safer operation. He suggested the adoption of a code to be used and enforced on all the lines of the state. Ninety per cent. of the accidents on the [illegible] lines are due entirely to carelessness, he said.

The discussion, led by ex-Governor Durbin, showed that the Indiana interurban men are ready to co-operate with the commission to bring out the desired results, since they more than any other class are interested in bringing about a safer method of operating interurban cars. Governor Durbin said that if the interurban men did not improve the service along that line the people would take the matter into their hands and drastic legislation might reasonably be expected. C. D. Emmons, general manager of the Ft. Wayne and Wabash Valley Traction Company, suggested the appointment of committees to take up the work of formulating rules to be adopted by the Indiana traction men and to be ratified by the commission, two inspectors to serve on the committees to assist the members thereof in the work before them.

President Hunt appointed the following committees: Rules for train men—C. D. Emmons, Ft. Wayne and Wabash Valley Traction Company; H. A. Nicholl, Indiana Union Traction Company; C. H. Lohman, C. C. Reynolds, F. M. Durbin. Committee on the maintenance-of-way rule—A. A. Anderson, Indianapolis and Louisville Traction Company; T. B. McMath, Terre Haute, Indianapolis and Eastern; W. J. Brennen, Ft. Wayne and Wabash Valley Traction Company; J. W. Moore, W. C. Sparks, Indiana Union Traction Company.

Annual Report of the Patent Office.

The annual report of the commissioner of patents for the year 1907 shows that there were filed in the United States Patent Office 57,679 applications for patents on inventions and there were issued a total of 36,469 patents including those on designs. This is the largest number ever issued in one year. In 1906, the next largest year, 32,806 patents were issued. Of this total 3,866 patents were granted to citizens of foreign countries, Germany leading with 1,182, England and Canada following next with 868 and 536, respectively. Of the patents granted to citizens of the United States New York leads with 5,231, and then come Pennsylvania and Illinois with 3,471 and 3,470. In proportion to population the most inventive citizens must be in the District of Columbia for one patent was issued to every 941 inhabitants, Connecticut coming next with one to every 987 inhabitants and South Carolina last with one to every 26,302. The total receipts of the Patent Office for the year were $1,910,618.14 and the expenditures $1,631,458.36, leaving a surplus of $279,159.78. The steadily accumulating balance to the credit of the Patent Fund amounted on January 1, 1908, to $6,706,181.64.

Mackay Companies' Report.

The annual report of the Mackay Companies for the year ended February 1st shows dividends received from sub-companies amounting to $3,830,390, compared with $3,310,327 the previous year. Investment in other companies amounts to nearly $93,000,000. The trustees say that the Mackay Companies still owns the whole or part of the capital stock of 102 prosperous cable, telegraph and telephone companies in the United States, Canada and Europe, including the entire capital stock of the Commercial Cable Company and the various companies constituting the land-line system known as the Postal telegraph.

The Mackay Companies has no debts. In 1907 a submarine cable was laid from New York city direct to Havana, Cuba, and is being operated in connection with the Commercial Cable Company, and is giving a one-minute service. The earnings from the operation of this cable are satisfactory. Its entire cost has been paid out of the current profits.

The recent completion of certain underground construction in England has enabled the Commercial Cable Company to dispense with aerial wires from Bristol to London. That company's submarine and underground cables between New York and London are now free from all the dangers of disturbance incident to overhead construction.

The chief improvement on the land-line system is the increasing of the wire facilities on one of the transcontinental routes to make the service to the Pacific Coast as efficient as that given by the Postal Telegraph Company in other parts of the country.

The Postal Telegraph-cable Company in October, 1907, organized the Postal Telegraph Employes' Association, to be open to all its employes who would abjure all unions; to be conducted without dues and without debts; and to entitle its members to aid from the company during sickness or disability. This association was enthusiastically received and joined by the employes. It is now thoroughly established and renders impossible another strike, and further, it strengthens the bond of loyalty and sympathy which always existed between the Postal Telegraph Company and its employes.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Practical Talk on the Securing of More Power Business.

The central-station manager is no longer confronted with the old difficulty of wondering at what conclusion the electrical engineers will arrive at next in regard to equipment. Generating plants have come to be, in a measure, standardized, and the existing means possessed or obtainable are sufficiently reliable and satisfactory to permit of turning attention to the important proposition, "How to get more business from your community."

The old idea of the central-station man was merely to take care of the demand for his current. The new idea is to hustle for business, getting all the business you can and insisting on your engineer taking care of the load. You have an opportunity to get nearly every user of power to spend a considerable amount per year for electric current.

The man who has gotten along for years with the old, dirty, cumbersome power units, for instance, does not realize how much more convenient, clean, efficient and economical electric power really is until he has it forcibly presented to him.

Until you get after him—advertise, solicit, argue—the little extra expense of new installation will look big enough to keep him from using your current for power purposes. He will not of his own accord exert himself in an effort which may result in his spending considerable money for your electrical energy.

Nearly everyone has the impression that electric power is expensive, so it is up to you to overcome that impression. And once you overcome this view, educate and encourage consumers in their instinctive desire for convenience, cleanliness, speed, safety and economy, and you will have no trouble to get them to use your power. If you set forth the advantages of the electric motor over the old methods in a plain, forceful way, anyone using power and of a conservative and economical disposition, would find it a very difficult matter to convince himself that he should not install electric motors.

The question is, "What methods are best adapted to convince power users of the advantages of motor equipment?" It might be well to have a personal talk with each prospective power user in town every week or 10 days, or two weeks, were it not for the probability that you would grow old before you made the rounds many times. Besides, you might grow boresome.

There is a much better way. By a systematic series of direct-by-mail advertising in the form of personal letters, newspaper ads, mailing cards, booklets, folders, etc., you could reach these people and lay before them such regular, sensible arguments as they must heed. Going before your people, say every other Monday morning, with a bright, attractive, common-sense argument for the user of power, you would be apt to strike your man sooner or later at just the time when he is in the mood to listen and when he feels like considering your proposition.

If, after receiving your advertising for a while, a few power users should happen in on you or send you a postal card saying that they would like to know how much it would cost to equip and run their factory or shop with electric power you could afford to spend a little time with them. You have them interested and it will not be a difficult matter to line them up.

As an aid to trying this method of increasing your power business, several follow-up letters are given below which have been used to advantage on prospective power users in other towns and cities:

Gentlemen: No matter how much or how little power you may require, experience has time and again demonstrated that the substitution of an electrical system of driving machinery will not only increase the output and furnish more convenient, safe and reliable power, but will permit of economies before undreamed of. Discerning power users in nearly every part of the country have rendered their verdict in favor of electric motor drive for all power purposes.

Would it interest you to get just what you pay for, to break away from the old, troublesome, dirty methods with their expense and annoyances and get a cheaper, handier and better power? Would you care to eliminate the noise, oil and dust occasioned by belting and shafting, and to enjoy more room, greater accessibility, increased light and [illegible]

[illegible] coal bills to meet.

[illegible]

Very truly yours,

Gentlemen: We would like to tell you about a power equipment that far exceeds all others in economy, steadiness, convenience and efficiency. First of all, we will stand back of every statement we make.

A motor electrically driven with our current is the power that can be depended upon—the most reliable. It practically never breaks down and repairs are infrequent and easy to make. It is always ready—daytime, nighttime, overtime, all the time. If your engine stops, your whole plant stops. If a direct-connected motor stops, only one machine stops.

A twist of the switch is all that's needed to start or stop an electric motor. There are no fires to feed, no gauges to watch, no engineer is required, little space is occupied; the electric motor is clean, speedy, precise and efficient.

We can produce an army of witnesses who will tell you as one man, "Equip your factory or shop with individual electric motors and enjoy the best and most economical of all working energies." If you are interested we would be pleased to go into details.

Very truly yours,

Gentlemen: You are done with worry—done entirely—when you have installed an electric motor on each of your machines. For you have eliminated entirely all those petty, aggravating annoyances so often met with in the old, expensive and unreliable single-engine power. Individual motor drive is the quintessence of power economy, and many who are using it now are actually saving in some cases one-half what they previously paid for power.

With individual motors you pay for just the amount of power you use—no more, no less. If only half your machines are running you pay for just half power. If you are operating five machines, you pay for the power for just those five machines—and no more. Can you say that of any other power?

Where motor equipment is found you find better and faster workmen and a cleaner place. There is also less noise and more light. Electric power is reliable, always ready, convenient, and is more economical as well as 100 per cent. better.

We want to place before you some facts and figures about power. Will you let us? If you do and should act on the suggestions we give you, believe us, you will think of us ever after with gratitude.

Very truly yours,

Business-getting Pointers on Electric Signs and Heating and Cooking Appliances.

Information of value to central-station men in their effort to increase their output is contained in the answers to questions directed to the Question Box of the National Electric Light Association. Below are given a few suggestions, printed in the February Bulletin, by men of wide experience in their respective lines.

Securing a Profitable Sign Business.

Edward Curry: Joliet is a city of about 35,000 inhabitants, and until April, 1907, we had no free-sign proposition. Since that time we have contracted for 30 signs, having 2,889 two-candlepower lamps, all burning on our patrol from dusk to midnight daily, and giving us a gross annual income of $4,649.64. I enclose a night picture of Chicago Street, showing 11 of the 30 signs. In the block just north of those shown in the picture there are two large electric signs that are owned by the consumer. These signs were burning only one night a week previous to our patrol system, but are now allowed to burn from dusk to 11 o'clock nightly.

In getting this business there were no unusual features used. We advertise in three daily papers devoting about half the space to sign talks. We took particular pains and plenty of time in hanging the large flat sign, which is No. 3 in the picture (that being our first one), thereby creating a lot of interest and a certain amount of jealousy among the other storekeepers, which worked to our advan- [illegible] that source.

[illegible] the insurance companies would not allow them to [illegible] and consume approximately 37,500 kilowatt-hours per year. From these signs we receive a revenue of $4,100 per year, about 20 per cent. of which is charged as a rental on the signs, the remainder being charged for the current consumed. We therefore receive about $125 per kilowatt connected per year, which is good business. We make two-year contracts only. The company owns all the signs, turns them on and off and keeps the lamps renewed. This we advertise as our "free-sign proposition." While the customer does not get the sign absolutely free, he is not put to any expense for the sign, its installation or its maintenance. He is required only to pay a stipulated sum per month. Our total expenditure for signs to date is as follows: Cost of 29 signs, $2,200; cost of installation, $650; cost of lamps, $320; making a total of $3,170.

R. S. Hale: The best way to get sign lighting is to go after it. We have a special man who pushes for sign business, and in addition all the agents promote it. We charge exactly the same rate that we charge for equally long-hour use of other installations. We find it pays to inspect the signs frequently and see that the lamps are kept up, but give no other service, the customer buying and repairing his own sign. Undoubtedly more business can be obtained by giving free signs, but the supply and maintenance of the signs involve a very considerable expense in proportion to the price of current, and are therefore equivalent to a cut in price; and, in our opinion, cuts in price should be made, so far as possible, in the price of electricity itself, and should not be disguised by giving free signs, which is equivalent to making a special rate for signs. Of course, a company that is attempting to do business without long-hour discounts or their equivalent may have to do all sorts of special things to get a satisfactory result, which would be avoided by a proper rate system.

D. Thomson: Offer your customers signs on 12 monthly payments. You can make arrangements with the manufacturers (or some of them) on this basis.

Placing Heating and Cooking Apparatus.

R. S. Hale: We maintain an exhibition room where all current-using apparatus is kept on exhibition and shown in operation. Our agents sell cooking and heating apparatus to customers. We have given free trials of flatirons to a large extent with considerable success. We give free trials of other apparatus to a very small extent. Our policy is that when we can give a short free trial without making the apparatus into second-hand apparatus we shall be quite liberal with free trials, but not otherwise.

ELECTRIC SIGNS IN JOLIET, ILL.

E. R. Davenport: Flatirons are placed on 15 days' trial, except from November 1st to March 1st. From previous experience we have found that the majority of irons placed on trial during winter months were returned. Water heaters and other appliances that are not made secondhand by a few days' use are placed on a week's trial where there are good prospects of a sale, with satisfactory results.

Automatic Scales in Boiler Houses.

Of the many new devices which have come to the front in recent years in connection with boiler-house plant, one of the most useful is the automatic scale. There is scarcely any industrial undertaking which demands such close attention to economical working as a power station. The initial capital outlay compared with the annual receipts is proportionately much higher than with most manufacturing plants, and the charges on account of interest and depreciation are so large in consequence that it is essential to keep a very careful watch on running expenses if the plant is to be successfully operated.

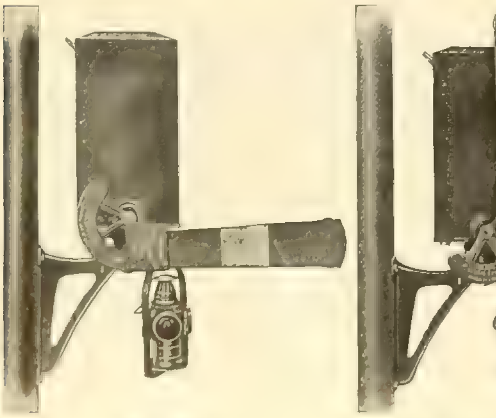
The object of the automatic coal scale is to keep a constant check on the efficiency of the boilers and at the same time to prevent any waste of coal. It is installed immediately beneath the coal bunkers and weighs all the coal as it is delivered to the stokers. A complete record is at the same time preserved showing the exact amounts weighed. This brings about very considerable economies in the operation of the plant. All is done without any additional running expense, as the scale is entirely automatic in its action, requires no supervision, and so long as it is kept reasonably clean works with the utmost accuracy and regularity.

The scale is built on the principle of the equal arm beam, its action being identical with that of the familiar counter scale, or any other kind of weighing machine operated on the even-balance principle. The special feature of the machine, however, is that it is so arranged as to automatically cut off the supply for a few seconds as soon as a balance is reached, discharge the contents and start a fresh weighing without any external assistance. It keeps an unfailing record of every weighing on a specially constructed register.

This type of machine was first manufactured by W. & T. Avery, Ltd., well-known English scale makers. Full selling rights for automatic scales were obtained from them some time ago by the Avery Scale Company of North Milwaukee, Wis., who have established an up-to-date plant at North Milwaukee, admirably fitted up in every way for the construction of this class of machinery. This company also manufactures many other types of automatic weighing machinery of considerable interest to everyone who has much weighing to do. One of these is an automatic track scale which will weigh truck loads, indicate the net weight of the load on a dial, print the weight on a ticket, keep the total of the net weights of all loads passed over the scale and also count the number of trucks.

New Signal for Single-phase and Steam Roads.

In order to meet the requirements of single-phase electric railways and steam railroads the Blake Signal and Manufacturing Company has developed the type of signal shown herewith. These signals are similar in every detail to the well-known Blake dispatcher's signals for telephone train dispatching, now in use on many 500-volt interurban electric roads, excepting the signal light for use after dark. On 500-volt trolley lines the most effective as well as simplest and cheapest method of getting the light for night use was to connect the 500-volt trolley or feeder to an incandescent-lamp circuit through a certain amount of resistance, the circuit being



[illegible] Clear Position.

NEW SIGNAL FOR SINGLE-PHASE AND STEAM ROADS.

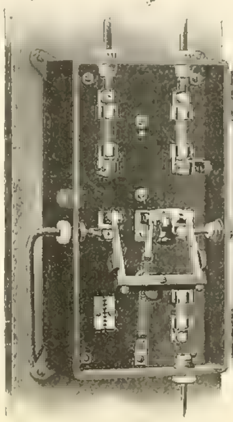
closed by a substantial knifeblade switch when the semaphore was set in the horizontal position. With single-phase lines or steam railroads this comparatively low-voltage electric current was not available at the line signal and it became necessary to [illegible] for getting the necessary [illegible]

[illegible] by [illegible] substantial [illegible] through the [illegible] of this shaft is so connected with the semaphore shaft that when the semaphore drops to the horizontal position the lamp shaft and lamp are given a quarter turn, so that where the lamp shows a white or green light up and down the track when the semaphore is in the vertical or "clear" position it will show a red light up and down the track when the semaphore is set to the horizontal or "stop" position. The weight of the hanger and lamp is supported on a spiral so that not only does the weight of the lamp assist rather than retard the dropping of the semaphore to the horizontal position, but should the rod or pin connecting the lamp shaft with the semaphore shaft be broken the lamp would of its own weight make a quarter turn and show a red light. This is on the side of safety and makes it impossible for the lamp to show anything but red when the semaphore is set at danger.

As with all switch lamps, whether fork or socket type, it is impossible for a lamp to be put up showing the wrong light, that is, a light at variance with the position of the semaphore. All of the working parts of this lamp hanger are under the signal cover, where they are thoroughly protected against the weather. It is this type of signal which has been furnished for the Annapolis branch of the Washington, Baltimore and Annapolis Railroad.

High-potential Automatic Cut-out.

The Electrical Manufacturing Company of Oshkosh, Wis., which was incorporated several months ago, is now equipping its plant with machinery to manufacture the M. & R. high-potential automatic cut-out. This device is used for the purpose of preventing any foreign current of higher voltage



HIGH-POTENTIAL AUTOMATIC CUT-OUT.

than that intended from entering the building in which it is installed. The cut-out may be operated independently of the automatic device, and, being equipped with fuses, it takes the place of a service entrance switch and cut-out, protecting the building from excessive current or voltage.

The automatic device operates entirely upon excessive voltage, and after operating it will not remain closed until the trouble which tripped it has been removed. The accompanying illustration shows the cut-out in the tripped position. It is said to be the only device of its kind on the market using absolutely no current. The interest shown in the exhibit of this cut-out during the recent Chicago show is being followed by numerous inquiries from electrical men.

Large Machines Built at West Allis.

Several months ago steps were taken to stock and equip two of the great machine-shop units at the West Allis Works of Allis-Chalmers Company, known as shops 5 and 6, for the building of large electrical machines, particularly those intended for direct connection to the various forms of prime movers which constitute a large part of the product of this company.

Heretofore the large electric generators for driving by gas engine, steam turbine, waterwheel or Corliss engine have been built exclusively at the company's works in Cincinnati, Ohio. The construction of a part of these large machines in Milwaukee gives much-needed room for the manufacture of motors, transformers and small generators at Cincinnati, and does away with the former necessity of shipping heavy engine shafts to the electrical works to be fitted and keyed to the rotors of engine-type generators. On the other hand, the West Allis Works are better equipped, through large experience in the building of big equipments, to handle the heavy parts.

To indicate the type of work which has already been turned out at West Allis, shipment was recently made of two 2,000-kilowatt, 6,600-volt, 25-cycle, three-phase alternators which were sent to the Homestead Works of the Carnegie Steel Company. These alternators are for direct connection to 42 by 54-inch Allis-Chalmers twin tandem gas engines, also products of the West Allis Works.

A third alternator was recently shipped to the central furnaces of the American Steel and Wire Company. This machine was a 1,000-kilowatt three-phase unit designed for direct connection to a gas engine. These three generators were the first to be completed and shipped from the new shops, and others, including a 6,500-kilowatt unit, will follow in rapid succession during the next few weeks.

Single-phase and Polyphase Motors Compared.

Under the rather alarming title, "A Phase of the Panic," the Wagner Electric Manufacturing Company of St. Louis sends out an interesting pamphlet to argue that now is the time for the central-station man to consider more carefully than ever before the single-phase motor as his "hard-times" friend. The central-station man is said to be investing money needlessly if he runs three wires and uses two transformers to supply a motor customer whom he can handle with two wires and one transformer. "The cost of the motor doesn't hold off a customer when you have convinced him that his monthly power bill will be within his purse." Moreover, the "Wagner single-phase motor takes less current from one phase of a polyphase circuit in starting than a polyphase motor from each of the three phases." Interesting curves, said to be based on actual performance, are given to substantiate this statement. The Wagner company says that it believes in polyphase distribution in big units, in large isolated plants and in many special applications. The "line of demarcation between the two types is clear and logical," and this apportionment is made:

Single-phase—All central-station power in small and moderate sizes. All small power in isolated plants.

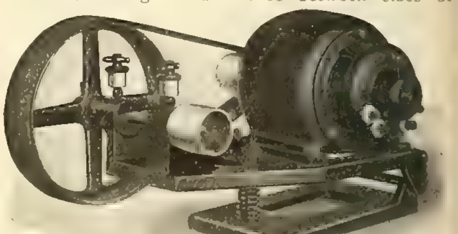
Polyphase—All large central-station power. All concentrated large isolated installations (with the small motors single-phase). Large cranes, hoists, etc.

Countershaft Belt Tightener.

An ingenious and simple device for tightening the driving belt of an electric motor has just been perfected by the Crocker-Wheeler Company and is shown by the accompanying illustration. It consists of a countershaft and a simple and effectual belt tightener. Though designed for the peculiar requirements of linotype machines, it can be used to advantage with any machinery requiring slow-speed drive.

The device consists of a cast-iron base on which are mounted the motor and countershaft. The base is pivoted at one end to a sub-base, and belt tension is produced by means of an adjustable nut at the other end. A spring is provided to support the movable base in case of breaking of the belt. The belt between motor and countershaft is tightened in the usual way, by shifting the motor on the movable base with the aid of an adjusting screw.

It will be readily seen that this device is much more effective than a simple idler. Not only does it keep tension on the belt, but by the use of the countershaft a great difference between sizes of



COUNTERSHAFT BELT TIGHTENER.

driving and driven pulleys is avoided, and the belt therefore makes contact with a greater arc of the driving pulley, with consequent absence of slip.

The motor is of the well-known Crocker-Wheeler L type, made in sizes from one-twentieth to five horsepower. Of neat appearance and compact design, it is specially suited for application to small tools, printing presses, pumps, and all kinds of light machinery. By means of simple covers for the openings in the frame, the motor is easily rendered dust and moisture-proof, in cases where an open type of motor would be out of the question.

The Postal Telegraph-cable Company has leased two wires of the New Long-distance Telephone Company of Indianapolis, between Indianapolis and Muncie and Indianapolis and Logansport, and will open offices in the various cities touched, and conduct a telegraph service over the telephone company's wires. This territory has thus far been served only by the Western Union Telegraph Company.

Multiple Luminous Arc Lamp.

The luminous metallic arc is now recognized as one of the most efficient and best all around street illuminants in commercial use. This system of street lighting, having passed the experimental stage, is now in quite general use. For low voltage di-

FIG. 1. GENERAL FORM OF MULTIPLE LUMINOUS ARC LAMP.

rect-current multiple circuits, however, there has been but little use made of the luminous arc lamp.

The General Electric Company has now on the market a luminous arc lamp for operation in multiple on direct-current circuits of from 100 to 125

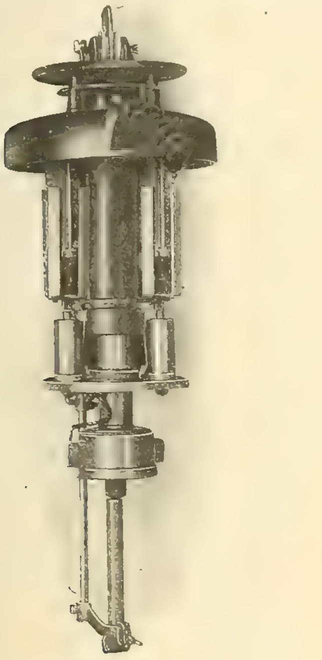


FIG. 2. VIEW OF MECHANICAL CONSTRUCTION OF MULTIPLE LUMINOUS ARC LAMP.

volts. The general form of this lamp can be seen by referring to Fig. 1. The casing is of solid copper with a black oxidized finish and of sufficient thickness to form a durable housing for the lamp mechanism, as well as a substantial support for the outer globe and its supporting ring.

Fig. 2 is an interior view showing the mechan-

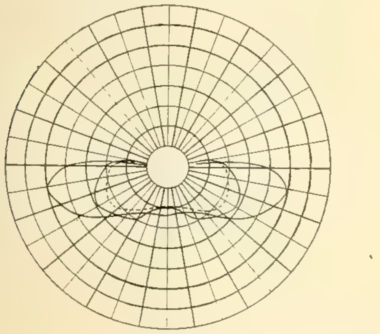


FIG. 3. COMPARISON OF PHOTOMETRIC MEASUREMENTS.

ical construction of the lamp. The main frame consists of a 1½-inch iron pipe connecting the top and bottom casings. This method gives a rigid construction and at the same time provides a suitable center draft or chimney for disposal of the arc fumes. At the top this chimney is protected [illegible]

The upper or positive electrode consists of a [illegible] copper. With [illegible] possible to keep the electrode at a low temperature. This [illegible] together with the peculiar character of the luminous arc results in [illegible] away of the copper. The copper electrode in a four-ampere lamp, it is said, will require renewal after about 1,800 hours' operation, or with an average burning of five hours per day will last about one year.

The lower electrode, which is responsible for the flaming characteristic of this lamp, is an iron tube about three-fourths of an inch in diameter filled with a prepared composition. One electrode only is used at each trimming, with a life of about 150 hours.

There are two single magnets, with two armatures mechanically connected. The action is positive and at the same time remarkably sensitive, responding quickly to any variations of the line or arc, and thus maintaining a close regulation of the current.

Fig. 3 shows a comparison of photometric measurements of a five-ampere direct-current enclosed arc, a 7.5-ampere alternating-current enclosed arc and a four-ampere magnetite arc. Even with the decreased wattage, the increased candlepower, as shown by the outer curve, is noticeable. The characteristic distribution of the luminous arc, with its maximum intensity near the horizontal, is well known. This natural distribution can be changed to meet other street-lighting requirements by the use of correctly designed concentric wave reflectors.

In general the lamp needs little attention, less, it is said, than the enclosed lamp, as there are no enclosing globes and gas caps to require careful handling, cleaning and renewing. The luminous arc lamp is specially recommended for the lighting of foundries, machine shops, train sheds, freight houses, drill halls and riding academies.

Convenient Electrically Heated Glue Pots.

A line of improved electrically heated glue pots that represents the application of electricity in the simplest and most convenient form is being put on the market by the Westinghouse Electric and Manufacturing Company. The pots are made in two-quart and four-quart sizes, in both portable and bench types. They are made of the best materials for the purpose, and the application of electricity is as simple as it is efficient. There is nothing to get out of order or to require any more attention than is given the ordinary glue pot. They are especially desirable for use in those crafts where cleanliness is an important factor, where drip from steam pipes means damage to valuable materials, and where the fire risk from a gas-heated glue pot is hazardous. At the same time their convenience and reliability recommend them to all users of glue.

The pots themselves are of seamless drawn copper with brass bail and wiper rod. The water bath is made of seamless copper, and the heating element, which is wrapped around the lower portion, is enclosed in a water-tight tin envelope. The water bath is provided with a patent circulating device, which gives it the maximum heating efficiency. This device consists of a hollow ring, the lower end of which is closed by a diaphragm having a central opening. This confines the heat-

FIG. 1. ELECTRICALLY HEATED GLUE POT AND WATER-CIRCULATING DEVICE.

ing action to the thin film of water outside of the device, and sets up a rapid circulation in the water, which brings the glue up to the working temperature in a short time.

To further promote economical heating, the pots are provided with heat-regulating switches by means of which the glue can be rapidly brought to the desired temperature and then maintained there by a lower amount of current.

Fig. 1 of the accompanying illustrations shows the parts of the four-quart portable pot, including the water-circulating device. Fig. 2 shows the bench pot with the cover in place, giving an unobstructed working surface on the bench. The glue pot and water bath are hung underneath, so as to [illegible] undesirable.

Varnished Cloth in the Electrical Industry.

At the recent meeting of the Pittsburg Section of the American Institute of Electrical Engineers in the Carnegie Institute Lecture Hall several original papers were read and discussed, a short summary of which is given.

Henry W. Fisher of the Standard Underground Cable Company, read a paper on "Varnished-cloth Insulated Cables," which was very interesting and instructive. Most of the processes of manufacture are still secret, but Mr. Fisher gave some good data. The samples of cloth are made in thicknesses varying from 5 to 16 mils. The specific gravity of varnished cloth is very close to 1, and while the electrical properties of different makes vary widely, some average tests made on samples a circular foot in area showed as follows: Insulation resistance, from a few megohms to 955 megohms; alternating electrostatic capacity, from 0.11 to 0.26 microfarad; breakdown electromotive force, from 120 volts to 860 volts. One sample when tested with 20,000 volts for two hours became very hot, while a similar sample of another kind was perfectly cool after a similar test. Mr. Fisher exhibited a number of samples of varnished-cloth cables, some lead-covered and others covered with an asbestos braid for switchboard work.

A. B. Reynders of the Westinghouse Electric and Manufacturing Company explained the great variety of uses varnished cloth is put to in modern electrical machinery. As an insulation for curved surfaces it stands alone. He also explained the different processes of its manufacture, and said that when finished it would stand a voltage of from 800 to 1,200 volts per mil of thickness. The methods of inspection and testing are important to see that the cloth will stand bending and creasing without breaking down. The testing surfaces should be flat disks. The cloth should stand baking at high temperatures for a number of hours without being injured. A temperature of 300° F. or over will injure the mechanical strength of the cloth.

G. A. Jacobs of the Sherwin-Williams Company expounded the technical requirements of varnish in varnished cloth. He called attention to the fact that it was impossible to have a quick-drying varnish that will remain permanently elastic. A varnish should never lose its life and elasticity when used at temperatures below 180° F. He said that most oxidizing or drying agents keep on working and drying out after the process was supposed to be stopped, and for that reason alone the varnish lost its elasticity with age. Hot air is one of the most reliable oxidizing agents. Varnished cloth

FIG. 2. GLUE POT FOR BENCH USE.

should also possess a tackiness, which is useful in making it adhere to itself.

Dr. Riddle read a paper for James Todd of the Sterling Varnish Company. Mr. Todd believes that the mechanical properties of varnish-insulated cloth are just as important as the electrical properties. A cloth should be given an endurance test as well as a quick-puncture test. Varnished cloth is best when made up of a succession of layers dried one on top of the other. Some kinds of oil tend to rot the cloth. Linseed oil should be purified before being used.

In a general discussion of the subject S. P. Grace, chief engineer of the Bell Telephone Company, called attention to a varnished-cloth insulated

cable several miles long, used by the Pittsburg Railways Company, for carrying a three-phase current of 13,000 volts from Brunots Island to Bellevue. This cable is hung aerially, without lead sheathing, and has been working for several years without giving any trouble with the exception of one splice that was improperly made. He considered this an important stride onward in the art of high-tension power transmission. He also spoke of trying varnished-cloth distributing wires for telephone service.

Paul Lincoln called attention to the use of varnished-cloth insulated cables as a protection against breakdowns caused by electrolysis.

Mr. Rowe, who has charge of switchboard design for the Westinghouse Electric and Manufacturing Company, called attention to the advantages of using varnished-cloth insulated cables with asbestos covering for power switchboard work and short-duct runs. He noted the great permanency of everything about a switchboard except the reliability of insulation on cables. He thought this should be made as permanent as the barriers they build for protection. He spoke of the advantage of doing away with bells on cables without lead covering.

C. E. Skinner of the Westinghouse Electric and Manufacturing Company thought that the varnished-cloth insulated cable with an asbestos covering was a great point when considering the fireproofing of wires. He also spoke on the subject of the manufacture of varnish, calling attention to the three principal methods of oxidizing linseed oil. These agents consist of, first, heated air; second, borate of manganese, and third, oxide of lead.

Messrs. DeWolfe and Sandborn of the Westinghouse Electric and Manufacturing Company gave some data regarding power factors and weakness of varnished cloth with rise of temperature. Some linseed oils under test show a power factor of 50 per cent. and other oils show as low as 1 per cent.

Mr. Wilson of the Union Switch and Signal Company spoke highly of varnished-cloth insulated signal cables, which he has been using for some time. These cables are unaffected by oil.

QUESTIONS AND ANSWERS.

Large Single-conductor Cable.

F. J. T., Chicago: Is there a lighting or railroad company using cables larger than 2,000,000 circular mils? What is the largest cable in circular mils made?

ANSWER.

The Hartford Electric Light Company of Hartford, Conn., in 1898 installed an 80-foot piece of 3,000,000 circular-mil rubber-insulated lead-encased cable made by the Safety Insulated Wire and Cable Company of Bayonne, N. J. This is probably the largest single conductor cable ever made. The largest regular size made by most manufacturers is 2,000,000 circular mils, and even this is very unwieldy and difficult to transport and install on account of its great stiffness, making it almost impossible to place on a reel.

Use of Storage Battery in Three-wire Distribution.

A. C. C., Chicago: In your New Years Number you published a system for three-wire and five-wire distribution by storage battery. With this system, using a 220-volt generator and three-wire distribution from the batteries, would the latter always be charged fully? What effect would this charging have upon the load of the engine? In case for a short time the plant was overloaded, would the batteries carry the overload? In case of a breakdown on the engine or generator would the batteries carry the load for a short time? What size batteries in ampere-hours would you use for three-wire distribution in a 30-kilowatt, 220-volt system? Would the engine have to be any larger than 50 horsepower?

ANSWERS.

Some of the foregoing questions cannot be answered definitely, owing to lack of sufficient information in relation to the character of the load. But Mr. Metcalfe, the author of the statement to which the inquirer refers, furnishes the following:

The three-wire system of distribution by means of a 220-volt generator, with three-wire distribution from the battery, [illegible] convenient [illegible], but it is not rec[illegible] only a short distance. For this condition a 220- [illegible] or an [illegible] cheaper to [illegible]

[illegible] distribution [illegible] where [illegible] it is desired to install a direct-current three-wire system at the end of an alternating-current transmission line. In the latter case the battery could be connected directly across the direct-current side of a rotary converter, and the three-wire distribution taken from the battery.

With this system of distribution the batteries would probably never be fully charged, although the charge in the battery would depend upon the conditions of the load and also upon the number of cells connected in the series. The effect of the batteries would be to make the load on the engine very nearly uniform, as the batteries would be charging in times of light load, and would assist the engine in carrying the peak load. The battery would be able, in case of a breakdown of the generating plant, to carry the load for a certain time, which would depend on the condition of the charge when the breakdown occurred.

The proper ampere-hour capacity of the battery to be installed cannot be determined until the conditions of the load are known. If there is a heavy peak load, requiring a high rate of discharge for a short time, the capacity of the battery would have to be considerably larger than if the load was nearly uniform. The capacity of the battery would also depend upon the balance on the two sides of the system. A 50-horsepower engine would probably have ample capacity for the conditions specified.

Australian Capital Wants Telephone Supplies.

Bids will be received by the deputy postmaster-general, Melbourne, Australia, up to May 26th for supplying the following telephone material required by the postmaster-general's department at Melbourne: (1) Apparatus for exchange, one common-battery switchboard of 30 sections in all, together with all associated frames, racks, power plant and parts; (2) apparatus for subscribers' premises, 3,000 telephone wall sets, 1,000 telephone table sets, 150 extension switches complete, 70 switchboards for two and six lines, 50 switchboards for three and 10 lines, 10 switchboards for six and 20 lines, 10 switchboards for eight and 50 lines, 200 telephone wall sets and 100 telephone table sets for party lines. Interested persons may obtain specifications and tender forms from the office of the deputy postmaster-general at Melbourne, or the Commonwealth offices, 72 Victoria Street, London, S. W., England.

Annual Report of the Chicago Telephone Company.

Directors of the Chicago Telephone Company, in the annual report to the stockholders, dated February 12th, make the following statements of the results of the business of 1907:

REVENUE AND EXPENDITURE.

Gross revenue	$ 8,718,950.85
Gross expenses	6,976,867.88
Net earnings	$ 1,742,082.97
Dividends	1,472,712.50
Surplus for year	$ 269,370.47

BALANCE SHEET AS OF DECEMBER 31ST:

RESOURCES.

*Invested in plant	$24,324,112.03
Invested in real estate and buildings	2,320,034.53
Other investments	92,819.93
Bills and accounts receivable	751,836.15
Material on hand	397,738.41
Furniture and Fixtures, and tools and teams	369,059.49
Cash	157,837.03
	$28,413,437.57

LIABILITIES.

Capital stock	$16,908,500.00
Capital stock subscriptions (stock not issued)	655,624.28
Reserve for deferred maintenance (to provide for renewal of switchboards and apparatus and for accruing depreciation of cables and plant)	1,836,714.26
Reserve for depreciation on buildings	62,899.20
Reserve for taxes	228,726.64
Reserve for insurance fund	200,000.00
Reserve for uncollectible accounts	50,793.35
Reserve for directory expense	24,395.20
Reserve for outstanding toll tickets and car tickets	4,599.96
Bills and accounts payable	3,331,241.99
*Surplus	5,109,942.69
	$28,413,437.57

*To show actual investment to date, the balance sheet includes aggregated tentative deductions during past years.

Following are extracts from the statements of Arthur D. Wheeler, president of the company:

INCIDENTAL STATISTICS FOR 1907.

Payments to employes for services amounted to $4,733,244.05, being 54.28 per cent. of the gross revenue. The number of employes at the end of the year was 7,681, the highest number, 9,563, having been upon the payroll at the end of July.

The maintenance items during the year were $2,610,481.47. The property has been carefully inspected and maintained. Damages from sleet, wind and electrical storms have been promptly and suitably repaired.

The net increase in telephones in service at the end of the year is 31,847. In reports for other years your attention has been called to the fact that a telephone system is in a constant condition of change. To secure a net increase of one telephone station during this past year two telephones have been put in and one taken out. In service December 31, 1907:

Chicago exchange system	145,480
Neighborhood exchanges in Chicago	10,599
Suburban	46,602
Grand total	202,681

December 1, 1907, the company ceased to operate under the Chicago ordinance passed in January, 1889. Under that ordinance the city has demanded and received by way of percentage on gross receipts from the telephone business $1,621,184.88. Such payments to the city operate in effect as a special tax on telephone users as a class. The city continues this plan under the ordinance in force December 2, 1907, referred to later.

REAL-ESTATE OPERATIONS.

The real-estate additions during the year have included the erection of a large toll building, containing about 42,000 square feet, fronting on Franklin Street and adjoining our Main office building in Chicago. The building will be occupied in due course with the new toll switchboard and apparatus. It will also provide space for our school for operators and additional quarters needed in the growth of our Main exchange.

New exchange buildings have been erected by the company for Lincoln exchange on Larrabee Street, Chicago, and for our exchange at Glencoe, Ill. Enlargements of our Oakland and Wentworth exchange buildings, in Chicago, and of our Oak Park exchange, have been practically completed. Land has been secured in Lawndale (Chicago) and in Berwyn for exchange buildings to be hereafter erected.

CHICAGO ORDINANCE.

The negotiations opened at the end of 1905, at the suggestion of the mayor of Chicago, were completed by the acceptance by the company on December 2, 1907, of an ordinance tendered by the city for a term ending January 8, 1929. Our company surrendered to the city the unexpired term under its ordinance of 1889 and also its rights under other ordinances covering areas within the limits of the city of Chicago.

The ordinance provides for a separate set of books for the city of Chicago, and for the inspection and direction, by the city, of the company's accounting, construction, apparatus and methods of operation and collection in the city of Chicago. Rate scales and classes of service are prescribed which the city may reasonably revise June 1, 1910, and at five-year intervals thereafter.

A right of purchase by the city arises in January, 1919 and 1924, and in favor of the city or its designated licensee on January 8, 1929.

As stated in our report last year, the proposals submitted by our company to the Council "involved material alterations of the company's plant, large additional investment and a material reduction in revenue from the existing body of subscribers." In each particular the ordinance now in force imposes more than was proposed. The city, by the extensive powers acquired by it under the ordinance in addition to those conferred under the statutes, is now peculiarly empowered to provide and permit reasonable results for all users of the company's service and all investors in its property. The city may be looked upon as a managing partner jointly interested in the welfare of the company in all of its relations. All questions arising as to the correct application of the ordinance are being submitted to the city officials.

The city has dismissed the litigation, described in last year's report, over the alleged obligation of the company to pay the city three per cent. upon gross receipts from telephone business done in territory not covered by the ordinance of 1889. The company paid an amount as one of the conditions imposed by the new ordinance. A total of $414,724.55 paid to the city under agreement that the company should have its day in court upon the question of its liability has, therefore, been permanently abandoned to the city without such hearing.

The company is now applying itself to meeting promptly and fully its obligations to bring the equipment and service of its present subscribers into compliance with the ordinance provisions. The ordinance allows 18 months for completing this task. Some intricate problems in electrical and telephone engineering have been created by it. These are in the way of successful solution and when the construction season opens the final plans will have been developed, the new cables and apparatus now being ordered will be ready for use and the changes can proceed with reasonable rapidity.

CAPITAL STOCK.

In July 40,000 shares of stock were offered to the stockholders for subscription. The last preceding offer had been made in June, 1903. All the shares offered have been taken. Final payments were due February 10, 1908. With the issue of these shares the outstanding capital stock of the company will be $18,000,000, the authorized capital being $20,000,000. The directors recommend that

the authorized capital stock of the company be now increased to $30,000,000. If this recommendation is approved, shares would be offered from time to time as required for extension of the company's system. Forty-five thousand [illegible] may be offered for sale, payable in installments, during 1908. The directors believe that the business and resources of the company will warrant the continuation of quarterly dividends reasonable under the circumstances.

TABLE SHOWING GROWTH OF THE COMPANY

	[illegible]	[illegible]	[illegible]	[illegible]
No. exchanges....	58	[illegible]	162	*[illegible]
Toll stations....	86	[illegible]	[illegible]	[illegible]
No. of exchange telephones....	21,188	[illegible]	[illegible]	[illegible]
Underground conduit miles....	[illegible]	[illegible]	[illegible]	[illegible]
Underground duct miles....	[illegible]	1,1[illegible]2	1,964	[illegible]
Miles of wire underground....	30,259	12[illegible]	245,[illegible]	[illegible]
Miles of wire aerial cable....	11,225	12,5[illegible]0	[illegible]	[illegible],192
Miles of wire on poles....	15,62[illegible]	18,742	[illegible]	62,[illegible]
Total miles of wire	57,113	1[illegible]5,020	[illegible]	[illegible]
Capital stock....	$4,[illegible]36,500	$11,[illegible]	$14,[illegible]	$1[illegible]

*The exchanges (now seventeen) in Chicago exchange system are counted as one.

A Busy Telephone Pay Station.

The telephone pay station in the basement of the Times Building in New York city has more calls than any other single position station of the New York Telephone Company. Its business is brisk from 8 a. m. to 1 a. m. of the following morning. There is an average of 92 calls an hour from the station, that is, a call and a half each minute during the busy times of the day. Often during the other hours there is an average of a call every minute. The total exceeds a quarter of a million calls per annum. This surprising showing is the outcome of only 18 months' growth. The station's business is restricted only by the limitations of its space.

Bell Company Prosperous in 1907.

Advance figures given out by the American Telephone and Telegraph Company show that the year 1907 was one of physical expansion and increased earnings. For the year the company shows net earnings of $23,479,290, 31 per cent. greater than for 1906. The balance for dividends was $16,269,-387.

All four of the main sources of revenue—dividends from subsidiary companies' stocks, net earnings of the long-distance lines, instrument rental, and interest on loans—show substantial gains over the previous year. Not only do the actual figures outstrip any previous record achieved by the company, but the share earnings, in spite of the issuance during the last six months of the year of nearly $21,000,000 additional stock, are the largest in the recent history of the company

The annual meeting will be held in March, when more detailed figures will probably be given out.

Indiana Telephone Items.

The Gaston Home Telephone Company has filed articles of incorporation with a capital stock of $10,000. Charles W. Rector is president.

The American Long-distance Telephone Company has procured a site on Fulton Street, Evansville, upon which to build a modern long-distance toll-line station. The company secured a franchise some time ago.

It is the intention of the Home Telephone Company of Elkhart to install a new switchboard and to make material improvements in its plant.

The citizens' committee of Bloomington having in charge the fight being made against the Home Telephone Company's advance in rates announces that $35,000 has been subscribed toward a new plant. Articles of incorporation have been filed and the call has been made for the first meeting of the stockholders for February 27th.

Dore Ogden of Columbus is experimenting with a wireless telegraphic outfit, using a box-shaped kite to carry the antenna instead of erecting towers to get the proper height for sending messages. By using kites he says he can obtain any height he desires, and there will be no limit as to the distance he can send and receive wireless messages.

General Albert L. New of Greenfield, Ind., has secured a patent on wireless telegraphic apparatus which will be put into practical use at once. General New was an officer of the company which established the stations along the Pacific Coast.

At a recent meeting in the second Indiana district of the Bell Telephone Company in Anderson the statement was made by J. W. Stickney, superintendent, that the Bell company is out to serve the public, and in order to better the service the Central Union Company is now ready to meet and cooperate with any Independent line on any equitable basis. The toll-line business is the patronage most sought by the Bell company, and whenever a rural or independent line desires to connect it will be met half way. Rural lines are only feeders for the toll lines, and when properly connected afford a greater

[illegible]

The City Council of [illegible] [illegible] the admitting of another telephone company [illegible] the establishment of [illegible] vote rejected the proposed [illegible] by the Central Union Telephone Company [illegible] service of the local company has been materially improved and other improvements, including the installation of modern equipment, will be added during the summer. S.

Telephone News from the Northwest.

The Greene County Telephone Company and the Citizens' Mutual Telephone Company of Churdan, Iowa, and vicinity have entered into reciprocal switching by which the Greene County company gets free connection for its patrons with all the Churdan Citizens' Mutual telephones and vice versa.

The building of a trunk line connecting both towns by the Mutual Telephone Company of Red Oak, Iowa, and the Mutual Telephone Company of Emerson, Iowa, may be carried through.

The Rock Island Railroad has installed in its freighthouse at Davenport, Iowa, a new automatic telephone exchange.

The Martin Telephone Company of Williams, Iowa, is stringing a new copper circuit from Webster City, Iowa, to Waterloo, Iowa. Three new circuits will also be constructed from Webster City to Des Moines.

The District Court has enjoined the city of Anoka, Minn., from attempting to enforce an ordinance to regulate the charges for telephone service by the Northwestern Telephone Exchange Company, ruling that under the law the city does not possess the right to regulate such charges. The court holds that the state possesses this right, however, which may be delegated to the city councils by acts of the Legislature.

The Eygland Telephone Company has been incorporated by John Logan and others at Eygland, Minn. Capital, $50,000. R.

GENERAL TELEPHONE NEWS.

The Orelia Telephone Company of Pearsall, Tex., has been incorporated with a capital of $50,000.

The Ainsworth (Iowa) Telephone Company has been incorporated with a capital stock of $10,000.

The Alden Telephone Company has been incorporated in Alden, Okla., with a capital of $10,000.

The exchange of the Nebraska Telephone Company at Axtell, Neb., has been destroyed by fire.

Thirty thousand dollars worth of bonds have been sold by the Farmers' Telephone Company of Wenatchee, Wash., west of Spokane, for the purpose of extending the line to Leavenworth.

Preliminary plans already prepared indicate that the Interstate Telephone Company will install a modern telephone system in Lewiston and Clarkston, south of Spokane, next summer. The Interstate has been delayed because of the difficulty in selling bonds, but resumption of work is expected in a short time.

Official announcement is made that the Pacific States Telephone Company has 12,440 telephone instruments in operation in Spokane at this time, a gain of nine per cent. over last year. As soon as the Home Telephone Company completes its plant in April this number will be increased to 20,000, or one instrument for every five inhabitants, a showing equaled by few cities in the world.

Fifteen per cent. dividend on a capital stock of $15,000 was declared by the Inland Co-operative Telephone Association at its annual meeting at Pullman, Wash., south of Spokane. J. C. Farr is president. The company owns a system extending through the rural districts, with connections at Pullman, Albion and Colfax, and switching arrangements with the Pacific Telephone and Telegraph Company. The company is composed largely of farmers, who built the line, beginning with a barbed-wire-fence system with four instruments. This has been changed to overhead lines and 300 instruments, distributed in various parts of the Palouse wheat belt.

According to a statement just filed with the Board of Supervisors of San Francisco by the Pacific Telephone and Telegraph Company, the value of the company's San Francisco property is $6,496,596. The total revenue of the company for the last year was $1,602,745, of which local telephone charges contributed $1,481,160; long-distance, $39,724; real estate, $70,330; interest, $5,386, and miscellaneous, $6,143. The expenses of the company aggregated $1,446,472, of which $389,626 was charged to operating expenses, $51,813 to taxes on real property, $5,808 to taxes on personal property, $114,779 to interest, and $286,903 to salaries and wages. The company gives its net revenue as $156,27[illegible].

CORRESPONDENCE.

Continental Europe.

[illegible] messages when passing over the city can be easily [illegible] posts within the city at a considerable distance [illegible] of the fact that the waves had to pass through the buildings of the city as well as through the hill of Montmartre, a high eminence lying inside of town. He now finds that he can intercept such messages by placing apparatus entirely within an intervening building. The wire of the receiver is connected to the gas or water piping, and the antenna is replaced by a wire stretched within the room and also connected to the receiver. The messages were received by M. Ducretet's receiver with relay and automatic Morse register, or, on the other hand, by a sound receiver provided with Captain Ferrie's electrolytic detector.

The negotiations relating to the railroads leading to the Simplon Tunnel, which have been carried on for the last four years between the French and Swiss governments, appear at the present time to end at a positive result, a partial one at least. During the first part of the year the negotiations had been resumed by means of diplomatic action. The last Swiss note showed that there were divergences as to the programme of the conference which had been projected by the delegates of the two governments, and for this reason there were frequent exchanges of views during the last few weeks with the object of smoothing out the last differences of opinion and of allowing the French government to draw up a note which would establish a definite accord between the two countries. The French and Swiss delegates will meet at Berne probably in the month of March. The programme of the conference will be an extensive one, and it will be occupied with the Fauville route, which requires the construction of a new tunnel, as well as the railroad connections for the two depots of Geneva, and also the consideration of the Frasne-Vallorbe route.

The Municipal Council of Paris has been occupied with the question of the reorganization of the tramway lines. During a recent meeting it was decided to adopt the duration of the concession, which will extend to the end of 1945. Another question was the project of reorganization of the lines of tramway known as the East Parisian, West Parisian and those of the Left Bank, as well as the North Parisian. Each of these systems includes from six to ten different lines. At present the Council is considering the modifications which are to be made in these different cases, as well as new lines which are to be constructed within the city.

Near the city of Marseilles has lately been erected a transformer post which is no doubt the largest of the kind on the Continent. It is intended to receive the high-tension lines coming from distant hydraulic plants in the coast Alps region and to transform the current so as to afford a supply for the city. The current brought by the pole lines is at 50,000 volts and 25 cycles and is produced by the hydraulic plants (either in operation or in project) on the Siagne, the Durance and the Verdon streams. In the Allauch post, the current is transformed to 13,000 volts. The station consists of a building 42 by 15 meters and of two stories height. The single-phase transformers, of the oil type, have a capacity of 1,000 kilowatts each, and when fully completed the plant will have 36 of them. The oil tanks are cooled by water, and for this purpose there are installed two turbine pumps worked by three-phase motors fed at 220 volts. In the plant is a very complete switchboard for handling the different circuits. Oil switches are used throughout for the 50,000-volt and the 13,000-volt circuits. The Allauch post is operated by the Energie Electrique Company and is equipped with Thomson-Houston apparatus. A. DE C.

New England.

Boston, February 22.—Following close upon the publication of the American Telephone and Telegraph Company's excellent showing for the year 1907 comes the exhibit for January, 1908. In the first month of the year the general gross earnings were $3,402,000, compared with $2,819,000 in the corresponding month last year, an increase of upward of 20 per cent. This is exclusive of the long-distance toll-line earnings, which were about $790,-000, against $703,800 a year ago, a gain of more than 12 per cent.

The mayor of Medford, Mass., on behalf of residents of that suburban city, was before the Legislature in advocacy of an extension of the Boston Elevated Railway Company's overhead system to Medford via Somerville. The [illegible]

takes a neutral attitude, neither favoring nor opposing the project.

Boston's municipal departments have undergone considerable payroll revision since the new administration was inaugurated in January. This week the mayor ordered the chief inspector, James E. Cole, who has been acting wire commissioner since Commissioner Kennedy resigned a short time ago, to drop six deputy inspectors from the force as a measure of economy.

The New England Telephone Company has notified stockholders officially of their right to subscribe until April 17th for $3,962,200 of new stock, in the ratio of one new share to eight shares held of old stock. B.

New York.

New York, February 22.—A report has been submitted to the stockholders of the Interborough-Metropolitan Company by its president, Theodore P. Shonts. This company is a holding concern and does not operate any railways. However, it controls the Interborough system of 72.48 miles of subway, 118.05 miles of elevated railway and 145.03 miles of surface railway, besides the Metropolitan system of 519.46 miles of surface lines. The assets of the company were stated to be $212,944,-509.51 on December 31, 1907, the receipts for the year being $5,278,485.63 and disbursements $4,511,-569.13, leaving a surplus income of $766,916.50.

The Public Service Commission will begin on Wednesday afternoon, February 26th, a general investigation of the companies that furnish electric light and power.

The ninety-fourth meeting of the American Institute of Mining Engineers was begun on the 18th in the United Engineering Building, in West Thirty-ninth street. Among the papers read was one on "Electric Power in Steel Mills," by David B. Rushmore of Schenectady. James Gayley was elected president.

Investigation of the affairs of John F. Randolph, treasurer of most of the Edison companies in West Orange, N. J., who committed suicide on February 17th, shows all his accounts to be correct. The opinion is now held that he was temporarily insane. The funeral was held on the 19th and was marked by the shutting down of all the Edison plants in West Orange. Many prominent men who had enjoyed the friendship of Mr. Randolph for years were present.

At a public hearing on the various applications that have been made for telephone franchises, held on the 18th in the City Hall, the New York Electrical Lines Company again asked for a franchise. Officials of the company said they could furnish residence service unlimited at $1 a month. They had a device, they said, whereby they could put as many persons as they liked on a line, keeping each free from interruptions. Neither the New York Telephone Company nor the Atlantic Telephone Company had anything to say at the hearing.

During January the number of persons injured on the railroads and street railways in New York city was 2,500 and the number killed, 44. This is an improvement over last December when the number of injured was 3,993 and the number killed, 51.

To expedite the handling of passengers in the subway the Public Service Commission has issued a formal order calling upon the Interborough Company to show cause why it should not put side doors in all cars in the subway. There are indications that the company will fight vigorously against such a change, because it would cost thousands of dollars for the alteration of the cars and many new station men would have to be hired to guard the additional doors.

On February 15th about 100 persons, officials of the Hudson and Manhattan Railroad Company and representatives of the press, made the first public trip of inspection through the new system of tunnels, commonly known as the McAdoo system, under the Hudson River. An eight-car train was run from Sixth Avenue and Christopher Street to Hoboken in eight minutes. The official opening is expected to take place on February 25th. Governor Hughes of New York and Governor Fort of New Jersey are expected to be present at this important event. W.

Western Canada.

Winnipeg, Man., February 22.—A citizens' league has been formed at Ladysmith, B. C., and is now agitating strongly for an electric-light system there.

Cecil B. Smith, C. E., Toronto, has been retained by the City Council of Nelson, B. C., to look into the question of establishing a civic power plant there.

During the coming summer the British Columbia Electric Street Railroad Company will spend approximately $200,000 at New Westminster in the con[illegible] for the system.

J. Harding of Winnipeg has invented a street-car fender which is worked by compressed air used on the brakes. In front of the fender is hung a screen which immediately drops upon coming in contact with [illegible] arranged that it drops whenever the motorman applies the brakes.

According to a decision of the law amendments committee of the Manitoba Legislature the city of Winnipeg cannot engage in domestic lighting. It is understood the city will fight the matter before the Legislature which is now in session. H. N. Ruttan is city engineer.

As a result of several fatal accidents recently the civic board of control of Winnipeg has instructed the Winnipeg Electric Railway Company to at once place wheelguards on all its cars running in the city.

The Dominion government wireless telegraph station at Pachena, B. C., has been completed and the stations at Cape Lazo and Estevan are being equipped with apparatus. The Empress steamers operated by the Canadian Pacific between Canada and the Orient and several other steamers on the Pacific Coast have been equipped with this apparatus.

A report is being circulated around Winnipeg to the effect that a strenuous effort will be made to rush through the necessary preliminaries for the immediate completion of the civic power plant on the Winnipeg River which was commenced and then abandoned on account of the tightness of the money market. Cecil B. Smith is still the civic power expert despite the efforts of Mayor Ashdown and several of the aldermen to have him discharged. R.

Southeastern States.

Charlotte, N. C., February 22.—A new electric-light plant is being completed at Thomasville, N. C., by the Thomasville Light and Power Company. Lights will be turned on by March 1st.

Superintendent P. T. Tillery of the Washington (N. C.) municipal electric-light company will make a canvass of the town, offering day and night current for manufacturing and other purposes, and if a sufficient demand exists the plant will be made adequate to the increased demand.

Henry H. Dalton, auditor of the Raleigh (N. C.) Electric Company, has resigned to accept a position with the Electric Bond and Share Company of 62 Cedar Street, New York. E. P. Summerson of Decatur, Ala., succeeds Mr. Dalton.

The plant of the Southern Car Company at High Point, N. C., builders of electric cars, etc., was destroyed by fire on the night of February 8th, the loss being estimated at $80,000. This was the only electric car manufacturing plant south of Delaware. It will be rebuilt at once. Mr. J. Elwood Cox of High Point is president of the company. The insurance was $28,000.

Col. John S. Henderson, recently appointed receiver for the Whitnet company, near Salisbury, N. C., is making active preparations to continue the work of completing the $5,000,000 hydro-electric development on the Yadkin River. Five hundred men are engaged at present on the work and the receiver believes that power will be available July 1. L.

Indiana.

Indianapolis, February 22.—The Evansville, Mt. Carmel and Olney Interurban Railroad Company of Evansville has filed articles of incorporation. The object declared is to promote, construct, operate and finance interurban roads and lighting and heating plants. The promoters, composed of Indiana and Illinois men, are headed by C. J. Seibert and E. Q. Lochyear.

The city attorney of Terre Haute has filed a petition in the Circuit Court for an injunction to prevent the Terre Haute, Indianapolis and Eastern Traction Company from operating interurban passenger and freight cars and maintaining its wires in the streets and alleys for commercial lighting purposes. This action is calculated to bring about a settlement of the differences between the company and the city that have existed ever since the McGowan syndicate obtained control of the local lines.

A test case is being made in the city of Elkhart to decide whether, in the absence of a provision in the franchise requiring it, the local street-railway company can be compelled to remove from the street the banks of snow thrown on either side of the tracks.

The Hancock Milling Company of Greenfield has contracted for $20,000 worth of improvements and machinery to be made immediately to the mills of the company. The modern machinery to be installed will be such as to operate the mills by electricity, being the first grist mills in the state to be so operated.

Following the failure of the City Council of Crawfordsville to take any definite steps toward bettering conditions relative to cheaper lighting facilities, the Commercial Club has become interested in the project. For 17 years the city has been operating a municipal electric-light plant, which, at the present time, has not the capacity to supply the city with light and power that is really needed. The rates are also regarded as too high. The City Council has been asked to provide by ordinance that a competent and expert electrical engineering firm be employed to go over the plant, ascertain just what is needed and what it will cost, and then prepare plans and specifications for the work.

Purdue students in the schools of civil, electrical and mechanical engineering to the number of about 300 are preparing to make an inspection trip during March and April. The civil engineers will have one schedule, the electrical another, and the mechanicals a third.

George C. Pyle of Indianapolis claims to be the original inventor of the headlight now being used on many of the locomotives and interurban cars of this country. Mr. Pyle says that he spent fully 12 years in perfecting and completing his invention. The headlight, though now made in Chicago, was at first manufactured in Indianapolis. S. S.

Ohio.

Toledo, February 22.—D. J. Cable of the Lima and Toledo electric line announces that the system will be in operation through to Cincinnati by June 1st.

A deal is said to be pending for the lease and possible sale of the Dayton, Covington & Piqua electric line to the Western Ohio and Toledo, Bowling Green and Southern, owned by the old Everett-Moore syndicate of Cleveland.

An electric railway is being projected between Mansfield and Wellington. New York capitalists are said to look with favor upon the proposed line and have sent a representative to make further investigation.

The plant of the Camden Electric Light Company at Camden, Ohio, has been sold to Charles S. Houston. He will ask the village council for a franchise to light the municipality.

R. H. Mathews, manager of the Bucyrus Telephone Company, has announced that an effort will be made to put in at least 300 new telephones by July 1st. The present number is one to every 25 inhabitants.

Preliminary steps looking toward the organization of the Ohio Electric Railway Benefit Association were recently taken at Lima. The association will provide sick benefits, allotments for accidents disabling employes, and provisions for the widows and orphans of employes killed in the service of the company. The membership will virtually include every employe of the Schoepf system in Ohio. Chapters will be established at Toledo, Hamilton, Columbus, Dayton, Newark and Lima. When the permanent organization has been effected President W. Kelsey Schoepf has promised his personal check for $5,000 to put the organization on its feet.

The eight corporations constituting the Schoepf Traction properties held their annual meetings last Monday, re-electing the old directors in each instance with the exception of F. A. Healy, who was made a director in the Southern Ohio Express Company. Mr. Healy will displace Walter Draper as secretary of that corporation.

A special meeting of the Central Electric Accounting Association was held at Lima last week to consider the demand for uniform systems of accounting. The association is a part of the general organization of electric roads in Ohio, Indiana and Michigan. H. L. S.

Illinois.

Peoria, February 22.—The Illinois Traction Company has closed a contract with the United States Express Company whereby the former will handle all the express business of the Express company to and from points reached by the lines of the system. The contract goes into effect April 1st, and it will necessitate increasing the rolling stock. The Chicago and Alton contract with the express company will terminate the first of April, when the electric road will handle the business.

An overhead crossing has been ordered for the Lincoln, Peoria and Springfield electric road where it crosses the tracks of the Illinois Central and the Chicago and Alton railways in the city of Lincoln. This is the decision of the state board of warehouse and railway commissioners. The traction company is to pay two-thirds of the cost and the other third is to be paid jointly by the steam roads. At the present time the Illinois Traction Company transfers at the crossing, but with the improvement will be able to run through cars from this city to Springfield and St. Louis.

The Economy Light and Power Company of Joliet will furnish the power for the new motor to pump water at the pumping station on Ottawa Street in that city. The company will furnish the power at $40 per month. The contract goes into effect the first of May and will be in force till the first of January.

Wrightsville, a small village four miles from Greenfield, will have electric lights. The Greenfield and Whitehall Electric Light and Power Company is placing the poles and wires, which will be part of the high-tension transmission line from Greenfield to Whitehall. Winchester is also bidding for lights for this system.

The Peoria County supervisors are securing an estimate on the cost of equipping the County Farm with an electric-light system.

At a meeting in Morrisonville in the interest of the proposed Litchfield-Decatur interurban electric

line, the sum of $3,000 was pledged toward the preliminary work of surveying the line. Meetings will be held in all the towns through which the line is proposed to run with the object of raising $15,000 for the work.

An electric road is proposed to run from Illiopolis, in Sangamon County, to Taylorville, going through Mt. Auburn and Grove City. A meeting was held in Mt. Auburn to promote the interests, and the promoters of the Litchfield-Decatur line were to be asked to take hold of the project.
V. N.

Michigan.

Detroit, February 22.—The village of Brighton has refused to grant an increase of $250, per annum for street lighting, and the Conrad Electric Company, which lighted the streets, has refused to maintain the service. The village will probably be without the light until the March election.

A new waterwheel will be placed in the plant at La Barge to take care of the increased power demand at Charlotte and Belleview.

The South Range Street Railway Company is beginning a line between South Range and Houghton and has asked the village of Houghton for a franchise. It is probable that the tracks of the Houghton County street railway will be used if an entrance to Houghton is secured.

The Common Council of Niles has granted a franchise to the Indiana and Michigan Electric Company for the transmission and distribution of all electric energy for light and power. The franchise provides that a service charge of $1 per horsepower per month may be made, and a charge for energy actually used at a rate of not to exceed six cents per kilowatt-hour; or a net rate of not more than six cents may be made if the customer agrees to use a sufficient amount of power to net $2 per horsepower per month for each horsepower installed. For light the gross rate is 12½ cents per kilowatt-hour, with a discount of 20 per cent. if prompt payment is made. Light can be furnished to only such customers as the Common Council permits to prevent competition with the municipal plant. The company is not required to extend its lines unless a revenue of 10 cents per foot of extension is guaranteed. Work must be started within six months and the service given in one year.

The new dam which is in construction at Berrien Springs will be ready this year.
D.

Northwestern States.

Minneapolis, February 22.—The Northern Electrical Manufacturing Company of Madison, Wis., was awarded the contract for installing electrical machines, fixtures and wiring in the Capitol Building at $42,000.

The electrical plant of New Hampton, Iowa, will be in full operation shortly. The equipment consists of a new steel water tower and tank with a capacity of 75,000 gallons and a new brick two-story building containing the pumping and lighting plant.

P. W. Gerhardt becomes superintendent of the Twin City Rapid Transit Company of Minneapolis, Gustavus Brigger resigning.

The installing of 24-hour electric service in Benson, Minn., is proposed. Electrican Taylor has been interviewing different persons relative to motors, irons, fans, etc.

The Des Moines City Railway Company of Des Moines, Iowa, proposes enlarging the power house and adding 1,500 horsepower. George B. Hippee was elected president of the company and A. G. Walsh general manager at the annual meeting held recently.

The construction of an electric railway from Thief River Falls, Minn., to Roosevelt is the topic of much discussion. It is estimated that the road could be built for approximately $10,000 per mile.

The voters of Livingston, Mont, voted against granting a franchise to the Madison River Power Company.

Parties from Fergus Falls, Minn., contemplate buying the Pillsbury waterpower near Swanville, Minn., and installing an electric-lighting plant. R.

Pacific Slope.

San Francisco, February 19.—Daniel O'Connell, who a few days ago filed a petition with the Board of Supervisors of this city asking that the street-railway and telephone franchises alleged to have been obtained from the former board of supervisors by bribery be rescinded, has now filed a petition signed by 14,616 voters of the city asking that the question of buying the street-railway and telephone systems be submitted to a popular vote. He estimates that not over $10,000,000 will be needed for this purpose. Unless some legal flaw in the matter can be found, the question must be submitted at the next general election.

L. E. Hanchett, president of the San Jose and Santa Clara Railway of San Jose, Cal., has established an office in this city.

The last act in the street-car strike of last May, which has been really dead for a number of months, was taken this week when the joint committee of the Building Trades Council and the Labor Council met and disbanded sine die. Of the $400,000 contributed to the labor union cause during the course of the strike, $1,400 still remains on hand.

The Enterprise [illegible] Works has been incorporated in San Francisco with a capital stock of $[illegible] by Frank Jones, [illegible], Bertha [illegible] and Mary E. Jones.

The Northern Power and Water Company has been organized at North San Juan, Nevada County, Cal., to operate in Nevada County. Extensive development of water rights, etc., already controlled is planned.

The Northern California Mining Company, of which H. H. Yard is the chief owner, is perfecting plans for two power plants to utilize the waters of Fall River at Mooretown, near Oroville, Cal.

The Great Western Power Company has secured a franchise permitting it to cross the public roads of Butte County, Cal., with its power-transmission line. Except where it crosses the public highways, the line will follow a private right-of-way.

A recent development of the long-distance transmission of electric power is the passing of ordinances regulating the construction, maintenance and operation of the transmission lines by the counties and municipalities of the state. The ostensible purpose of these laws is the protection of the public from accidents, but the Pacific Power Company, which has so far been the principal sufferer from these laws, claims that the laws have in several cases been made needlessly obnoxious and expensive to the companies.

Balfour, Guthrie & Co. of London and San Francisco are preparing to spend about $100,000 in putting in electric lighting, sewer and water systems at the new town of Strathmore, near Visalia, Cal.

The property of the Calistoga Electric Light and Power Company of Calistoga, Cal., has been placed in the hands of a receiver to satisfy $18,462 alleged to be due on promissory notes.

W. T. Van Brunt, manager of the North Butte Extension mine at Butte, Mont., states that he will in April or May place orders for a complete electrical equipment for the mine.

The Mollalla Electric Company of Canby, Ore., has issued bonds to the amount of $15,000, the proceeds to be used in the taking over of the property of the Aurora Electric Company and the locating of the latter company's plant on the Mollalla River about three miles from Canby.

The Seattle Electric Company estimates that the expenditures to be made this year in extensions, improvements and equipment, including the enlarging of the plant at Georgetown and the special arrangements to be made for the Alaska-Yukon Exposition, will cost approximately $1,500,000.

The Coos Bay Gas and Electric Company of Marshfield, Ore., will put in a central electric plant at Porter to supply the electric-lighting and power systems of Both Marshfield and North Bend.

The Allis-Chalmers Company, through its San Francisco district agency, has just taken a contract at a figure approximating $200,000, for a complete motive power and mining machinery plant for the Goldfield Consolidated Mining Company. The plant will be installed at Goldfield and electric power will be taken from the Nevada-California Power Company's transmission lines.

The Nevada-California Power Company, which was formerly called the Nevada Power, Mining and Milling Company, has closed a contract with the Allis-Chalmers Company for a 1,500-kilowatt waterwheel type three-phase generator. This will be the fourth machine of the same size and make to be installed by this power company at its plant on Bishop Creek, Cal., whence electric power is transmitted more than 100 miles to Goldfield. The growth of this system is keeping pace with the development of the new Nevada mining districts, and extensions of its pole lines are in progress.
A.

PERSONAL.

The death is announced at Providence, R. I., of Charles A. Potter of the American Electrical Company of that city. He was a Civil War veteran.

Mr. Thomas A. Edison is reported to have undergone an operation early this week to relieve him of trouble in the left ear. The operation, which was not considered serious, is said to have been wholly successful, and everyone will be glad to hear of his complete recovery.

Mr. F. E. Lowe, superintendent of the Twin City Rapid Transit Company at St. Paul, has resigned. He has been in the service of the Twin City company for three years, having resigned from the Pullman Car Company, Minneapolis, to become clerk to the general manager. Two years ago he became superintendent of the St. Paul branch. J. S. Peaver of Chicago succeeds Mr. Lowe.

J. A. Carothers, president of the Pontiac Light, Heat and Power Company, died on February 19th at his home in Pontiac, Ill., of Bright's disease, aged 45 years. Mr. Carothers was well known and liked by Illinois electrical men. Until recently he had been president of the Bloomington, Pontiac and Joliet Electric Railway. At the Decatur meeting of the Illinois State Electric Association, of which he was a member, he was elected vice-president. Mr. Carothers had amassed a considerable [illegible]

[illegible]

[illegible] engineering since 1866, died suddenly in St. Augustine, Fla., [illegible]. He was a member of the American Society of Civil Engineers, the Western [illegible] [illegible]

Mr. William P. Bear, now with Kohler Bros. of Chicago, will remove to Duluth about March 1st, to assume managerial duties with the Northern Electrical Company of Duluth and Minneapolis. Mr. Bear has been in the electrical business since boyhood, serving in various capacities with W. T. Osborne & Co. of Kansas City, Chicago Edison Company, Illinois Steel Company, Fort Wayne Electric Works, and in his last position with Kohler Bros. He was a student at Armour Institute. With Kohler Brothers, where he has been for the last three years, he has had full control of all switchboard work, doing the engineering and directing all switchboard installations, as well as handling the commercial end of the switchboard department. Mr. Bear leaves many friends in Chicago who wish him success in his new field.

ELECTRIC LIGHTING.

D. F. Shaddock and others will install an electric-light plant at Odessa, Tex.

Farmington, Mo., has voted $25,000 for the construction of an electric-light plant.

M. M. Neumann is seeking a franchise for an electric-light plant in Stanton, Neb.

Afton, Okla., is to vote on the question of issuing bonds to build an electric-light plant.

Bonds for $17,000 have been voted in Loyal, Wis., for an electric-light plant and waterworks.

Columbus, Neb., has granted a 20-year franchise to John T. Burke for a light and water plant.

The Clarendon (Tex.) Water, Light and Power Company will expend $10,000 in improving plant.

The city of Fort Worth, Tex., will expend $50,000 in improving and enlarging its electric-light plant.

Stein-Hirsh & Co., operating a starch and gum factory at the corner of Ashland Avenue and Thirtieth Street, Chicago, are preparing to install an electric generator of 250-kilowatt capacity direct connected to a horizontal Reynolds-Corliss engine, the complete unit to be built by the Allis-Chalmers Company. Three-phase, 60-cycle current, generated at a pressure of 240 volts, will be distributed over the building for power and lighting. With this alternator there will be installed a 15-kilowatt belted exciter of the same company's make. Adams & Schwab are consulting engineers and Nimmons & Fellows, architects of the building.

The Koreans, having discovered the service and comfort afforded by electrical power and lighting, are rapidly installing small motors in their shops and lights in the homes at Seoul. The modern Korean palace has been lighted for some time by electricity, and of late commercial plants have been established at Chemulpo and Fusan, while two plants, under one management, supply light and power to Seoul, the capital. The Seoul plant, which furnishes light for commercial purposes and power for electric tram lines, has recently been enlarged until its capacity is almost doubled, and further improvements are contemplated.

ELECTRIC RAILWAYS.

The Indiana correspondent of the Western Electrician writes that it is reported that the Murdock syndicate, which controls the Chicago, South Bend and Northern Indiana electric railway and other traction lines, will soon close a deal for the assets and franchises owned by the Chicago-New York Electric Air Line Company. This acquisition will give the Murdock syndicate possession of the franchises in Gary, which will hasten the completion of street-railway facilities in that city and afford the syndicate an opportunity to build a line from La Porte to Chicago.

The Chicago City Railway Company, this year, with a view of taking advantage of the decreased prices on materials and labor, anticipates doing about one-half of the work which the new ordinance requires of it. This work will include very largely the laying of the new-style grooved rails, reconstruction of track bed, paving, and the laying of about 300 miles of clay conduit. Nearly all of the materials for this construction work have already been contracted for. The conduit contract is probably for the largest amount ever let in a single contract. This contract for conduit was let to the Clay Product Company. All of the conduit to be laid will be 3½-inch single-duct ware and will eventually form the bed for all electrical transmission wires except the trolley wire.

Jay P. Graves, president of the Spokane and Inland Empire Railroad Company, has issued a report stating that the grading and bridgework on the Moscow extension from Palouse is completed and the road will be opened as soon as weather conditions will permit in the spring. Wheat and lumber shipments will add much to the freight tonnage of the road. During the six months following April 30th the net earnings of this line have been $617,732.67, and the expense has been less than 60 per cent. of the gross earnings. The report shows that the power plant is nearing completion and this will mean a saving in the expenses of the road, as it will then furnish its own power, while the completion of the Moscow extension will mean an increase in the gross receipts.

POWER TRANSMISSION.

A delegation of Canadians which met in Ottawa, Ont., on February 21st and there interviewed Lord Grey, Sir Wilfrid Laurier and Ambassador Bryce, is said to have expressed the opinion that the proposed treaty with the United States in connection with the beautifying of Niagara Falls will shut out any further power plant at Niagara Falls, which they contend would be injurious to industrial interests throughout Western Ontario. The delegation was composed of J. J. Foy, K. C.; Col. Hendrie, Adam Beck, W. K. McNaughton, M. P. P., and Superintendent Wilson of the Niagara Park.

Gerrick & Gerrick, contractors for the electrical work of the Northern Pacific Railroad in Washington, will begin work about March 1st, it is said, on the power plant which will furnish electric power to carry the company's trains over the mountains from Leavenworth to Skykomish. The water for the operation of the plant will be conveyed across the Wenatchee River through 1,000 feet of steel pipe 9½ feet in diameter to a steel penstock 196 feet high and holding 1,000,000 gallons, from which the turbines will be fed. Four 1,300-horsepower General Electric generators will be installed in the plant.

PUBLICATIONS.

"The Export Electric Accumulator" is the name of a new monthly that made its first appearance in London, England, last month. It is published by the Electric Accumulator Printing and Publishing Company, which for two years has successfully published "The Electric Accumulator." This has been till now the only English journal devoted to storage-battery interests. The new monthly will be the export edition and will have many articles of particular interest to readers outside of Great Britain.

Bulletin No. 1503, entitled "Allis-Chalmers Direct-connected Reynolds Corliss Engines," contains a liberal amount of information on the building of Corliss engines, in which that company has had almost 50 years' experience. This publication deals particularly with direct-connected units, a comparison with the belt-driven, however, being offered. Every user of steam power undoubtedly is interested in the most advantageous method of operation. What these conditions are and the service to which each type of engine is best adapted are described in this bulletin, issued by a company manufacturing both direct-connected and belted units.

The United States Geological Survey, Department of the Interior, has just published its comprehensive report on the "Mineral Resources of the United States" for the calendar year 1906. This volume of 1,307 pages is the twenty-third annual compilation of the production of mineral substances. In addition it shows the chief features of mining progress during the year. It also shows, where possible, the conditions in the various mining industries in foreign countries as compared with those of the corresponding domestic industries. The statistics have been collected and compiled by technical experts in the several branches and have been found to be of great value to the mining interests. The principal divisions of the work are: Metals, fuels, structural materials, abrasive materials, chemical materials. In 1906 the total value of our mineral production was $1,902,517,565, compared with $1,623,923,720 in 1905. Mr. George Otis Smith is director of the survey.

The Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Company have just issued a comprehensive catalogue of the electric locomotives for mine and industrial service manufactured jointly by these two concerns. The electric features of the locomotives are the work of the Westinghouse company and the mechanical features that of the Baldwin works. The numerous illustrations of typical installations show the extent to which locomotives of this make have been adopted. Among the illustrations is one of the testing plant in the Baldwin Locomotive Works, which enables a complete record to be made of the performance of every locomotive before it leaves the works. Considerable space in the catalogue is devoted to the rating and performance of locomotives. It is said that the Baldwin-Westinghouse locomotives are designed with particular reference to their "continuous capacity," experience having demonstrated that equipment thus rated is the least expensive for maintenance. The last two chapters are devoted to gathering locomotives and traction reel locomotives.

SOCIETIES AND SCHOOLS.

The March meeting of the American Society of Mechanical Engineers will be held on Tuesday evening, March 10th, at 8:15 o'clock, in the Engineering Societies Building. The meeting will be addressed by Dr. Charles P. Steinmetz, member A. S. M. E., past president A. I. E. E., and professor of electrical engineering Union University, the subject being "The Steam Path of the Steam Turbine."

The next meeting of the Missouri Electric Light, Gas and Street Railways Association will be held at the Marquette Hotel in St. Louis, Mo., on April 23d, 24th and 25th. Secretary C. Z. Pierson writes that a very interesting programme is being prepared. The St. Louis Electrical Show will be in progress during the convention, which will be an added inducement for members and guests to visit St. Louis at this time. Mr. J. D. Porterfield of Cape Girardeau is president of the association.

At a meeting of the executive committee of the Nebraska Electrical Association on February 19th it was decided to hold the next annual meeting of the association in Omaha on April 15th and 16th. This change was made in order to have the meeting take place during the week of the Omaha electrical show, which is to be held in Omaha the week of April 13th. Mr. T. H. Fritts of Grand Island, Neb., is president of the association and Mr. William Bradford, Linciln, is secretary.

The eighth annual convention of the Iowa Electrical Association will be held April 22d and 23d at Des Moines. The Savery Hotel will be headquarters. Arrangements have been made for a very creditable exhibit of electrical apparatus in the large banquet hall of the hotel. Space will be furnished at the expense of the association. The programme is now being arranged and Secretary W. N. Keiser, Des Moines, says that all indications are for the largest and best convention ever held by the association. George N. Carson of Iowa City is president of the association.

At the last meeting of the Chicago Section, A. I. E. E., held on February 18th in the rooms of the Western Society of Engineers, Mr. Garrett T. Seely read a paper on "Recent Improvements in the Mechanical and Electrical Equipment of the South Side Elevated Railroad," which is abstracted in this issue. The discussion of the paper consisted principally in a series of questions on various features brought out in the paper, which were elucidated by Messrs. Seely, Woodmansee, Junkersfeld, Wray, Powell, Chairman King and others. The next meeting was announced for March 19th, when Mr. A. H. Armstrong of Schenectady, N. Y., is expected to read a paper on "Relation of Electricity to the Problem of Transportation."

MISCELLANEOUS.

It is reported that the wireless-telegraph plant erected at the Eiffel Tower in Paris has been destroyed by fire. The tower itself was not much damaged. The Municipal Council of Paris had only recently decided to equip the plant with high-power apparatus to be used in long-distance wireless communication.

The Wolf Mill and Elevator Company, whose plant at Ellinwood, Kan., is being equipped with Allis-Chalmers flourmill machinery on the well-known universal bolter system, has purchased from the same builders power equipment driven by belting from a 12 and 24 by 36-inch cross-compound Reynolds-Corliss engine. Steam at 150 pounds pressure will be supplied from a Chandler & Taylor tubular boiler operated in connection with an open Stilwell heater and duplex hot-water boiler-feed pump.

TRADE NEWS.

The Gross Gas and Electric Fixture Company of St. Louis, Mo., has been incorporated with a capital stock of $13,500.

The Kuhlman Electric Company of Elkhart, Ind., through the Central Electrc Company of Chicago, has been recently awarded the contract by the Sanitary District of Chicago for its year's requirements in transformers.

Bending, Bicknell & Brightman, engineering and construction, 408-9-10 Murray Building, Grand Rapids, Mich., have secured the contract for equipping the Eclipse Box Company's new factory and will be in the market for 220-volt direct-current motors; galvanizing plant; printing presses for wood, multicolor; woodworking machinery and ventilating apparatus.

Charles B. Harris, United States consul at Reichenberg, Bohemia, reports that large orders for electric goods for that district are placed with German manufacturers or jobbers, whose traveling salesmen, speaking the language and knowing the wants of the purchasers, have no trouble in making sales. American manufacturers to secure orders in Austria must also employ German-speaking salesmen. Cargo for points in the Reichenberg district is transported by rail from seaports, or by boats on the Elbe to Tetschen.

The American-Korean Electric Company of Seoul, Korea, intends to introduce fans extensively during next summer, and electric flatirons, warming pads and other novelties will probably follow in due course. The steady market demand at present, however, is limited to motors and fixtures. On account of the power companies' method of installing fixtures and then renting them to the consumers, there are no stores in Korea carrying exclusive stocks of electrical fixtures and furnishings. The power companies import the bulk of these supplies direct.

Mr. H. P. Copeland announces the opening of new quarters at 203 West Broadway, New York. Agencies for Glitterene, two-hole telegraph blocks, wood battens, wood wiring cleats, ebonite and specialties in wood and sheet metal for telephone and telegraph construction and maintenance, also the manufacture of the H-P rustless cable hanger, will hereafter be carried on in Mr. Copeland's name and under his personal supervision. Mr. Copeland has had 12 years' experience as manager of the electrical department of James S. Barron & Co.

At the office of the supervising architect, Washington, D. C., sealed proposals will be received until April 7th for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the postoffice at Nevada, Mo. Drawings and specifications can be seen at the office of the custodian of site at Nevada or at the above office. Proposals will also be received until March 30th for an elevator plant in the postoffice and courthouse at Los Angeles, Cal. Drawings and specifications are at the supervising architect's office, or at the office of the superintendent of construction, Los Angeles.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 18, 1908.

[illegible] Signaling Device. Frederick Bauer, [illegible], N. Y. Application filed October 18, [illegible]

[illegible]

879,158. Transformer. Charles Le G. Fortescue, [illegible] Westinghouse Electric and Manufacturing Company. Application filed June 8, 1907.

[illegible] that are symmetrically located with respect to the other winding can be cut out of circuit to adjust the volt[illegible] of the transformer. (See cut on next page.)

879,168. Electric Railway Signal. Frederic M. Hill and William C. Davis, Columbus, Ohio. Application filed April 6, 1907.

An overbalanced semaphore arm is provided with a disk upon which a chain is wound so as to move the arm. Electrical means accomplish this when the car enters and leaves a block.

879,180. Arc Lamp. Oskar Könitzer, Munich, Germany. Application filed January 19, 1906.

[illegible] longitudinal passage close to one side thereof, and a [illegible] piece upon which the thin wall of the electrode formed by the channel rests.

879,224. Cystoscope. Reinhold H. Wappler, New York, N. Y. Application filed August 28, 1906.

A tubular surgical instrument adapted to permit interior portions of the body to be viewed through its bore has an incandescent electric lamp at its further end.

879,234. Electric Circuit Controller. Christian Aalborg, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed April 4, 1906.

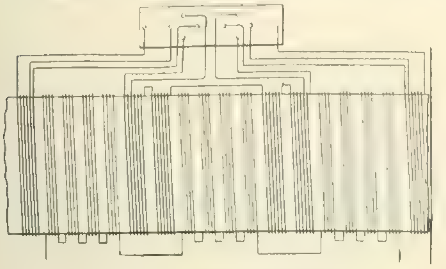
Stationary and movable contact members are arranged so that movement of an operating lever moves certain of the movable members into engagement with their complementary stationary contacts, and movement of the lever in the other directions moves the other movable members into engagement with their complementary stationary contacts.

870,245. Contact Finger. William Cooper, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed May 21, 1906.

In combination with a contact-carrying device, an engaging finger therefor that comprises a resilient member having a hook at one end and a resilient contact-carrying member attached to one end of the former member and limited in its motion by the hook.

870,246. Commutator for Electric Apparatus. Frederick W. Cox, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed April 4, 1906.

The commutator is composed of a single set of unitary segments having beveled outer ends, a support therefor having an integral clamping ring, an adjustable clamping sleeve which engages notches near the middle of the segments, and a clamping ring adjustably mounted on the sleeve to engage the beveled ends of the segments. (See cut.)



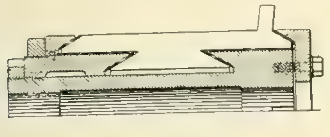
NO. 879,158. TRANSFORMER.

870,247. Drop-light Fixture and the Like. Arthur C. Davidson, Chicago, Ill. Application filed March 13, 1907.

A number of chandelier engaging hooks are secured to the upper end of a supporting member for the drop light so as to equally distribute its weight. Means are provided for conducting gas or electricity to the lower end of the supporting member.

879,252. Multiple-ratio Transformer. Charles Le G. Fortescue, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed June 8, 1907.

This is a modification of patent No. 879,158.



NO. 879,246.—COMMUTATOR.

879,257. Trolley Catcher and Retriever. Franklin J. Gustine, New Orleans, La. Application filed July 5, 1906.

There are in combination with a trolley pole, a pair of oscillating arms, a spring interposed between the trolley pole and one of the arms, a link connection between the arms, a trip bar coöperating with the arms to lock them against movement, and means for automatically tripping the trip bar.

879,267. Controlling Means for Pneumatically Operated Devices. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 3, 1906.

A pantagraph trolley that is normally raised can be depressed by means of compressed air. A catch retains the trolley in its depressed position and air pressure releases it. A pipe having branch passages is provided whereby air pressure may be applied to the respective means, the passage to the former means being provided with a constricted portion.

879,285. Automatic Multiple Fuse-block. William C. Mayo and John Houlehan, El Paso, Texas, assignors of one-third to George E. Briggs, Barstow, Texas. Application filed May 2, 1907.

A series of fuses is arranged so these can be interposed in succession into the power circuit. A shunt-circuit around the fuse in service maintains the power circuit intact when the fuse is blown and during the introduction of a fresh fuse. Means are operated by the current diverted into the shunt-circuit by the blowing of a fuse to automatically cut in a fresh fuse.

879,300. Telegraph Switchboard. Albert T. Newman, Greeley, Kan. Application filed March 6, 1907.

Contacts for a number of circuits are arranged in the form of an arc on the board. A shaft passing through the board carries a bundle on one end and a disk on the other. The latter connects the different circuits.

879,307. System of Electrical Distribution. Roderick M. Palmer, Cambridge, Mass., assignor to the Palmer Electrical Company, Bangor, Me., Bangor, Me. Application filed March 17, 1906.

A circuit of relatively high voltage contains an electromagnet and a circuit controller governing it. A second circuit connected in shunt with the high voltage circuit is governed by a circuit controller operated by the electromagnet. A number of branch circuits connected with the shunt-circuit contain translating devices and are governed by circuit controllers.

879,326. Process of and Apparatus for Preparing Effervescing Baths. Leopold Sarason, Hirschgarten, near Berlin, Germany. Application filed August 12, 1907.

The process of preparing effervescing gas-water baths consists in rendering water electrically conducting, and [illegible]

879,3[illegible]. Telegraphic Transmitter. [illegible] Brown, Patton, Kan. Application filed May [illegible], 1907.

[illegible]

879,[illegible]. Battery Plate. William M. Brodie, West Orange, N. J., assignor to the Edison Manufacturing Company, West Orange, N. J. Application filed February 18, 1907.

[illegible]

879,385. Electrical Measuring Instrument. Adrian H. Hoyt, Penacook, N. H., assignor to the Whitney Electrical Instrument Company. Application filed July 5, 1904.

The instrument consists of a permanent magnet, a pivoted inclined shaft carrying a polarized movable element, springs to oppose rotation and means for dampening this element, and a stationary coil through which the current flows that provides the moving torque.

879,387. Ammunition Hoist Control. John D. Ihlder, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed August 30, 1907.

In an ammunition hoist, there are in combination a carrier, a motor and driving connections therebetween, and means for stopping the carrier automatically at different positions varying with the gun elevation.

870,397. Air-brake, Lighting and Signaling System for Railway Trains. William C. Mayo and John Houlehan, El Paso, Texas, assignors of one-third to George Edwin Briggs, Barstow, Texas. Application filed January 31, 1907.

Each car has a reservoir and an air pump driven from the running gear of the car. A generator on the locomotive supplies current for operating electrical valve mechanism on each car that controls its air brakes.

879,409. Wireless Telegraphy. George W. Pierce, Cambridge, Mass., assignor to the Massachusetts Wireless Equipment Company. Application filed March 16, 1906.

In a receiving system for wireless telegraphy are comprised an inductive connection having a variable primary and variable secondary, a detector and a condenser connected with the secondary, and connections for sending the currents set up in the primary of the inductive connection through the detector.

879,410. Electric Signaling Clock. Henry S. Prentiss, Elizabeth, N. J. Application filed August 4, 1905.

A disk turning with the clock mechanism is provided with flexible circumferential contact teeth which are arranged for definite intervals of time and which close the several signaling circuits.

879,411. Self-winding Clock. Henry S. Prentiss, Elizabeth, N. J. Application filed September 14, 1906.

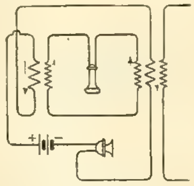
A weight actuated clock mechanism is provided with an electromagnet with an armature carrying an arm having a crosspiece at its extremity. A second arm is adapted to oscillate with the weight. Means carried by this arm close the circuit in conjunction with the crosspiece when the weight has descended a predetermined distance.

879,425. Electric Generator for Telephone Lines. Henry Tideman, Menominee, Mich. Application filed January 16, 1905.

The commutator for this magneto generator consists of two semicircular segments of which the joint periphery forms a circle about a shaft, two conducting circular segments having a reduced diameter through half of the circumference, and an insulating circular segment of similarly reduced diameter through the half circumference embraced between the two conducting circular segments.

879,438. Telephony. Morgan Brooks, Urbana, Ill. Application filed May 31, 1906.

The sub-station telephone set consists of local battery, transmitter, receiver and two induction coils. The transmitter and receiver are each connected to a winding of each induction coil so that their effects on each other are neutralized. The line is connected to a third winding of one of the induction coils. (See cut.)



NO 879,438. TELEPHONE SUB-STATION.

879,454. Telephone Exchange Apparatus. William A. Fricke, Chicago, Ill., assignor to the Monarch Telephone Manufacturing Company, Chicago, Ill. Application filed March 8, 1907.

A common-battery exchange system includes a number of line and cut-off relay circuits, condensers for separating the circuits, and connecting means at the exchange permanently associated with the condensers and adapted to connect them in talking sides of the telephone line and between the relays in the circuits.

879,[illegible]. [illegible]

879,[illegible]. [illegible] 1907.

[illegible]

879,522. [illegible] Grand Rapids, Mich., [illegible] to James B. [illegible], Grand Rapids, Mich. Application filed April 26, 1907.

[illegible]

879,532. Space Telegraphy. Lee de Forest, New York, N. Y., assignor to the De Forest Radio Telephone Company. Application filed January 29, 1907.

An oscillation detector [illegible] means for heating one of the electrodes, and a grid-shaped member of conducting material inclosed within the vessel and interposed between the electrodes. This is the de Forest "Audion" detector.

879,548. Signaling Apparatus. Jewet G. Homet, Scranton, Pa. Application filed October 8, 1907.

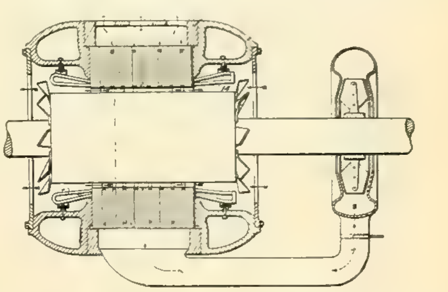
This railway signaling system has a number of electric lamps disposed at spaced intervals and connected in parallel, and means operative from a moving car whereby the lamps are momentarily extinguished consecutively.

879,555. Incandescent Lamp Control. Roy E. Kimball, Fruitvale, Cal. Application filed March 30, 1906.

A lamp socket has a switch including a turnable ratchet disk with arms, fixed independently connected conducting surfaces with which the arms are caused to successively contact when turned, and connections between the main circuit through the lamp, and the conducting surfaces.

879,564. Turbo-alternator. Charles E. Lord, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed June 7, 1905.

A cooling system for an alternator consists of a blower forcing air through the ventilating ducts of the stator, which ducts are closed at their inner ends so that the air passes out at the top of the machine. The rotor has fan blades to force a separate blast axially through the air gap. (See cut.)



NO. 879,564.—TURBO-ALTERNATOR.

879,568. Burglar Alarm. James E. Murray, Washington, Pa. Application filed February 1, 1907.

The circuit is closed between two contacts by the turning of a pin with a flattened end which normally separates them.

879,582. Trolley Retriever. Richard Phillips, Washington, D. C. Application filed June 8, 1906.

Means are mounted in sockets on a swinging frame for contacting with the feed wire when the trolley is thrown upwardly. Other means engage the wire to direct the trolley wheel back again to the wire.

879,586. Cable Hanger. De Elbert A. Reynolds, New York, N. Y. Application filed September 7, 1906.

A resilient supporting member arranged to embrace the cable with a yielding pressure has two oppositely disposed hook-like portions normally out of alignment and arranged to individually hook over a supporting wire from opposite sides thereof. The hanger has a protective lining against the cable.

879,593. Trolley Wheel. Jacob M. Siegrist, Oswego, N. Y. Application filed September 4, 1907.

The shaft passing through the harp and trolley-wheel is formed at one of its ends with a rigid head provided with a shoulder to bear on the outer side of the harp and with a transverse groove in the outer face of the head, and a spring tongue attached at one end to the harp and having its free end passing through the aforesaid groove and pressing the head of the shaft onto the outer side of the harp.

879,596. Reclaiming Tin Scrap. Elmer A. Sperry, Brooklyn, N. Y. Application filed October 8, 1906.

This method of reclaiming tin scrap consists in concentrating the material by electrolysis in an alkaline bath, removing the black scrap and treating the tin concentrate to render it comparatively inert with regard to the air.

879,612. Alkaline Storage Battery. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed June 29, 1904.

A practically non-foaming alkaline electrolyte for a storage battery is obtained by filtration of an alkaline solution through bone-black previously subjected to the purifying effect of a hot caustic solution followed by washing with water.

879,632. Cigar Lighter. Augustus C. Gruhlke, Waterloo, Ind. Application filed June 13, 1906.

An electrically ignited fluid-burning lighter comprises a fluid receptacle, a casing leading therefrom for the reception of the wick, an electrode secured adjacent to the casing tip, an extinguisher normally held over the casing tip, which extinguisher is provided with an opposite electrode, and means connected with the extinguisher and having sliding contact with the casing whereby the direction of its movement and the extinguisher is controlled.

879,633. Process of Treating Metallic Ores or Mattes. Emil Günther and Rudolf Franke, Eisleben, Germany. Application filed June 18, 1907.

In extracting metallic ores the method of producing nickel salt solution for electrolytic deposition of nickel consists in subjecting copper and nickel concentrated regulus to electrolytic action as anode in a bath of chloride of copper with addition of a chloride of alkali in presence of free hydrochloric acid, introducing copper salt into the bath during the electrolytic process, separating the solution when rich in nickel from the solid residue of the anode and eliminating the contents in copper from the solution.

879,636. Trolley-wheel. Edward J. Harrison, South Bend, Ind. Application filed July 18, 1907.

The wheel has a flanged periphery and hub with a recess formed therein. A lubricant cup is mounted upon the hub and communicates with the recess, and ducts communicate with the recess and lead to the periphery of the wheel.

879,640. Campaign-cane. George C. Hockenberry, Ravenna, Ohio. Application filed April 11, 1907.

Near the top of the cane is a hollow sleeve containing a storage battery and push button. The handle of the cane is a glass head containing an incandescent lamp connected with the battery through the push button.

879,643. Telephone Circuit. Charles M. Jacobs, Reading, and William J. Thorrowgood, Wimbledon Park, England. Application filed October 12, 1906.

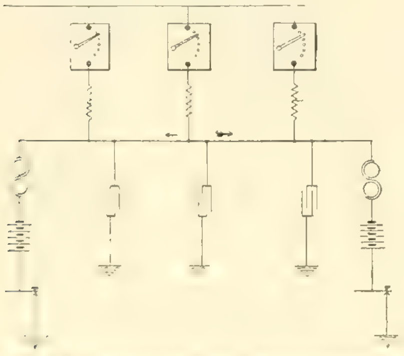
In a system for eliminating or reducing the influence of disturbing currents on telephone circuits, there are in combination a telephone transformer, a phonoporically wound receiver and a condenser, the two latter being connected in series with each other across the terminals of the secondary winding of the transformer and having their intermediate point connected with earth.

879,648. Means for Automatically Closing Electric Circuits. Fayette W. Keeler, Temple, Tex., assignor of one-half to W. Morants, Temple, Tex. Application filed August 18, 1906.

An alarm circuit has a local circuit including an electromagnet and co-operating lever provided with an armature. Circuit-closing means for the alarm circuit are adapted to be controlled by means of the lever and comprise a rotary member and a complemental member adapted to be brought into contact therewith by the action of the lever.

879,650. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed May 14, 1906.

Means to shield receiving devices in a telegraph circuit from impulses induced through neighboring wires, comprise a direct shunt with practically no impedance but capacity for each of the electromagnetic devices, a ground for each of the shunts, in combination with a series of inductance coils distributed along the line, part of the coils provided with a direct shunt having practically no impedance but capacity.



No. 879,651.—NEUTRALIZING DISTURBANCES IN TELEGRAPH LINES.

879,651. [illegible] Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed [illegible]

[illegible]

879,[illegible] [illegible] Frank D [illegible] filed January [illegible]

[illegible]

blocks in this recess. A number of protecting members are supported exteriorly upon the head and cooperate to form an inverted trough.

879,697. Electric Clock-winding Mechanism. Adolf Trilke, Eimsbüttel, near Hamburg, Germany. Application filed December 21, 1905.

There are provided a swingingly mounted weighted lever for each of the wheel trains, an electromagnet, an oscillatory armature having a lifting arm extending into the path of travel of the weighted levers to be depressed thereby on the descent of the levers, and means operated by the armature for making contact when the armature descends to cause the electromagnet to oscillate the armature.

879,699. Electric Pump Governor. Walter V. Turner, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed September 21, 1905. Renewed June 28, 1907.

A pressure governor comprises a controlling device and an actuating piston, a low tension regulating means for causing the movement of the piston to cut in the pump, and a high-tension regulating means for causing the movement of the piston to cut out the pump.

879,709. Pressure Governor for Pumps. Henry H. Westinghouse, New York, N. Y., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed December 13, 1902.

In combination with a number of motor-driven pumps are controlling devices for the motors, and cylinders with pistons for operating the controlling devices, a main reservoir pipe line connecting the reservoirs, and means operated by the main reservoir pressure for supplying compressed air simultaneously to all of the pistons.

879,711. Telegraphic Transmitter. Clyde Williams, Porter B. Mitchell and Sharpe Hathaway, Barton, Ohio. Application filed May 6, 1907.

The transmitter consists of an electromagnet, armature-carrying means, a contact point, keys and contact posts for the keys, and a pivoted plate coacting with the contact point to make and break the circuit through the armature, the plate having adjustable parts disposed on opposite sides of and operated by the armature-carrying means, whereby the period of duration of the break may be varied.

879,723. Attachment Plug. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed January 29, 1904.

A plug for screw-threaded lamp sockets comprises an insulating base, a center contact carried thereby, an outer contact, means for expanding and contracting it, and means for locking this movable contact at both limits of its movement.

879,724. Electric Lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed February 29, 1904.

This pendant lamp socket has a one-piece insulating base with a hole in its top for the leading-in wires and a transverse opening and side recesses connecting with the top hole. A threaded shell and central contact are carried by the under side of the base and connected to binding posts in the two side recesses. A metallic casing is connected to the base and insulated from the live parts by a fiber lining.

879,725. Attachment Plug. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed March 25, 1907.

This is a modification of No. 879,723.

879,729. Trolley-pole Head. George G. Buchanan, Dubois, Pa. Application filed April 21, 1906.

The pole has fitted to its top a triangular frame composed of two diverging arms with sockets, spring springs that engage the trolley head and a guiding member connecting the outer ends of the arms. The trolley head is pivoted inside of a flange at the meeting point of the arms and has a stud projecting through a slot in the guiding member.

879,760. Switch-plug. Henry C. Froelich, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed August 12, 1903.

A switch plug has a longitudinally movable cap with a post secured to the body. A terminal plate is also secured to the body, and has ears and a shank comprising sections pivotally secured to the ears and a pair of contact strips secured to the sections, the sections being spread by the post when it is shifted longitudinally in one direction.

879,765. Support for Electric Service Wires and Cables. Edward H. Greenleaf and Theodore A. Dissel, Newburgh, N. Y. Application filed July 23, 1907.

A support for electric service wires or cables comprises a span wire and a hanger having coils and a depending loop for the reception of the cable, the coils being adapted to be sprung in place on the span wire to hold the hanger in place thereon, and the depending loop being arranged to permit of placing a drawing rope in position therein for drawing the cable into the loop.

879,773. Extension Plug for Electric Lights. Bryson D. Horton, Detroit, Mich., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed October 2, 1903. Renewed January 12, 1906.

This is a further modification of No. [illegible]

879,777. Electro-medical Appliance. Samuel H. Lockland, St. Louis, Mo. Application filed April 22, 1907.

[illegible]

879,789. Regulating Magnet Controller for Electric Elevators. Henry P. McColl, Hawthorn, Victoria, Australia. Application filed May 29, 1906. Renewed August 7, 1907.

This controller consists of a rheostat actuated by solenoids having windings with opposite influences, the windings being controlled by the car switch so that acceleration of the motor may be suspended at any speed by the operation of the switch.

879,814. Electrical Typewriter. George W. Donning, East Orange, N. J., assignor to Harry T. Ambrose, Orange, N. J. Application filed March 28, 1903.

A series of electrical terminals is arranged adjacent to the keys so as to be operated by them to close the circuit through a number of electromagnets which actuate the typebars.

879,819. Electric Lamp Socket. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Original application filed July 18, 1907. Divided and this application filed October 26, 1907.

A socket has the end of the shell provided with projections and the cap flange provided with a greater number of symmetrically arranged openings with any of which the projections in the shell can latch.

879,824. Lighting Attachment for Gas and Acetylene Burners. Clifford J. Larkin, Everett, Mass., assignor of one-half to John R. Learned, Newton, Mass. Application filed August 10, 1907.

A body is shaped to present two arms and a foot to embrace the burner. A main electrode is pivoted on one of the arms. A secondary electrode is pivoted on a fulcrum block. Springs are mounted between each electrode and the body.

879,827. Coin-controlled Apparatus. Hermann Meyer, New York, N. Y. Original application filed August 3, 1905. Divided and this application filed December 23, 1905.

The apparatus consists of two electric circuits having a part in common, a motor in both circuits, a coin-controlled switch for closing and opening one of the circuits, a pneumatically controlled switch for opening and closing the other circuit, and pneumatic means for actuating the coin-controlled switch to release the coin and break the coin-controlled circuit immediately previous to closing the other circuit by the pneumatically controlled switch.

879,828. Electro-pneumatic Drill. Olin Proctor, Denver, Colo. Application filed August 26, 1905.

A rock-drilling machine has in combination an actuating motor, an air cylinder provided with spring-pressure valves, to automatically regulate the density of the air in the cylinder, a by-pass or port, communicating with each end of the air chamber of the cylinder, a plunger and a piston adapted to reciprocate in the cylinder independently of each other, the latter constituting a hammer to strike the tool, means for transmitting the motion of the motor to the plunger, a chuck or drill support held in the casing against longitudinal motion, and mechanism for rotating the chuck.

879,830. Attachment Plug. David L. Webb, New York, N. Y., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed April 16, 1903.

This is a still further modification of No. 879,723.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 24, 1908:

446,846. Thermostat. A. M. Barron, Kansas City, Mo.
446,917. Electric-railway Signal. E. T. Harvey, Chicago, Ill.
446,931. Trolley for Electric Railways. S. H. Short, Cleveland, Ohio.
446,967. Electric Time Lock. M. I. Flowers, Springfield, Mo.
446,974. Method of and Apparatus for Electric Welding. H. Lemp and L. M. Schmidt, Lynn, Mass.
446,995. Socket for Incandescent Electric Lamps. J. M. Orford, Bridgeport, Conn.
447,016. Galvanic Battery. M. W. Robinson, Medford, Mass.
447,023. Electro-heating Apparatus. C. E. Carpenter, Minneapolis, Minn.
447,045. Magneto-electric-signal Device. N. B. Ginochio, New York, N. Y.
447,058. Police-signaling Apparatus. B. J. Noyes, Boston, Mass.
447,059. Police-signaling Apparatus. B. J. Noyes, Boston, Mass.
447,060. Municipal-signal Apparatus. B. J. Noyes, Boston, Mass.
447,061. Municipal-signal Apparatus. B. J. Noyes, Boston, Mass.
447,062. Signal Box. B. J. Noyes, Boston, Mass.
447,104. Electric-welding Apparatus. M. W. Dewey, Syracuse, N. Y.
447,105. Independent Electric Clock. W. J. Dudley, Everett, Mass.
447,113. Electric Heater. J. J. Ashbaugh, Chattanooga, Tenn.
447,166. Telegraph Transmitter. S. W. Smith, New York, N. Y.
447,177. Regulator for Electric Circuits. T. M. Edwards, New London, Conn.
447,194. Telephone. F. [illegible] P. Mercadier, Paris, France.
447,[illegible] Annunciator and Indicator System. J. E. A. Miller, San Francisco, Cal.
447,[illegible] Electrical [illegible] J. A. Parker, St. Louis, Mo.
447,[illegible] Electric-railway System. C. J. Van Depoele, Lynn, Mass.
447,[illegible] Current-controlling Device for Electric-railway Cars. J. C. Chamberlain, New York, N. Y.
447,[illegible] Electric-motor Mechanism. S. E. Mower, New Haven, Conn.
447,[illegible] Secondary Battery. S. C. C. Currie, Philadelphia, Pa.
447,[illegible] Electric Railway. R. M. Hunter, Philadelphia, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLII. CHICAGO, MARCH 7, 1908

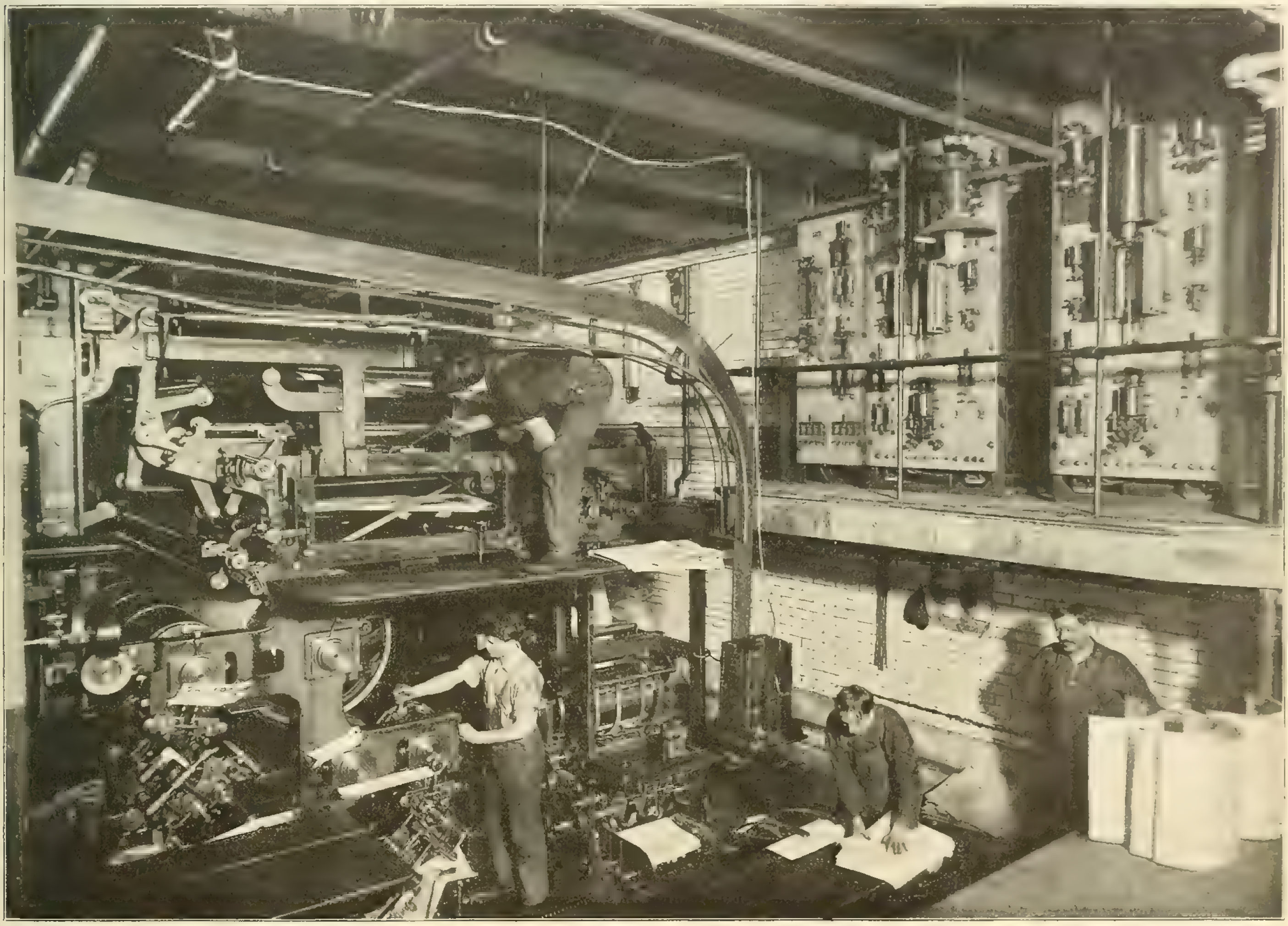
The Use of Electricity in a Large Newspaper Pressroom.

There are but few industries in which the element of speed is of such great importance as in the publication of a large city newspaper. The demands of the public, as well as keen competition, require that the minimum possible time shall elapse between the occurrence of any public event and its being brought before the public eye.

The most important factors contributing to the quick publication of the news of the day are the perfection of the telegraph and telephone in communicating the events to the editorial rooms, the use of linotype machines in setting up the type, of stereotyping machines for making the printing plates and finally the development of the large printing presses that transform the paper from large rolls to completely printed and folded newspapers ready for sale. It is of interest to note that electricity made the first of these factors possible and is becoming more and more a valuable adjunct to the other factors, so that it is becoming more apparent every day that the modern newspaper is the product of electrical methods applied to the highest type of machinery.

One of the largest and busiest newspaper printing establishments in the country is that of the Chicago Daily News. It is of particular interest in that it makes very extensive use of electrical machine driving and contains many ingenious labor and time-saving appliances, most of which are electrically operated, and were developed on the premises by Mr. Irving Stone, mechanical superintendent of the Daily News. The electrical equipment was described in an article in the Western Electrician ten years ago, but since then the installation has been greatly enlarged and entirely changed. The plant works day and night, running off on weekdays the three regular editions, 12, 3 and 5 o'clock, of the Daily News and [illegible] the daily and Sunday editions of the Chicago Record-Herald.

The plant has been [illegible] with the growth of the circulation and the size of the paper, until now it consists of four press rooms, two of them on Fifth Avenue each containing two presses, one on Madison Street, with four presses, and the main room back of these and containing six presses. Adjoining the last room are the boiler and engine rooms and two stereotyping rooms containing three stereotyping machines that mold the plates for all the 14 presses. There are also a number of stock rooms for storing the large rolls of paper, ink and other necessary supplies.



PART OF THE ELECTRICAL EQUIPMENT IN THE PRESS ROOM OF THE CHICAGO DAILY NEWS

All the 14 presses are of the sextuple web perfecting type and were built by R. Hoe & Co. Each requires 56 plates for a "full dress" and turns out two 28-page papers at each revolution of the cylinders. When running without interruptions at maximum speed, each press can print 24,000 28-page papers an hour. The normal capacity of all the presses is 500,000 28-page papers each afternoon.

Each press is driven by the Kohler two-motor drive, one motor being 50 horsepower and the other 7 horsepower. The large machine is used for normal running of the press through a wide range of speeds and the small one for the extremely slow speeds from dead slow to 10 revolutions per minute, necessary to permit rotation of but a fraction of one revolution for adjusting the cylinders in placing and removing the plates. This auxiliary motor is connected with the main motor shaft through a worm gear fitted with a ratchet-wheel device. The motors are 220-volt, direct-current, compound-wound machines. Their control is entirely by the Kohler system of electrical push-button control for printing presses and will be described below.

The stereotyping machines, two of which are [illegible] the "Autoplate" type [illegible] the large pots shown, which have a capacity of seven tons each. These pots are kept at a uniform temperature of about [illegible] coal fire beneath each one. The casting and cooling of the plates is done with great facility by means of electrical motor-driven machinery, a 10-horsepower motor being used on each machine. The plates that have been used are melted again and recast; a pile of them is shown near one of the pots.

The plates are taken to and from the south press room by means of an endless-belt conveyor with wooden slats on its surface. This conveyor is motor-driven and crosses the main press room on a slight incline. Its use saves a great deal of time and hard work in handling the plates. The printed and folded papers are taken from each press to the main mailing and distributing room by a system of paper carriers and belt conveyors. One of the former is shown at the delivery end of the press illustrated. A bundle of papers is put into a cage and hauled up over an inclined runway by means of a motor-driven hoist and the papers are deposited onto a belt conveyor, carrying them to the distributing room. Each of the 10 presses in the main and west rooms is provided with one of these carrier outfits. The four presses in the south room have their papers carried off by means

of short belt conveyors that run east and west and discharge their papers to another conveyor running south. These conveyors are all motor-driven and save a great deal of time, labor and confusion.

Eight of the presses are installed on the main floor, with their motors and paper reels in the basement. To enable the pressmen to get from one floor to the other with speed and little effort a number of lifts and drops are installed conveniently near to the presses. The drops are of the type commonly used in the stations of fire departments and consist merely of a brass pole passing through a hole in the floor to the basement. The lifts are cylinders running from the basement floor to the ceiling; they have a portion of one side removed to permit a man to enter, step on a platform and press his foot on a spring floor push, which operates a valve in a compressed-air cylinder, and forces the platform up.

A great deal of time was formerly lost in changing from one roll of paper to another. It was necessary to stop the press, remove the spindle of the exhausted roll, substitute a new roll, paste it to the loose end of the sheet and then start up again. To overcome this delay a system of magazine reels has been invented by Mr. Stone and was first installed in the Daily News plant. It provides for continuously feeding the paper to a press without stopping for changing rolls. Two of these reels are shown in one of the pictures. Each reel carries three rolls of paper on separate arms. While one roll is feeding the paper to the press, an exhausted roll can be removed and replaced without interruption by running a new one into place on a truck. This can be done indefinitely. In connecting the end of the paper to the new roll, the beginning of the latter has paste applied to it, the press is slowed down somewhat and the reel is slowly turned by means of a motor so that the pasted end engages the end of the sheet that has been quickly slit along the old roll. Thus a "flying paster" is made and the new roll immediately begins to feed in the paper.

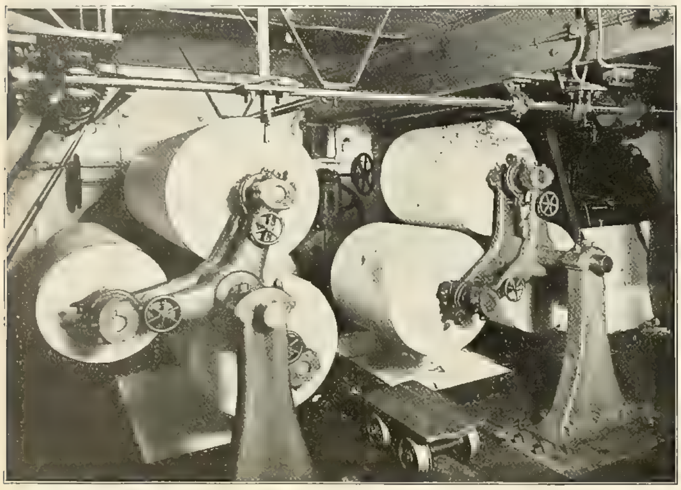
To aid in the feeding, two belts bear against the roll and frictionally keep its peripheral speed equal to the feeding rate of the paper through the press. The driving pulley for these belts is geared to the press train. This almost entirely prevents tearing of the sheet, even when there are flaws in the paper. The reel is turned slowly in either direction by means of a one-horsepower motor operating through a worm and worm wheel. The motor is controlled by a double-throw, double-pole switch suspended from the ceiling. Adjacent to it is one of the controlling stations for the press. The main driving motor for the press is shown in the background. In these particular presses paper is taken from three rolls on separate reels simultaneously. Sixteen of these reels are installed in the plant. They can handle any width of roll up to 72 inches. The rolls most commonly used are 70, 52 and 35 inches wide, depending on the make-up and number of pages to be printed. The 70-inch rolls weigh about 1,500 pounds; the others in proportion.

[illegible] of the press is probably the most interesting thing about the plant. Each press has an automatic motor-control [illegible] balcony. The four panels last installed are shown in one view and two others adjacent to one of the presses in another view. These panels are governed entirely from eight different stations on each press. Each of these stations comprises a tablet board with five push-buttons. These buttons are "On," "Stop" and "Off" on the upper row, and "Run" and "Safe" on the lower row. The "Safe" button locks the controller so as to prevent starting up, if the press is at a standstill, or to prevent speeding up beyond a certain point when running. No change of speed, except to stop, can be made while any "Safe" button is depressed. This provision insures the pressman that the press will not start up while he is removing or fastening plates to the cylinders or making other adjustments. When he is through he pushes the "Run" button, which enables any of the pressmen to start up, if desired.

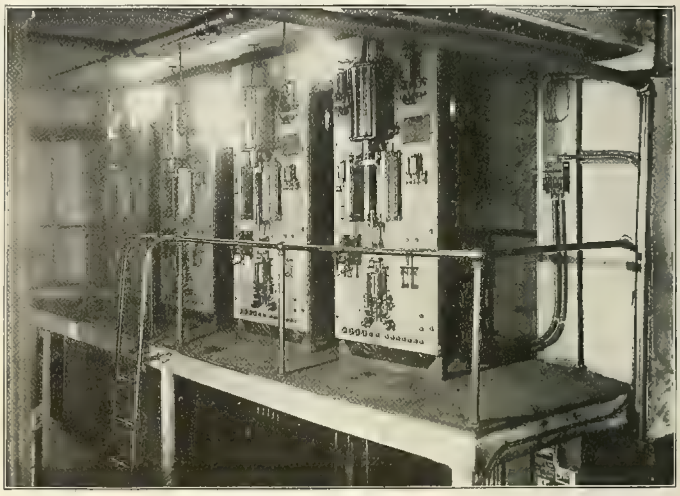
By pushing the "On" button the press starts up and accelerates very gradually to any point desired by keeping the button depressed till the desired speed is attained. In slowing down the "Off" button is depressed in a similar way. The "Stop" button is used only for an emergency or dead stop.

The motor-control panels consist of a main solenoid control switch with vertical sliding contacts, a circuit-breaker and relay switches, all electrically controlled from the several stations on the press. The control is arranged so that the speed is automatically accelerated at a rapid but safe rate. The push-button stations are connected to the main controller and the latter to the motors through iron conduits. The entire electrical equipment was installed by Kohler Bros. of Chicago.

Mr. Stone estimates that since the installation of the Kohler system of control and the use of the magazine-reel system that his plant has approximately 50 per cent. more capacity than formerly. The system was adopted, however, not only because it enables him to do with his 14 presses what would otherwise require 21, but because it enables his pressmen to handle the big machines more easily and with greater safety to themselves and to the machinery. By merely touching a button a press can be run so as to move the cylinders only one-eighth inch as easily as at any speed from this very low rate to full speed. The press can always be stopped and guarded by any of the pressmen from their several stations, thus giving the men a feeling of personal security, which enables them to do quicker and better work. The threading of the paper through the press, adjustment of the plates and regular running are all facilitated, so that the time required to print an edition is decidedly reduced.



Stone Magazine Reels.



Kohler Motor-controlling Panels for Four Presses.

ELECTRICAL EQUIPMENT IN THE PRESS ROOM OF THE CHICAGO DAILY NEWS.

Massachusetts Institute Alumni Banquet.

Sixty members of the Northwestern Association of the Alumni of the Massachusetts Institute of Technology held their annual banquet at the University Club, Chicago, on February 29th. Everett Morss, president of the Boston Alumni Association, spoke of present conditions at the institute of technology, and Isham Randolph gave an illustrated lecture upon the building of the Panama Canal. John Tyrell Cheney, president of the Northwestern Alumni Association, was toastmaster. After dinner the following officers were elected: President, J. L. Shortell; vice-president, Samuel D. Flood; secretary-treasurer, Andrew W. Woodman.

Electric Power for a Mountainous Railroad in Mexico.

The Kansas City, Mexico and Orient Railroad Company is preparing to utilize its concession which it obtained from the federal government for the construction of a large hydro-electric plant on El Fuerte River, in the state of Sinaloa, Mexico. An initial energy of 10,000-horsepower can be generated. The site of the proposed plant is in the most inaccessible and difficult part of the Sierra Madres.

It is planned to use the electric power for operating sections of the railroad through the mountains. The power will also be used in the construction of tunnels and other difficult work in building the road through that section. There are several large mining camps within convenient distance of the site of the power station and transmission lines will be built to the larger mines and power furnished for running the mills and other machinery of the properties.

It is figured that the cost of the proposed plant will be more than made up in the saving of expense that will result from the application of the power in the construction of the railroad through the heart of the Sierra Madres. There is an abundance of waterpower for operating hydro-electric plants in the streams which flow down from the summits of the Sierra Madres and a number of electric-power projects are on foot in that region. In most instances the electrical energy is to be transmitted to mining camps and industrial centers.

Electrical Exports for January.

Electrical exports from the United States for the month of January show a marked falling off compared with January, 1907. There was also a decrease as compared with December, 1907. The total value of all electrical exports for the month of January, 1908, was $999,606, while for January, 1907, the value for such exports was $1,577,449. Considering the two classifications of electrical exports—appliances and machinery—both show a decline as compared with last year. Following are the figures: Electrical appliances—January, 1908, $454,748; January, 1907, $674,367. Electrical machinery—January, 1908, $544,858; January, 1907, $903,082.

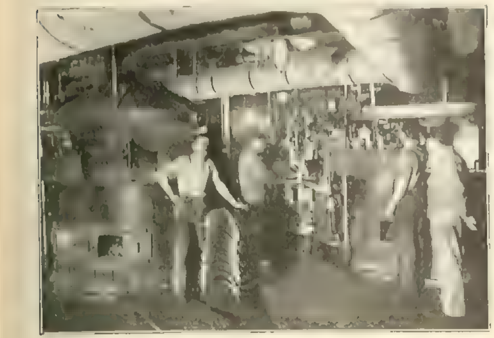
In the item of electrical appliances, the exports to the United Kingdom alone fell off from $114,887 in January, 1907, to $39,564 in January, 1908. The Brazil figures also show a falling off from $110,295 to $61,170. This is partially made up by an increase in the appliances exported to British North America of from $89,563 for January, 1907, to $104,989 for January, 1908. The electrical machinery exports for January also show some large single declines compared with last year, the United Kingdom figures showing a falling off of nearly $80,000; British North America fell off nearly $100,000 and Mexico about $90,000. Japan was the largest importer of our electrical machinery for the month of January, the amount being $150,313, only about $3,000 less than January, 1907.

The following paragraphs show the principal destinations of electrical exports from the United States in January, 1908, the value of each being given:

Appliances British North America, $104,980;

Brazil, $61,170; United Kingdom, $39,[illegible]; Mexico, $38,441; Japan, $33,441; Cuba, $31,138; Central American States and British Honduras, $12,[illegible]; Argentina, $12,438; British Australasia, $10,689; France, $8,974; Germany, $8,373; Belgium, $7,178; Philippine Islands, $1,437.

Machinery—Japan, $150,313; British North America, $54,550; Mexico, $51,501; Brazil, $48,8[illegible]; United Kingdom, $45,713; British Australasia, $29,



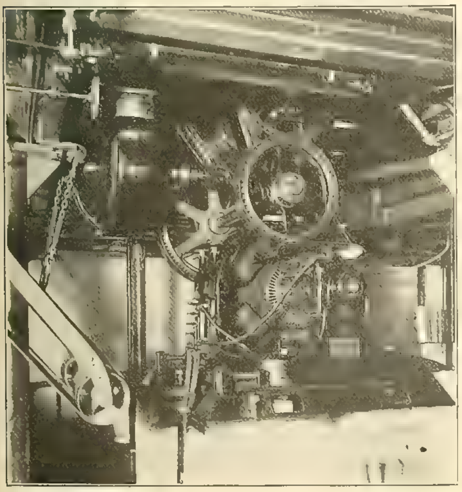
STEREOTYPING MACHINES OF THE CHICAGO DAILY NEWS.

962; Central American States and British Honduras, $13,958; Argentina, $9,376; Chinese Empire, $8,900; France, $7,491; British East Indies, $7,504; British Africa, $3,870; Cuba, $3,162; Philippine Islands, $3,062; Germany, $2,189.

San Francisco to Have Uniform Lamp Posts and Lamps.

The question of deciding upon a uniform system of poles and lamps for the electric lighting of the principal downtown streets of San Francisco is to be settled soon. General Manager Black of the United Railroads has notified the artificial lights committee of the Board of Supervisors that a contract is to be closed at once for the ornamental power and lighting poles which his company promised to erect on Market Street when granted permission to operate overhead trolley cars on that thoroughfare. The city will pay for the current and the San Francisco Gas and Electric Company, which has the city lighting contract, will furnish the arc lamps.

The city has never had adequate electric lighting downtown. While many arc lights on wooden poles have been in use in the outlying districts, gas



DOUBLE MOTOR EQUIPMENT OF A DAILY NEWS PRESS.

lighting was until recently the main dependence in the principal business centers.

Several of the local improvement clubs have interested themselves in the subject and designs have been secured from architects and engineers. The Board of Supervisors insists upon a uniform design. Poles of several designs have been erected for demonstration purposes and a decision upon the best type will be made soon.

While there has been considerable enthusiasm over the esthetic side of the pole designs, the practical questions of adequate lighting according to the best modern practice and keeping the first cost down to a reasonable figure seem to have been overlooked thus far. One of the ornamental poles proposed costs $150 and the other $200 each. It is understood that the Daniels concrete pole has been completed. The pole, [illegible] lamp in a 20-inch [illegible] South Park system, Chicago, [illegible] it is said, at a figure to permit of installing probably twice as many poles for the same first cost and have more illumination in consequence. It is almost certain that arc lights will be adopted, although one of the designs submitted was intended to carry a cluster of five incandescent lamps.

Cities and towns of California are moving quite generally in the matter of putting in ornamental electric street lamps. In Los Angeles the Board of Public Works is receiving bids for poles, wire, etc., for ornamental lights on Fourth Street. In San Diego ornamental lights have been ordered placed on Sixth Street, and in Ocean Park similar lights have been ordered placed on the water front. In Oakland, Berkeley, Los Angeles and other towns ornamental lights have already been placed on a number of streets.

Passing of a Unique Mexican Street Railway.

The Matamoros and Santa Cruz street railway which has been purchased by W. K. Bixby, Thomas West and associates of St. Louis, Mo., is one of the most unique lines of transportation in Mexico. It has no counterpart in the United States. It was built by Mexicans nearly a half century ago, soon after the establishment of the town of Brownsville. The city of Matamoros is nearly three miles from the ferry landing on the Mexican side, just opposite Brownsville. The street-railway line runs from the ferry landing on the bank of the Rio Grande in Mexico to the main plaza of Matamoros. Returning from the plaza, the line makes a loop through the main business streets of the town and returns to the main line before the limits of the city are reached.

The passenger station of the National Railroad of Mexico is situated about two miles from the main plaza in Matamoros. It is a trip of five miles from Brownsville to the station of the National Railroad, and the trip can be made only a part of the way by street cars.

The Matamoros and Santa Cruz Railway never fails to attract the attention of American visitors. The cars, one of which is shown herewith, are of such miniature size as to have the appearance of toys. A man of ordinary height must lower his head in order to enter the door of the car. Four cars are operated on the line, and each will accommodate, when crowded, as many as 15 persons. To do this some of the passengers must stand upon the platforms. Eight persons fill the car very comfortably. The track is narrow gauge.

It is said that this miniature railway and cars were built to fit the little mules which pull the wheeled vehicles over the line. One mule is hitched to each car. The animals are almost as small as the average-size burro. In the days when the railway was built, it is said, no mules or horses of larger size were to be had in this part of Mexico. It was decided by the projectors of the enterprise that it would be too expensive to operate each car with two mules, so it was planned to build a line of one-mule capacity. Each car is provided with a driver and conductor.

A peculiar checking system of passenger fares has been in operation on this line. The fare between the two terminal points is six cents Mexican money, equivalent to three cents United States coin. When the passenger enters the car to make the entire trip the conductor collects the fare and hands the passenger a small brass check, resembling in appearance the one-cent coin of Mexico. At a point midway on the line is a little shanty, which is occupied by the auditor. When the car reaches that point the auditor enters and collects the brass checks which the passengers were given in receipt for their fares. In this manner a count is kept of all fares that are paid to the conductors.

The antique and unique features of the little railway are to be done away with by its new owners. It is planned to erect a large electric power station upon the bank of the Rio Grande and to completely rebuild the line and operate it by electricity. It is also proposed to extend it to a connection with the National Railroad at its passenger station.

The most important of the proposed improvements, however, is that of extending the line into Brownsville, and to make it a part of the Rio Grande Railroad, which runs between Brownsville and Point Isabel, a distance of 22 miles. The Rio Grande Railroad is now operated by steam, but it is planned to convert it into electric traction. [illegible] Cruz electric-railway system. Point Isabel is sit[illegible] a popular summer and winter resort.

[illegible] international bridge across the Rio Grande will have to be built. A concession from the Mexican [illegible] government must first be obtained before the inter[illegible] proposed bridge. Application for the concession is already pending before the proper authorities of the Mexican government.

[illegible] railway are the principal stockholders in the St. Louis, Brownsville and Mexico Railroad, and it is reported that the proposed bridge across the Rio Grande will be used also by that line to gain entrance to Mexico.

Minnesota Central Station Men's Association.

A meeting of the central-station managers of Minnesota, called by E. E. Rines of the Northern Electrical Company of Minneapolis, who is also interested in several central-station plants, was held in Minneapolis a few days ago. The object was to organize for the purpose of bringing about mutual helpfulness in solving the various common problems which now have to be puzzled out individually. About 35 central-station men from various parts of Minnesota were in attendance.

A. H. Lane of Glencoe, Minn., as temporary chairman, pointed out that all lines were finding great profit by organization, and the central-station men were losing much valuable knowledge by their failure to grasp the opportunity open to them. He predicted the ultimate amalgamation of the various

A UNIQUE MEXICAN STREET RAILWAY

electrical societies of America into a general organization.

A permanent organization was effected under the title of the Minnesota Central Station Men's Association, and officers were elected as follows: President, W. R. Murray of Red Wing, Minn.; first vice-president, A. H. Lane of Glencoe; second vice-president, Leonard Peterson of Thief River Falls; secretary and treasurer, Ludwig Kemper of Albert Lea. The returns from the members, present and prospective, indicate a list of about 80, there being that many applications received. Annual meetings are to be held the third week of March each year, the location of the meetings being left to the executive committee, which consists of Adolph Wagner of New Ulm, R. E. Brown of Mankato and D. C. Gordon of Little Falls.

A committee will be named to work with the Legislature for the regulation of electric rates. The association looks forward to securing legislation covering maximum and minimum charges for service upon a scale based upon the size of the town served. There is also to be a standing committee of electrical engineers to answer questions raised by the members on the various problems and troubles which they encounter.

A banquet was tendered by the electrical manufacturing and jobbing concerns at which E. E. Rines was toastmaster. Among the speakers were Adolph Wagner, W. R. Putnam of Red Wing, Mr. Boyd of the Columbia Lamp Company, Joseph Barnard and Samuel Furst. E. H. Brown of the Minneapolis Steel and Machinery Company spoke upon power gas plants and machinery, accompanying it by illustrations. A theater party followed the banquet.

It is said that electricity will be soon transmitted across Green Bay by cable, and it has been estimated that 7,500 horsepower can be developed on the Peshtigo River and transmitted to Sturgeon Bay, Wis., for the new cement plant.

The New Paris Subway.

By A. de Courcy

At this time a number of the large cities of the world are deeply interested in the subject of subway construction for street railways, and in view of this fact, a consideration of the construction features of the new north-and-south subway in Paris, France, will be of interest on account of the novel character of the work.

In general, the new subway runs in a double-track tunnel of about the same section as the standard subway. It runs from the Versailles Gate in the southern part of the city to the Place Jules Joffrin in the northern part. There is also a branch line which runs from the St. Lazare railroad depot to the St. Ouen Gate, the total length of the line being about 8½ miles. The present line is operated quite independent of the Metropolitan subway and is in charge of a company formed for the purpose at Paris under the name of North-South Subway Company. The original concession for this line was granted by the Municipal Council to Messrs. Berlier and Janicot, who afterward assigned the concession to the present company. It is capitalized at present at $6,000,000.

NEW PARIS SUBWAY, SHOWING TUBE UNDER THE SEINE.

One of the principal difficulties in building the tunnel was to get across the Seine. The point for crossing the river being near the Concorde Bridge, quite in the center of the city, a bridge could not be allowed for esthetic reasons. It was accordingly decided to use a system of steel tubes, having one tube for each track. Such a system had already proved a success in England, and it was afterward introduced into France by J. Berlier, who applied it to the construction of several large sewers which were laid across the Seine in the river bed.

A general idea of the steel tube which passes under the Seine may be gained by referring to one

[illegible]

[illegible] There are two tubes of similar construction laid under the river, each tube carrying a single track. At each bank of the Seine the two tubes, which run nearly [illegible] in a common station. At the other end of the station begins the standard form of double-track tunnel, and in this way is effected the junction of the tubes with the main tunnel.

Underground stations are located near the bank [illegible] located under the Rue de l'Université, and in this station is placed the machinery and air compressors which are used for carrying on the work upon the steel tube as it is run under the river bed. From this station the two steel tubes run for a short distance under the pavement and the quays of the Seine, then pass under the river at a grade of 0.040 per 1,000. Under the middle of the river the grade is 0.0015 per 10,000, and when proceeding to the other bank it rises to 0.0351 per 10,000. The figures for both tubes are very nearly the same.

After crossing the Seine the tube passes under the Place de la Concorde and ends at the second large underground station mentioned above. At the opposite end of this station commences the standard double-track tunnel, and immediately after leaving the station the tunnel passes under the Metropolitan subway No. 1, which runs from east to west, after which it proceeds to the northern part of the city. The total length of the two steel tubes lying between the two river stations is 538 and 548 meters, respectively.

The steel tube has a diameter of five meters inside measurement and 5.24 meters outside, being sufficient to carry a single track and the standard subway car. The center of the tube is 1.40 meters above the rail level of the track.

The steel tube is built up of a series of rings measuring 0.595 meter long. It is run under the river by means of the compressed-air shield system, and as the work advances other rings are added to the end of the tube. Each of the steel rings of the tubes is formed in turn of 12 curved plates of cast-steel in the form of voussoirs, including the final or key voussoir, which is of shorter length. By means of flanges these are bolted to each other. In order to make a tight joint there is placed a five-millimeter strip of treated wood between the plates, but this lies only at the outside of the joint, and the rest of the space at the inside is filled up with Portland cement. After a certain length of tube has been put in place it is given a protecting covering. To carry this out Portland cement is injected into the space which has been left between the outside of the tube and the surrounding earth. The cement is run in by means of holes which have been made in the tube for this purpose. By hydraulic apparatus the cement is injected into the outer space at a pressure of three atmospheres, after which the holes are stopped up by means of screw plugs.

In order to run the shield which cuts through the ground in advance of the tube it is necessary to provide an extensive compressed-air plant so as to operate the hydraulic jacks which push the shield forward. At the same time compressed air is needed to keep the tube filled up and thus prevent water from leaking in from the river bed.

For the compressed-air supply there has been installed a plant of large capacity in the underground station lying under the Rue de l'Université, which is the starting point of the two tubes. High-tension lines have been brought here from one of the large city mains, and these are connected to several large transformers which lower the voltage for the electric motors. Each of the latter is coupled to an Ingersoll air compressor of large capacity. At the end of the station the starting points of the two tubes are well embedded in masonry and cement, and leading to each tube is an air-lock.

The underground plant and the interior of the tubes are lighted by mercury-vapor lamps, and these have been found very satisfactory for the purpose.

In general, the stations are built on about the same lines as those of the Metropolitan subway, viz., of a masonry and cement construction, having the side walls of a considerable thickness. In several places the North-South line was obliged to pass along under very narrow streets, and as it lies near the surface the foundations of the houses give a very narrow limit for the width. This difficulty was overcome in the present instance by using a reinforced-concrete construction for the stations. A sectional view of one of these, located at the Rue Falguière, is given herewith. Here the distance between the foundation walls of the houses is only 14.80 meters. Nevertheless, the station has the same inside width as the standard station, namely, 13.50 meters.

In order to support the side walls of the station the work was commenced by digging a trench of the size of the station and then sinking 64 shafts in the ground to the required depth, having 2.40 meters diameter. These shafts were filled up with beton, and thus afforded a solid foundation for the station. Upon this were built the side walls, lying against the foundations of the houses, and afterward the elliptical vaulting of the station. The side walls are in this case only 0.60 meter thick, while the vaulting is only 0.18 meter in thickness. It is, however, reinforced at short intervals by a series of webs, which give it 0.60 meter thickness at these points, the webs being spaced 1.60 meters apart. The top of the vaulting lies within 1.40 meters of the street level.

In the construction, in many cases electric elevators are used in the shafts. At the south end of the line, near the Versailles Gate, has been installed an electric plant to operate two electric locomotives or tractors. The latter are used in the galleries to bring out the earth and are then run along a special track for several miles around the fortifications, taking the earth to the Seine, where it is unloaded upon barges. In the northern part of town, near the St. Ouen Gate, there are also several electric tractors in use for the same purpose.

Moisture Good for Illinois Coal.

There is no advantage in storing soft coal from Illinois mines under cover. In fact, as indicated by experiments by Prof. S. W. Parr of the University of Illinois, Illinois coal keeps best when stored under water.

The loss in heating value of coal kept in exposed places varies from 2 to 10 per cent., according to

STATION AT RUE FALGUIERE IN PARIS SUBWAY.

the report. Coal completely submerged in water and kept submerged until it was about to be used showed practically no loss in heat value. The deterioration of coal kept dry and under cover was practically the same as in the samples kept in the open air, or in some cases slightly greater.

Deterioration in the samples was found to be practically completed in five months. Between five and seven months it went on very slowly and from the seventh to the ninth month there was practically no loss.

Reel for the Use of Armature Winders.

It has often been found desirable, particularly in the winding of dynamo-electric machines which are designed for relatively high voltages, to employ substantially closed core slots and to wind the coils by threading the conductors of which they are composed back and forth through the proper slots. Windings formed in this way are preferable to those formed by forcing previously formed coils

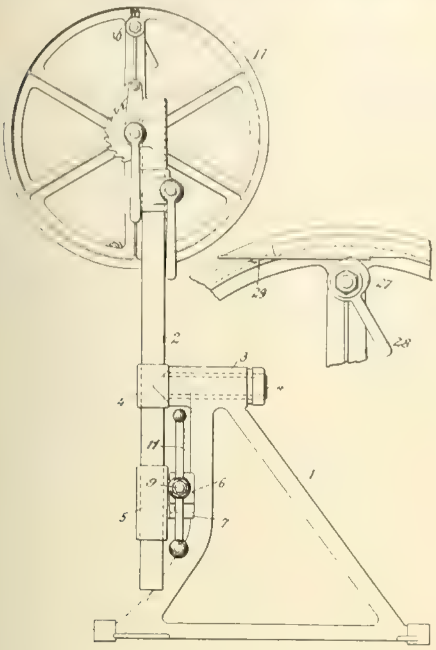


FIG. 1. REEL FOR COIL WINDINGS

into the slots from one end, since such coils require a large number of joints or connections in the conductors in order to connect the proper turns of the winding together.

The winding of coils of the threaded construction, which are commonly known as hand-wound coils, has involved the use of a relatively large amount of floor space, since the conductors which are pulled through the slots by hand are usually of considerable length. Furthermore, the conductors are continually being drawn along the floor in the hand-winding process, and considerable difficulty is therefore sometimes experienced in the use of machines so wound by reason of the rapid deterioration of the conductor insulation, which is largely due to the worn condition of the insulation and the impregnation of its fiber with dirt.

A reel has been invented by Isaac De Kaiser of Wilkinsburg, Pa., upon which the conductor may be coiled and from which it may be readily removed without injury, so that the winding process is materially facilitated and the insulation of the conductor kept clean. This reel was recently patented and the patent assigned to the Westinghouse Electric and Manufacturing Company. The construction of the reel is shown by the two accompanying drawings. Fig. 1 shows a general elevation of the reel and a detail of the device for clamping the end of the conductor to it. Fig. 2 is an elevation at right angles to that of Fig. 1, the pulley being shown in section; a detail of part of the rim is also shown.

The reel is mounted on a pedestal or base which is shown in the form of a tripod and which is made relatively heavy, so that the reel may not easily be overturned. A rod (2) is pivotally supported in a horizontal bearing (3) at the top of the pedestal (1) by means of a swivel (4) in the form of T-pipe connection, one portion of which surrounds the rod and is rigidly attached thereto. The rod may be held in either a vertical or an inclined position by means of a guide bearing (5) which is similar to the swivel except that the sleeve portion which surrounds the rod is fitted loosely thereon, in order to allow the rod to slide through it. A horizontal projection (6) of the bearing (5) is engaged by a sleeve projection (7) which is integral with a traveling nut (8) and perpendicular to its axis. The guide bearing and the traveling nut are both supported by a horizontal screw-threaded shaft (9) that is mounted in a pair of similar bearings (10) and may be rotated by a crank handle (11). These bearings are separated by a considerable distance, and are supported by projecting arms (12) which are attached to the [illegible] the rod.

[illegible] port the pulley (17) in any desired position. The vertical position of the pulley on the rod may be determined by fixing the split bushing (14) by [illegible] upon bushing (14), so that the pulley is free to revolve around the rod when the clamp (15) is loose, or it may be held at any convenient angle by setting this clamp. The pulley itself is rotatably mounted upon a horizontal shaft (18), which is attached to and supported by the bushing (13).

The outer surface of the pulley is conical and is provided with flanges (20) which serve to keep the wire or similar conductor in place. A ratchet wheel (21) is rigidly fixed to the hub of the pulley and may be engaged by a pawl (22), which is supported from the pulley shaft. A handle (23) that is attached to the pulley near its circumference, is employed for rotating it while drawing the conductor through the core slot and winding it about the pulley surface, the ratchet and pawl being employed for preventing the backward turning of the pulley by reason of the strain exerted upon the conductor.

As the end of a conductor is first pulled through a core slot, it is clamped to the surface of the pulley by any convenient means, such, for example, as that illustrated in detail in Fig. 1. This clamping device consists of an eccentric cam (27) having a handle lever (28) to clamp the conductor against a plane surface, which is provided on the inside of the rim, a suitable opening (29) being provided in the rim, through which the end of the conductor may be thrust to be engaged by the clamp.

The pulley is so adjusted vertically that its highest point is on substantially the same level as the core slot from which the conductor is received, and it is then revolved on the rod until the center line of the core slot is substantially tangent to its outer

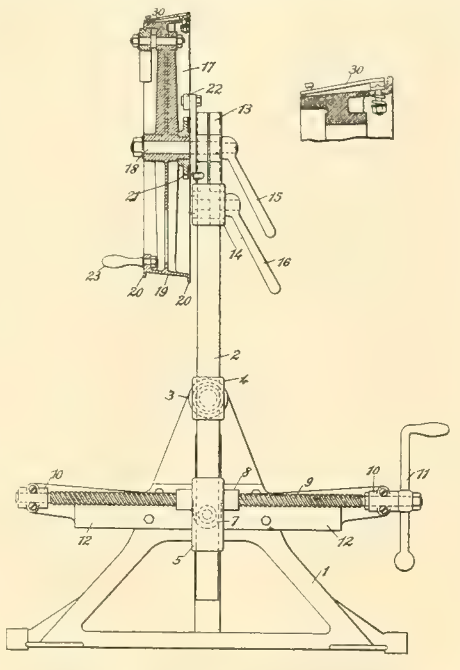


FIG. 2. REEL FOR COIL WINDINGS

surface in a plane perpendicular to the pulley axis. When the reel is properly adjusted in this manner and the end of the conductor is clamped to the pulley, the latter is rotated by means of the handle until the total length of free conductor is wound upon its surface. The conductor is held in place on the pulley by means of a number of guides (30) which are tangent to its surface and near one side while the conductor is being coiled, but which may be swung through an angle of 90 degrees to extend across the surface of the pulley after the conductor has all been wound thereon. The end of the conductor is released from the clamp after the conductor has all been coiled and is threaded back through another predetermined slot to be received, at the [illegible] so that the conductor is perpendicular to its plane of rotation.

A Great Copper Concentrating Plant.

[illegible] blocked out in the mines belonging to the Utah Copper Company more than 100,000,000 tons of ore, the milling of which will probably be begun at the new Garfield concentrator plant just brought to completion. This is estimated to have cost $3,000,000, including a $750,000 power plant.

The concentrator buildings are located 16 miles east from Salt Lake City, on a slope facing the lake. The plant is supplied by means of the Bingham branch of the Rio Grande Western Railroad from the company's mines in Bingham Canon. It is designed to treat 6,000 tons of porphyry daily, with a copper content varying from 1.5 to 2.5 per cent. The resulting concentrates carry more than 150,000 pounds of copper.

Ore is received in a bin building with a holding capacity of 36,000 tons, or six days' supply. The concentrator proper is divided into 12 separate groups, each a complete unit in itself and having a capacity of 500 tons, the machinery of which is driven by means of induction motors.

Ore is taken from the bins in collecting cars, then discharged through centrally placed bottom gates directly onto the grizzlies over the hoppers of four No. 7½ type K Gates gyratory breakers, built by Allis-Chalmers Company, Milwaukee, each having a capacity of 100 tons an hour. These crushers are fed from the hoppers through discharge pockets with vertical gates operated by compressed air. Only the oversize from the grizzlies goes to the crushers; the under size passes along to the first set of trommels, of which there are two for each of the Gates crushers.

Elevated to the milltop, the dry, coarse crushed ore is screened wet through No. 10 mesh screen. Pulp passing the screen is classified and then sent to the jigs. The concentrator floors are occupied by 72 jigs, 1,104 six-foot vanners and 48 concentrating tables. Each of the 12 mill sections may be operated entirely independently from the others.

The power for operating the coarse crushing machinery is supplied from four 150-horsepower, three-phase induction motors, 440 volts. Each motor is belted to a line shaft which drives a gyratory crusher, a set of roughing rolls, two trommels and elevators.

A power station, having nearly 7,000-horsepower capacity is required for the operation of the main mill and a small 700-ton mill at Bingham Canon, originally built as an experimental plant. The power house, built of reinforced concrete, brick and steel, 150 feet by 228 feet, stands a short distance below the mill. Twenty water-tube boilers furnish a boiler capacity of 600 horsepower each for reciprocating engines direct connected to three-phase alternating-current generators. J. G. White & Co. acted as consulting engineers for the plant. Power is generated at 4,000 volts, which is stepped down to 440 volts for use in the mill. Power for Bingham Canon mines and mill is transmitted over a 15-mile line at 40,000 volts.

Electric Versus Gasoline Commercial Vehicles.

Answering the frequent inquiries of large scale wagon users concerning the choice between electric and gasoline machines in the selection of power wagons, Mr. Hayden Eames, general manager of the Studebaker Automobile Company, says:

"Confining our consideration to large cities, in the great majority of cases either one power or the other is distinctly the most economical available for any given service. In general, to accomplish a given amount of work, fewer drivers are required for a gasoline installation than electric, while, on the other hand, the maintenance and station charges are in favor of the electric. This is, of course, a rule of the most general character, from which there are infinite departures to meet the multitude of varying conditions.

"In the majority of cases, the limitations of traffic in cities throw the advantage in economy to the electric on all installations of any considerable size. In some cities of peculiar topography, it is expedient to use both types in the same installation."

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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DATES AHEAD.

Electrical Committee, Underwriters' National Electric Association (general meeting), rooms of the New York Board of Fire Underwriters, March 25th and 26th.

Nebraska Electrical Association (annual meeting), Omaha, Neb., April 15th and 16th.

Omaha Electrical Show, Auditorium, Omaha, Neb., April 13th to 18th.

St. Louis Electrical Show (first annual), First Regiment Armory, St. Louis, Mo., April 18th to 25th.

Iowa Electrical Association (annual meeting), Savery Hotel, Des Moines, April 22d and 23d.

Iowa Street and Interurban Railway Association (annual convention), Savery Hotel, Des Moines, Iowa, April 23d and 24th.

Missouri Electric Light, Gas and Street Railway Association, Marquette Hotel, St. Louis, April 23d, 24th and 25th.

Missouri Independent Telephone Association, Kansas City, May 6th and 7th.

Southwestern Electrical and Gas Association (annual meeting), El Paso, Tex., May 7th, 8th and 9th.

National Electric Light Association (annual convention), Auditorium Hotel, Chicago, May 19th to 22d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

AN ENCOURAGING SIGN of improving business conditions is the reopening of some of the Montana copper mines. As a result of the heavy purchases of copper by Europe, the stocks of the metal in this country are said to be low. The price continues in the neighborhood of 12½ cents a pound, and the demand is sufficient to cause the augmentation of the supply. As this demand comes to a considerable extent from the electrical industries, it indicates a hopeful state of affairs in construction work.

MR. EDISON, recently subjected to two severe surgical operations in a New York hospital, is reported to be resting comfortably and to be in excellent condition at this writing. It is believed that he is practically out of danger. This news is a great relief, for a few days ago the newspapers contained very alarming reports in reference to the great inventor's chance of recovery. However, by comparison, all's well that ends well. Although Mr. Edison's friends will greatly regret the discomfort and pain and anxiety of this illness, they will rejoice with deep thanksgiving that it has been no worse. At Mr. Edison's age, and with his family history of longevity, he should be spared for many years to give the world the ripened fruits of his extraordinary powers of practical invention. That this may be the case is the earnest wish of all electrical men—indeed, of all friends of progress. In this wish the Western Electrician joins with deep sincerity.

THE PERFORMANCE of the tungsten lamp is coming so near to a realization of what was predicted for it that its merits are now being appreciated by even those who scoffed at it when it first appeared about a year ago. The new lamps have still some limitations in that they have a high initial cost, should be hung in a vertical position and are always to be "handled with care;" nevertheless, their high efficiency, good quality and steadiness of illumination outweigh these considerations in an increasing number of installations. The result of this has been such a rapidly increasing demand for tungsten lamps that manufacturers seem to be unable to provide a sufficient supply. In many instances it has been impossible of late to get as few as a dozen lamps in one batch. While this does not mean a wholesale revolution of the incandescent lamp industry, yet it is a significant indication of the strong tendency among electrical men to adopt a "good thing when they see it," even if it means a considerable outlay of money to get it.

STANDARDIZATION in the matter of stopping street cars at crossings in American cities would be desirable if it could be effected. At present, in some cities the cars stop at the farther crossing; in some they stop at the near crossing, and in some at both crossings. With the consent of the municipalities it might be standard practice to stop uniformly at the farther crossing and perhaps at both crossings in the case of wide streets or boulevards. Local conditions affect the matter somewhat, for with poorly paved or badly cleaned streets the near crossing is of course objectionable. The farther crossing is apparently the favored one, and if the American Street and Interurban Railway Association, perhaps in co-operation with the League of American Municipalities, addressed a circular letter to the authorities of all important American cities, it is possible that concerted action could be taken. If a standard practice could be established in this simple matter, the day of the visitor in a strange city standing on the wrong crossing and watching the unstopping car with wrath in his heart would be over.

FOR SOME time past a good deal of attention has been paid to the electric propulsion of ships in its application to ocean-going liners, and a paper has just been read before a Scottish engineering society which went into the question in some detail. The underlying principle of the proposal made by the author was the use of a high-speed turbine running at a uniform velocity for all speeds of the ship and driving a generator from which electric power would be taken to variable-speed motors coupled direct to the shafts of the propellers. Naturally the author placed as outside the range of practicability the use of direct-current motors for this purpose, but recommends three-phase induction motors, the problem of speed control, in connection with which he now regards as solved. The author later gave details of a 17,000-horsepower ship having propellers 8 feet 1½ inches in diameter, running at 377 revolutions per minute and a speed of 20¾ knots. The probable maximum efficiency of the propeller was put at 62 per cent. under present conditions, whereas with electric-driving, propellers of the diameter of 14 feet could be used at 140 revolutions per minute, and the efficiency was calculated at not less than 70 per cent. The author admitted that it was not possible to base any generally conclusive argument upon these data, but there is sufficient encouragement to give detailed study to the subject.

IT HAS been pointed out that not all kinds of electric heating are of material advantage to the central station, and some, even, may be of great disadvantage. With the great increase in demand for heating by electricity, the electric companies should, therefore, not overlook this suggestion in carrying out their new-business campaigns. Mr. S. M. Kennedy has given it as his experience that by far the most profitable source of income to be derived from electric heating is that produced by the installation of a large number of small electric appliances, rather than by a small number of large current-consuming devices. The heating of rooms, instantaneous water heaters and similar devices using a large amount of current are among the latter class, and as they require a considerable number of amperes the electric company supplying them with current must go to considerable expense for additional transformer and meter capacity, and, frequently, heavier service connections. In addition, many of these large-sized current-consuming devices are used for only a short period at a time, and they are liable to be used at any time over the peak, and thus tend to load up a plant without commensurate returns.

The smaller devices—flatirons, chafing dishes, toasters, broilers, coffee pots, etc.—can be used by consumers through the lighting service. They require no increase in investment and at the same time bring the highest rate per kilowatt. Most of these smaller devices, also, are required daily, and in the aggregate their use amounts to an increased income for the supply company. Electrical appliances that may be installed on the lighting meter, according to the experience of Mr. Kennedy, noted in the N. E. L. A. Bulletin, should not exceed a consumption of five amperes. The contract department of an electric company may guide and direct so that the desirable class of heating may be put on the lines and the others diverted in another direction. Again, the great majority of residences wired for electric service have no circuits for heating purposes, and if the owners or occupants of these houses were compelled to install heating circuits in order to use electric appliances, the larger number of them would not use the electric appliances at all.

Rockford Electrical Men Dine.

One of the most pleasant gatherings of electrical men this winter was the first annual dinner given by the Rockford Edison Company to the allied electrical interests of Rockford, Ill., on February 20th. The Edison company is foremost in the movement to "Boost for a brighter, bigger, better Rockford," and the dinner, an excellent one, served well to further the company's purpose of getting all the electrical interests working in harmony.

F. H. Golding, manager of the Rockford Edison Company, and the speakers of the evening were seated at the table at the west end of the hall, and two other tables extending east were occupied by the other guests of the company, including, besides the electrical men, the architects of the city and members of the press.

Mr. J. Stanley Browne presided as toastmaster and by his eloquent and practical remarks started the feeling of goodfellowship which prevailed throughout the evening. Manager Golding had provided as the principal speaker of the evening, Mr. J. Robert Crouse of Cleveland. Mr. Crouse spoke along the lines of co-operative commercialism in the electrical field, and his remarks were well received, his carefully thought-out suggestions intended to create a unity of interests for the good of all being enthusiastically supported.

Other speakers were George D. Roper, manufacturer; E. E. Bartlett and F. E. Sterling, representing the local press; Edward F. Pendergast, electrical contractor, and D. Schureman, architect. Manager Golding closed the speaking and concluded by thanking those present for their assurances of support in the movement toward co-operation.

The Rockford Edison Company, by progressive and enterprising methods, holds a prominent place among the commercial and industrial interests of Rockford. It is always before the public through the columns of the local press, and its service and methods are appreciated.

High-tension Protective Devices Discussed in England.

An interesting discussion has been taking place both in London and at Manchester upon a paper read before the Institution of Electrical Engineers by Mr. J. S. Peck, who is well known in the United States, dealing with protective devices for high-tension circuits. Not much attention has been paid to this subject in Great Britain for fairly obvious reasons, and the author of the paper started off by calling attention to this fact. Mr. Peck thinks most highly of the possibilities of the electrolytic lightning arrester, and described in detail one of this class which is being developed by the Westinghouse company. This consists of a series of dishes connected to a central insulated rod and containing a certain electrolyte, the exact composition of which he did not disclose, saying that three years has been spent in developing it and a large amount of money spent upon the apparatus. There is a special process for treating the individual plates, and the voltages which each plate will withstand varies from 100 to 400, according to the stage of treatment.

More than one speaker in the discussion expressed the view that with the extra high pressures that were becoming common it would be quite safe to dispense with lightning protectors altogether, on the theory that the safety factor upon such lines would be ample protection in itself. Colonel Crompton, the president, stated that in India, where most extraordinary atmospheric conditions had to be contended with, circumstances forced the companies to do without lightning protectors, with quite satisfactory results.

A new form of horn arrester was described by Professor Kapp, which has been devised by Mr. Zapf of the Land und See Kabelwerke, in which the distance between the horns was adjustable, owing to the use of a high resistance, and the accuracy with which this worked was testified to by a subsequent speaker.

Modern Track-bonding Methods in Peoria.

The Peoria Railway Company is using a specially equipped bonding car for rebonding the tracks in Peoria, Ill. The bonds are placed on the outside of the rail, just below the tread, and are electrically welded to the rails. The car takes current from the trolley, and a motor-generator set gives alternating current, which is transformed to four volts and about 2,000 amperes. Placing the bonds this way [illegible] taking off the [illegible] and as the streets are paved with brick only a few brick have to be removed to [illegible] the bond, thus saving a large labor cost in removing the pavement. The rails are first cleaned with a portable emery grinder, which is equipped with [illegible] connection for taking current from the trolley. All the tracks in the city will be bonded to secure a better return.

Technical Graduates Prove Successful.

In answer to some statement recently made by prominent men in the engineering world questioning the final efficiency of technical training in schools, Prof. John R. Allen of the University of Michigan has compiled some very suggestive statistics concerning Michigan's graduates in engineering from the years 1883 to 1897.

President W. W. Brigden of the Michigan Engineering Society is reported to have said at the meeting of the society held January 7th at Battle Creek that it was the custom of university presidents and others to overrate the value of a technical education; "that not more than half the graduates of engineering schools ever put their education to any considerable use. * * * Modern technical graduates who achieve fame could almost be counted on one's fingers."

In reply to this Professor Allen offers the following analysis of the record of the 85 men who were graduated between the years mentioned:

Position.	*No. Men.*	*Pct.*
Presidents of manufacturing corporations	(9)	10.6
Vice-presidents or secretaries	(4)	4.7
General managers	(12)	14.0
Superintendents	(4)	4.7
Chief engineers	(22)	26.0
Consulting engineers	(11)	13.0
Patent attorneys	(3)	3.5
Professors	(3)	3.5

Leaving 24 per cent. as chief draftsmen and in similar positions.

Of the entire 85, only five, or six per cent., have gone into other pursuits.

British Company Plans Important Telephone Construction in Mexico.

Under date of February 25th, from Mexico City, Mexico, the Western Electrician correspondent writes that a British company, which will have its headquarters in London, is being formed for the purpose of installing an extensive system of long-distance telephones and many local telephone exchanges in Southern Mexico. Francisco Alfaro, a well-known attorney of Mexico City, is the representative of the company in Mexico during the preliminary work.

It is stated that the company will operate under a concession which Manuel S. de Corbrera and J. Sitzenstatter of Mexico City obtained from the Federal government for the construction of a long-distance telephone line between Mexico City and Vera Cruz, including the building of various lines in the state of Vera Cruz and the establishment of exchanges in the cities of Vera Cruz, Cordova, Orizaba and other places. The concession also gives Messrs. Corbrera and Sitzenstatter, or any company that they may organize, the right to establish wireless-telephone stations throughout the territory in which they are to operate. It is stated that a study is now being made of the practicability of the wireless system, and that when the method is further perfected it may be installed.

Messrs. Corbrera and Sitzenstatter are already at work constructing underground telephone systems in Vera Cruz. More than five kilometers of conduits have already been laid for the proposed system. The telephone cables in the other towns will also be placed underground. Governor Teodoro A. Dehesa of the state of Vera Cruz is giving the new enterprise his support.

Thomas A. Edison Improving.

The latest reports from New York are to the effect that Thomas A. Edison is rapidly recovering from the effects of the operation at the Manhattan Eye, Ear and Throat Hospital for abscesses in the ear. Following the operation mentioned last week a second one was performed, from which it was feared for a time he might not rally. His condition was temporarily so serious as to cause alarm. Dr. Arthur B. Duel, who performed the operation, does not look for further complications and gives assurance that the great inventor will recover. However, Dr. Duel does not believe, it is said, that the operation will entirely relieve Mr. Edison from the defective hearing with which he has been afflicted for a number of years. Mr. Edison celebrated his sixty-first birthday a few weeks ago.

Use of Electricity in London.

[illegible] ing, and 16,578,716 for public lighting, the cost per kilowatt-hour [illegible] heating, 82,995,205 for private lighting, and 4,377,-875 for public lighting, charging for such supply 1.45d., 3.833d., and 1.62d. per kilowatt-hour, respectively, altogether 125,379,278 units supplied at an average cost of 3.034d. per kilowatt-hour. The average cost per kilowatt-hour for the total supply was [illegible] per kilowatt-hour.

Poles Scarce in Canada.

The Winnipeg correspondent of the Western Electrician writes that a scarcity of telephone poles is liable to hinder construction planned for Western Canada this summer. The British Columbia Lumber Company, the Yale Lumber Company and the Shuswap Lumber Company, all of which supplied poles to the Alberta government last year, say they have been obliged to refuse orders for over half a million poles and are of the opinion that considerable difficulty will be experienced in filling these orders. Representatives of the Manitoba, Saskatchewan and Alberta governments, as well as the representatives of several American companies, are said to be in British Columbia seeking poles. It is expected that fully three times as many poles will be required in Western Canada this year than ever before, and to add to the scarcity the Grand Trunk Pacific Railroad Telegraphs plans an active construction campaign, which includes the installation of a telegraph line between Fort William and Edmonton, a distance of approximately 1,300 miles. In addition the other railroad companies will string a large amount of new wire this summer.

The two varieties of wood in chief demand in Western Canada are tamarack and British Columbia cedar, but conditions are now such that those requiring poles are not over particular about the kind of wood, provided the measurements come up or close to the required standards. Miller & Robertson of Lloydminster, Alberta, have received a contract from the Alberta government for supplying 6,920 poles for telephone work. The majority of these poles will be 25 feet long, but a few are ordered 35 feet long, and all will have a diameter at the smaller end of six or seven inches. These poles are for the long-distance line between Edmonton and Lloydminster.

Interesting Condensing Apparatus in New Orleans.

The new Claiborne station of the New Orleans Railway and Light Company recently extended and rebuilt into one of the best-equipped power houses in the country, has among its many interesting features one which relates to the condensing apparatus and the means taken to prevent the sediment from the Mississippi River being drawn into the condenser intakes.

Four 72-inch pipes have been provided to serve the condenser intake and discharge. They are all extended through the levee, three being installed under the boiler room and one placed under the railway tracks between the boiler room and the levee. Pipes are made in 30-foot lengths of one-half-inch riveted steel, protected by a coating one-sixteenth of an inch thick applied by dipping the sections into a hot compound.

The provision made for removing sand and silt from the water pipes is comprised of water jets installed at 10-foot intervals in the bottom of the pipes, and, by a system of valves, the intake and discharge may be connected at the station end with an Allis-Chalmers motor-driven screw pump, so located as to secure a flow of from eight to 10 feet per second through the pipes. When the cleaning is to be done the jets are first operated to loosen the deposit, which is then worked out by the flow from the pump.

The pump is driven by means of a 700-horse-power, 550-volt induction motor directly coupled to it, and in the construction of its hub, guide vanes and bearing above the propeller wheel, is identical with that used on the large Allis-Chalmers screw pumps built for the New Orleans Drainage Board. Messrs. Sanderson & Porter, engineers, New York city, were in charge of the design and construction of the power station.

The Burning of Coal Without Smoke in Boiler Plants.[1]

By D. T. Randall.

The technologic branch of the United States Geological Survey has been conducting investigations to determine the best method of utilizing the coals of the United States. The law under which this work has been carried on aims to increase the efficiency and prevent the waste of these fuels, especially such as are used by the United States government. It is a recognized fact that the more nearly perfect the combustion of any fuel the greater is its efficiency. With perfect combustion there is no smoke. In view of the need for more complete information on the conditions favorable to the burning of coal with economy and without objectionable smoke in boiler furnaces, extended tests have been made at the fuel-testing plants at St. Louis, Mo., and Norfolk, Va. The results of the St. Louis tests are summarized in the present paper, which has been prepared by the author as engineer in charge of smoke abatement investigations.

The term smoke as used in this paper refers to chimney gases that contain small particles of unconsumed carbon, which give the gases a dark color. Smoke may be of any degree of blackness, but what some persons would call smoke is not considered smoke by others.

Smoke is due to a lack of air at the proper temperature at the point where the volatile gases should be burned, the result being that these gases are only partly burned and the carbon is set free.

The following are reasons why furnaces sometimes smoke:

1. The furnaces and the grates are not properly designed to burn the coal available. There is almost no equipment on the market that will handle equally well all the fuels found in the United States.
2. There is a lack of sufficient draft.
3. The firemen are unskilled.
4. There is not enough combustion space.
5. Wood, paper and other refuse are burned.
6. The load is changed quickly.
7. Excessive overloads are maintained.

Within the last few years there has been a remarkable development in the utilization of coal under the steam boiler. Today many steam power plants in the United States are burning bituminous coal practically without smoke. This has been brought about by improving the design of the furnaces and by careful attention on the part of the fireman.

It is now possible to design and operate boiler plants burning a high-volatile coal which will be practically smokeless under usual operating conditions, giving off no black or dense gray smoke except when a fresh fire is being built. Banking the fire, shutting dampers, etc., causes smoke of a light or gray shade only.

Coal can be burned smokelessly, the same as gas, gasoline, or kerosene oil, if the equipment is properly designed and adjusted. Each of these fuels will give off smoke if conditions are not favorable. All the authorities on the subject of combustion and smoke prevention agree upon the following conditions as requirements for a smokeless furnace:

1. The coal should be supplied to the furnace in small quantities at frequent intervals. The more nearly the feed approaches a continuous and uniform supply the better the results.
2. The air supply should be slightly in excess of the theoretical amount required and be admitted principally through the fuel bed, with an auxiliary supply admitted at the front or rear of the furnace to burn gases from the coal.
3. The temperature in the furnace should be sufficiently high to ignite the gases given off from the fuel bed.
4. There should be a fire-brick combustion chamber of sufficient dimensions and so designed as to cause the thorough mixture of the gases and air, permitting complete combustion before the mixture reaches the boiler surfaces.

Numerous inventions for preventing smoke have been made, based, according to the inventors, on the recognized principles discussed in the foregoing section. Most of them have not been properly designed to meet the severe service to which a boiler furnace is subjected.

The proper design of the furnace and settings, including the breeching and stacks, is a subject of much dispute. All authorities, however, agree that [illegible] air must be admitted to allow complete combustion. This means that ample draft must be provided. Stacks less than 125 feet high are usually unsatisfactory, but steam or electrically driven [illegible] used to produce either [illegible] draft in connection with stacks [illegible] be required. [illegible] be made for the admission of [illegible] It is also now generally [illegible] should be a fire-brick chamber [illegible] for the gases and [illegible] an average of [illegible] from the furnace [illegible] This [illegible] place before [illegible]

[1] [illegible] report to the United States [illegible]

the gases leave the combustion chamber. These conditions have been so successfully met in some plants as to permit the use of low-grade coal without the production of objectionable smoke. These plants are few when compared to the total number in operation, but they indicate the possibilities of securing practically perfect combustion.

The efficiency of the furnace and the degree of success attained by any equipment in the prevention of smoke depend on the following factors: Skill of the fireman, proper design of the furnace and boiler setting, character of the coal, capacity of the boilers and furnaces and load carried.

The skill of the fireman is the most important element in connection with the ordinary equipment. As a matter of fact, the personal element is the greatest hindrance to progress in the abatement of smoke. Both the owner and the fireman must be interested to obtain the best results. Intelligent supervision in the boiler room to secure proper air admission and care in firing will result in the saving of the losses due to smoke or unconsumed gases and to heating an excessive amount of air. At many plants such supervision has reduced the coal bills by 5 to 20 per cent, depending on the coal and the methods formerly in use.

It is a generally conceded fact that intelligent men trained in boiler-room practice could save 10 per cent. of the fuel used in 50 per cent. of the plants of the United States, and that in another 25 per cent. of the plants such men could save 5 per cent. of the fuel. It is the practice of nearly all large power plants to employ a boiler-room expert, and many of them have chemists who make frequent tests and investigations to determine the conditions favorable to the best economy. The saving of only a small percentage of the coal consumed will make a handsome return for the cost of the experimental work. There are now in a few of our larger cities competent engineers who are making a specialty of supervising boiler plants for a number of firms.

A few examples of carelessness and indifference on the part of firemen will in a measure explain why many persons are skeptical regarding the value of mechanical stokers and other smoke-preventing devices.

At a plant which had a smoke-preventing device, but which was smoking, the fireman said a connecting chain had been broken for several days and he "didn't have time to bother with it." It would not have required more than 10 minutes to join the two ends with wire for a temporary repair. In another plant the fireman said: "The thing takes too much steam, and I shut it off." Many other cases of willful neglect have been observed.

Very few firemen can be induced to fire regularly and frequently, because it is easier to put in enough coal to last 20 or 30 minutes at one time and have little or nothing to do in the interval between firings. In one instance the engineer took occasion to measure the draft between the grates before and after firing on a down-draft furnace which had a good draft. The draft before firing was 0.35 inch of water, but after the fireman had thrown on 63 shovelfuls of coal the flow of air was so seriously retarded that the draft increased to 0.62 inch. Great volumes of smoke were given off, indicating this lack of air.

Difficulties are also encountered with stokers. One of the greatest troubles is the tendency of the fireman to poke the fires unnecessarily instead of using or adjusting the attachments provided for feeding and handling the coal. In many plants where it is possible they will shovel green coal into the stokers instead of feeding it through the hopper, and then take a bar and stir up the fresh coal with the coke and ashes, causing smoke and wasting the coal.

It is not an uncommon experience that on inspection the boiler tubes are found to be covered with scale on one side and soot on the other. One plant with nearly 4,000 horsepower had soot hanging from the surfaces of the tubes, and on inquiry it developed that these tubes had not been cleaned for a period of four months, no cleaning having been done since the new master mechanic had taken charge.

The foregoing examples emphasize the facts that the management of the boiler room is a problem for properly trained men and that as the coal burned is a considerable item of expense, averaging about 50 per cent. of the cost of producing power, there is more opportunity to save in the boiler room than in the engine room with any given equipment. The average boiler room is a hot, dirty and otherwise unattractive place. For these reasons but little attention has been paid to it by superintendents and operating engineers in moderate-sized plants. The boiler rooms are managed for the most part by men hired not so much for what they know as for their ability to do hard work, and they get comparatively small wages. There are, however, some mechanical appliances, such as the chain grate, which leave but little to the skill of the fireman.

Many furnaces may be classed as smokeless when attended by careful men, but unsatisfactory when fired by ordinary firemen. In some power plants it is difficult for even a trained man to secure reasonable economy and prevent smoke. This may be due to the fact that the plant is poorly designed. It does not follow that a plant having a high chimney will have a sufficient draft. The chimney may be too small, or there may be many elbows in the flues leading from the boiler to the stack, or there may be serious leakage of air through holes in the flue, boiler setting and breeching. A poor draft is responsible for a great deal of trouble in the boiler room. Difficulty in burning coal in some one furnace in a plant has been reported where investigation showed that the damper had turned on its shaft and instead of being open, as the fireman supposed, was nearly closed. Such difficulties can be avoided only by systematic supervision.

In many plants the grate surface is not properly proportioned to the load carried. This can be remedied in hand-fired furnaces, but not without considerable expense in stoker plants. Some plants maintain fires under too many boilers for good economy; on the other hand, there are probably more in which the furnaces are overloaded.

The hand-firing of plain furnaces violates all the principles laid down for securing good combustion. The coal is usually supplied in large quantities at long intervals, and the result is that at the times of firing the temperature of the furnace is lowered, the resistance to the flow of air through the fuel bed is increased, and consequently great quantities of combustible gas are generated which cannot be burned for lack of air and the necessary amount of heat.

Hand-fired furnaces with steam and air jets may save enough by better combustion to make up for the cost of the steam used in the jets. They are looked upon as makeshifts by experienced smoke inspectors and others competent to judge of them.

Hand-fired furnaces with ample combustion chambers and adjustable openings for air admission are suitable for some kinds of coal, if tended by experienced and careful firemen.

Down-draft furnaces have shown decided economy in many plants and have been fairly successful in the prevention of smoke. The principle is a good one, but few installations of these furnaces are properly fired. Whether they can be run smokelessly depends on the required capacity, the kind and size of coal and the attention.

Mechanical apparatus for burning powdered coal in boiler furnaces has been tried in many plants and with but few exceptions has been found unsatisfactory on account of the cost and difficulty of maintaining the furnace. It has, however, proved a decided success in firing cement kilns.

Sprinkling stokers have as yet made little headway in this country. Records given in the Manchester (England) smoke-prevention report show that these stokers are not as successful in preventing smoke as those of the coking type.

Furnaces with mechanical stokers of the overfeed types, including chain grates, which feed the coal gradually and coke it under a firebrick arch, are used more widely than any others except the plain hand-fired furnaces. When these stokers are properly installed, in connection with ample combustion chambers, and carefully operated, they give good results and prevent smoke. Many of these furnaces are not properly installed, and a still greater number are badly operated. The inclined-grate stokers will burn either high-volatile coals or coals high in fixed carbon. The chain-grate stokers are successful in burning high-volatile coals such as are found in Indiana and Illinois. They require less attention from the fireman than other types of stokers, and they can be operated smokelessly when properly installed. This stoker has not been adapted to burning low-volatile coals, such as are largely used in the East.

Underfeed stokers that automatically feed the coal are usually successful with either high or low-volatile fuels when properly installed and operated at a reasonable rate of combustion.

Many furnaces are burning coal unsuited to them, and under the load conditions it is impossible to prevent smoke. A change to another kind, or in some cases to another size of the same kind of coal, would prove satisfactory.

There is at present a general tendency to centralize power, heating and gas plants. In the heating of buildings it is customary, under existing conditions, to generate steam in the building. Where this is done, it is in general considered more economical to install engines for generating current for light and power also. However, many buildings furnish their own heat, but purchase current. Large power or light plants can now be located at any convenient place, say at the coal mines, because of the ease and economy with which electric current can be transmitted; but heating plants, whether for residence or for business districts, must be within a comparatively short distance from the section to be heated, on account of the cost of installation and the losses from radiation. There are now more than 150 central heating plants in the United States, furnishing steam or hot water to residences or business buildings, or to both. The greater number of these plants are located in the coal producing states. Some of them have been built especially for the purpose of heating; others are additions to electric-lighting or industrial plants, and utilize the exhaust steam from the engines. These central plants can be operated without smoke under favorable conditions, and they relieve the smoke situation in a measure. The plan of purchasing both heat and light, not only for residences,

[illegible] houses and hospitals.

The increasing use of storage batteries by street railways and other interests has aided in the prevention of smoke. These batteries furnish the extra power needed when traffic is heavy during rush hours on the street railways and make unnecessary any sudden heavy demands on the power plants. The load on the engines being more nearly uniform, there is less change in the rate of combustion in the furnaces and less smoke, for change of load and crowding of boilers constitute a most prolific source of smoke.

SUMMARY.

The increasing use of gas and coke for domestic, manufacturing and power purposes and the centralization of power and heating plants tend to relieve cities of a large percentage of the smoke now given off by small and inefficient heating and power plants. Notwithstanding the fact that other ways of utilizing coal are growing in favor, it will evidently be necessary to burn coal in small boiler plants for some time to come. These coal-burning plants will continue to keep the problem of smoke abatement before the residents of large cities.

It is recommended that in order to improve the conditions in any city a record of all equipment and furnaces in the power plants be made, and that improvements, methods of operation, and the kinds of coal used be made a special study. It is only by such systematic methods that the local problem can be solved, as conditions in any one city are generally different from those in others, depending on the amount and kind of manufacturing and the character of the coal available.

The personal element is the most difficult obstacle to overcome in the fight against smoke. Study of the requirements, and a desire to obtain good results on the part of the firemen will do more to clear the air in cities than any other influence.

Being principally the result of an imperfect air supply, smoke can be prevented by providing for sufficient air and for its mixture with the gases in the furnace.

Well-designed furnaces may smoke to a greater or less degree, depending on the methods of the firemen, the kind or size of the coal, and the rate at which the coal is burned. They may be expected to give smokeless combustion when burning a suitable coal, except under the following unfavorable operating conditions:

1. When fires are built. The furnace not being heated to the required temperature, the gases cool below their ignition point and escape unburned.

2. When so much coal is burned on the grate that it is impossible to supply sufficient air without frequent poking. This condition usually results in so large a volume of gas from the coal that it can not be properly mixed with air and burned in the combustion chamber. On reaching the boiler surfaces it is cooled, combustion is arrested, and soot and smoke result.

3. When the rate of combustion is suddenly increased, as when more coal is added, and fires are poked to get up pressure in short time.

4. When the fires are checked by closing doors or dampers, thus cutting off the air supply. Banked fires are difficult to maintain and start up without smoke. Automatic dampers are frequently the cause of smoke when not properly adjusted or designed.

There is need of further study of coals, furnaces and combustion, but enough is now known to enable an engineer to design and operate a steam plant without objectionable smoke.

Lord Kelvin's Predicament.

One of the former students of Prof. William Thomson, afterward Lord Kelvin, at the University of Glasgow, was Sir William Ramsay of London, now the celebrated chemist. In the Youth's Companion of February 6th he gives interesting reminiscences of Lord Kelvin, with several anecdotes, including the following, which is rather amusing:

"Nor was the professor always prescient. On one occasion I turned the handle of a large electrical machine while he held a two-gallon Leyden jar by its outside coating, and charged it by the knob. It was not until it was fully charged that it occurred to one of us that while the jar was quite safe as long as it was in his hands, it was impossible to deposit it on the table without his running the risk of an inconveniently heavy shock. Finally, after rapid deliberation, two of us held a towel by its corners, and Sir William dropped the jar safely into the middle. It was then possible to touch the outside without mishap."

The City Council of Salt Lake, Utah, has granted to the Emigrant Cañon Railway Company a franchise for an electric street railway in that city.

QUESTIONS AND ANSWERS.

Fusing Point of Porcelain.

[illegible]

ANSWER.

[illegible] it varies from 2,400° F. to 3,000° F., or even higher. What are known as hard porcelains fuse at the higher temperatures. For electrical purposes the porcelains with the lower fusing points are mostly used.

A Compound Dynamo that Loses Voltage.

J. T., Tiffin, Ohio: I have a dynamo which should give 600 amperes at 250 volts. It is a compound machine and now runs a little above normal speed. When I have only a small load on and all the rheostat resistance cut out the voltage begins to drop; with 200 amperes the voltage is down to 220 volts. What is the trouble?

ANSWER.

In all probability the series field is connected up so that, instead of aiding the shunt field, it neutralizes its magnetizing power. Therefore the greater the load the greater the loss of voltage. To remedy this, reverse the terminals of the series field. If this does not cure the trouble, it is due to some other cause, which cannot be pointed out without further particulars.

Operating an Electrical Piano from Primary Batteries.

E. B., Marytown, W. Va: We have an electrical piano with a 24-volt motor. As there are no electric power lines of any kind in the vicinity, we have decided to use primary batteries. The motor takes about five amperes at 24 volts. What kind of batteries are best for this purpose and how many cells will it require:

ANSWER.

What are known as open-and-closed-circuit primary cells should be used. These can be operated intermittently or steadily to supply the motor with current. The most common types of such cells use caustic soda as electrolyte and zinc and copper oxide as the electrodes. These batteries give only about 0.7 volt as average electromotive force, so that about 34 cells would be required in series. If the cells were of such a size that they could supply one-half ampere continuously, 10 sets of these would have to be connected in parallel, making 340 cells in the battery. Figuring a couple of dollars per cell, this would make an expensive installation. A small gasoline engine driving a 24-volt dynamo would be found cheaper and to give less trouble than the maintenance of such a battery.

BOOK TABLE.

THE CONSTRUCTION OF DYNAMOS. By T. Sewell. New York: D. Van Nostrand Company. 1907. Pp. (5⅝ by 7⅞ inches), xii., 316, with 233 illustrations. Price, $3.

This book deals with the theory, design and construction of both direct-current and alternating-current dynamos. The subject is treated in a clear, concise manner, involving only elementary mathematics, and is presented in such a way as to appeal to the practical engineer and to the student pursuing the elementary branches of electrical engineering. The volume is divided into 15 chapters, each devoted to a different phase of the subject.

First, the fundamentals of direct currents are taken up. Ohm, volt, ampere, watt, power and energy. Ohm's law, temperature coefficient and specific resistance are clearly defined, and the methods of measuring these discussed. Next in order of treatment is the magnetic field, its production, direction, density, calculation, measurement and purpose. The generation of electromotive force and the principles of commutation are considered, and then the principles of alternating currents, with the wave form, root-mean-square values, frequency, power-factor, self-induction, impedance, reactance and vector diagrams. The effect of iron in an alternating field as pertaining to a dynamo, hysteresis and eddy-current losses and methods of minimizing them are discussed. The effect of capacity in an alternating-current circuit and circuits having inductance and capacity, with the characteristic vector diagrams and mathematical calculations follow in order. Three chapters give a detailed description of the methods of constructing bipolar dynamos, a very clear discourse on the theory of operation, including armature reactions and dynamo characteristics of machines, and the design of a bipolar machine with the necessary calculations. The construction of multipolar machines, methods, diagrams and rules for winding the armature, paral- [illegible]

The author then takes up the theory of the [illegible] tures. This is followed by a chapter on the con- [illegible] ods of building up the armatures and field cores [illegible] ters are devoted to polyphase alternators, covering the subject in all departments, including theory, design, construction, parallel operation and syn- [illegible] addition to the literature on the subject.

[illegible] Floy, M. A., M. E. New York: Illuminating Engineering Publishing Company. 1908. Pp. (6 by 9 inches), 327, with numerous diagrams and illustrations.

The "Colorado Springs case" is well known to electrical men. It related to the arbitration of last year between the city of Colorado Springs, Colo., and the Pike's Peak Hydro-electric Company, based on certain differences relating to street lighting. The author of this book was one of the arbitrators. In his preface he says that the case was memorable because it decided for the first time in a judicial way three questions of importance to those engaged in the business of electric lighting: First, the meaning of the phrase "An arc light of standard 2,000 candlepower; second, the monetary damage accruing by the substitution of a 6.6-ampere series alternating-current arc lamp for "an arc light of standard 2,000 candlepower;" third, the financial damage resulting from the failure to maintain the substituted lamps at their normal operating conditions. The controversy is furthermore of unusual interest and value, because there was put on record, under oath, the opinions of many of the leading experts of this country on questions of lighting, arc lamps and illumination.

Mr. Floy has compiled the records of the case, with an introduction and epitome, and thus a mass of valuable data is collected for all who have to do with the problems of street lighting. Among the experts who testified at the hearing were Dr. Louis Bell of Boston, E. P. Dillon of Colorado Springs, C. W. Humphrey of Chicago, Prof. J. R. Armstrong of Colorado Springs, L. B. Marks of New York, Prof. C. P. Matthews of Lafayette, Ind., W. D'A. Ryan of Lynn, Mass., R. F. Schuchardt of Chicago and George B. Tripp of Colorado Springs.

HANDBOOK OF WIRELESS TELEGRAPHY. By James Erskine-Murray. New York: D. Van Nostrand Company. 1907. Pp. (5½ by 8½ inches), xiv., 322, with 131 illustrations. Price, $3.50 net.

In this treatise the author first describes the discoveries in electrical science which made possible the systems of wireless telegraphy as they exist today. He explains the methods of producing high-frequency currents and of detecting them in various ways, illustrating with diagrams the apparatus involved. The author deals almost exclusively with the open-circuit systems and the types of apparatus based on the inventions of Hertz, Lodge, Jackson, Marconi and Tesla. There are then described, in a concise and practical manner, the leading systems of wireless telegraphy and references cited to more complete discussions. Among the number so treated are the systems of Marconi, Lodge-Muirhead, Fessenden, Hozier-Brown, De Forest, Poulsen, and of the Telefunken Company, and systems transmitting only in a desired direction. This is followed by the theory of alternating currents of high frequency as pertaining to this branch of applied electricity, and the theory of transmission, with curves showing the effect of atmospheric conditions and distances on the operation of systems.

Among other phases of the subject touched upon in the book are: Mr. Tesla's system of world-wave telegraphy; the measurements of insulation, leakage, current, frequency, and wave length; the characteristics and adjustments of transmitters, receivers, interrupters and condensers, and the tests and location of faults. A chapter is devoted to the calculations necessary for the design of a modern wireless-telegraph station, with numerical examples illustrating the use of the mathematical deductions. The book is concluded with a set of tables which deal with inductances, capacities, insulations sparking distances, and similar numerical quantities required by those engaged in this kind of work. The clear, straightforward manner in which the author presents his discussions of the various topics and the completeness with which they are illustrated should make this book popular with students, electrical engineers, and operators interested in wireless telegraphy.

The Wausau Street Railroad Company of Wausau, Wis., has purchased the waterpower at Mosinee at $60,000.

Non-synchronous Generator in Central-station and Other Work.[1]

By W. L. Waters.

The question as to the advisability of adopting the non-synchronous generator for power-station work, was decided adversely by engineers at the time when steam engines and water turbines were the only practical prime movers. But today we have to deal with steam turbines and gas engines, and the coming of these two new types of prime movers has altogether changed the situation in regard to the use of this generator for power-station work. It often happens in such cases that the real meaning and possibilities of the introduction of types of machinery with such fundamentally new characteristics as the steam turbine and gas engine are not recognized until they are accidentally forced upon us. This has been the case in the present instance; the question of the use of non-synchronous generator with steam turbines was not seriously considered until it was brought up indirectly.

As a fundamental characteristic of the non-synchronous generator, for a given load it runs at a certain definite speed above that of synchronism, and (a) it supplies a watt current which represents the power delivered by the generator to the circuit, and (b) it takes a wattless magnetizing current from the system, the magnitude of which depends on the voltage and on the watt component of the current. Hence this type of generator cannot supply a lagging current to the outside circuit, and can only deliver power to a circuit which can provide the lagging magnetizing current required by a non-synchronous generator; for any given speed, the magnitude and phase of the current which the generator will supply is definitely fixed. Also, as the wattless component of the current varies in magnitude when the load of the machine changes, we must have in circuit some apparatus which can supply a variable amount of lagging current, and which will keep the voltage of the circuit constant.

Usually the load on a power station is either non-inductive or has a lagging power factor, so that if this type of generator is used, the lagging current required by the generator, and perhaps also by the outside circuit, must be artificially supplied. There are two ways of obtaining the lagging current required by the non-synchronous generator: (1) from a condenser; (2) from a synchronous generator or an over-excited synchronous motor. It would not be desirable, commercially, to install a condenser specially to supply the required lagging current, as the cost would be prohibitive; but a large cable system has quite a considerable electrostatic capacity, and the lagging current supplied by this system will usually help greatly in reducing the size of the necessary synchronous machine. In any case, however, it is necessary to have a synchronous machine, either a motor or a generator, in the circuit, in order to set the frequency and the voltage. If we have the non-synchronous generator running, together with a synchronous generator, the latter machine supplies all the lagging wattless current required by the non-synchronous generator and the outside circuit, while the voltage of the circuit is decided by the excitation of the synchronous generator.

Obviously, the disadvantage of the non-synchronous generator for power-station work is, that it cannot carry a lagging wattless current, that it requires an additional lagging wattless current to excite it. The power factor of the current supplied by such a generator is a direct measure of the amount of wattless current required to excite it under that particular load. The power factor which can be obtained in designing any non-synchronous generator depends on the size, speed, voltage and frequency of the machine. Low speed, high voltage and high frequency, all tend to lower the power factor which can be obtained.

It has been shown that on high-speed 2,200-volt generators, the power factor rises as high as 98.25 per cent. and that we can obtain on such machines a power factor which averages 97 per cent. to 98 per cent. from one-half to 1¼ load, while the no-load magnetizing current is less than 10 per cent. of the full-load current of the machine. Another advantage of this type of generator is the extremely high efficiency at all loads that is obtained in high-speed machines. This means that these generators have a very low temperature rise at [illegible] rated load, and that they have a very [illegible] overload capacity.

The greatest commercial field for the non-synchronous generator is undoubtedly in connection with [illegible] generators. This type of generator is [illegible] both mechanically and electrically for [illegible] work than any other type of [illegible]. The squirrel-cage secondary [illegible] each bar held in a [illegible] practically requiring no in[illegible] mechanically and [illegible] operated at very high temperatures [illegible]. Comparing this with the

[1] [illegible] of the American Institute of [illegible] Engineers, New York, February [illegible] National Electric Company of [illegible]

rotating magnets of the standard synchronous turbo-alternator, the difference is very great.

A synchronous generator requires direct-current excitation, while a non-synchronous generator requires alternating excitation. The non-synchronous generator is excited by a lagging current taken usually from a synchronous machine, and as this synchronous machine requires direct-current excitation to produce this lagging current, it can be said that indirectly the non-synchronous generator does require a direct-current exciter. But on account of the small air gap of this type of generator, it requires much less excitation than a synchronous generator. The actual capacity of the exciters which are required by a power station consisting of non-synchronous generators, depends on the power factor of the load on the system. The capacity required will usually vary from one-quarter to one-half of that which would be required for the corresponding synchronous generators.

In a system consisting of non-synchronous generators supplying power to synchronous converters it is unnecessary to have any exciters or synchronous machines in the power station. The first converter put in circuit must be run up to speed from the direct-current side, and then thrown on the generator circuit, when it will excite the latter, and the voltage will be decided by the excitation of the converter. In a large system the capacity current of the cables cannot be neglected, so the wattless current to be supplied by the converters will not be directly proportional to the load. Such a system usually requires constant voltage at the direct-current terminals, and in such cases it may be found advantageous to install compound-wound converters with automatic voltage regulators to control the shunt excitation. The voltage regulators would then serve to control the voltage of the generators, and to keep that constant, while the series winding would serve to compound each individual feeder in order to compensate for the voltage drop in that feeder.

Synchronous generators and motors will give a greater sudden rush of current, or surge, in the case of short-circuit than almost any other class of machine. And though they have wave forms which approximate closely to sine waves on no load, these wave forms become so distorted by armature reaction on load, and change so with the magnitude and phase of the current, that there is an excellent chance of introducing such harmonics as will produce resonance. If we were deliberately to try to choose conditions which would be most liable to give trouble from high-power surges and resonance, we could not well choose anything that would be worse than synchronous generators feeding synchronous motors through a cable system of high capacity. The non-synchronous generator is a great contrast to the synchronous generator in this respect, as it tends rather to eliminate disturbances from the line than to originate them. A short-circuit on a system means that the voltage falls to zero, consequently any non-synchronous generator on the circuit becomes dead, and does not tend to supply either power, current or voltage to the short-circuit.

The sudden surge which takes place when any synchronous machine, whether generator, motor or converter, is short-circuited is equal to:

$$\frac{\text{Electromotive force of synchronous machine}}{\text{self-induction in circuit}}$$

After the current has flowed for an appreciable time, so that the magnetism of the synchronous machine has had time to change, the armature reaction cuts down the electromotive force generated, and the current falls to the value commonly known as the short-circuited value, this being the value of the current on a continuous short-circuit.

There is one point, however, that must be considered when operating non-synchronous generators on the system containing considerable electrostatic capacity, and that is that the individual generator units are not too small. A non-synchronous generator can be excited by the lagging current from a condenser, and the voltage to which it will be excited depends on the size of the condenser. In a system consisting of non-synchronous generators and synchronous machines we might, as the result of opening circuit-breakers by line disturbances, have just one generator and one small synchronous unit left running on the line. The capacity current of the cable system would then tend to build up the voltage of the machines until the saturation of the magnetic circuit prevented any further rise.

Distortion of the wave form introduces higher harmonics, and may cause resonance or cross-currents. In a synchronous generator or motor, the wave form of the magnetism is usually badly distorted as the load comes on the machine, this distortion being greater the higher the power factor, and the greater the load. This distortion of the magnetic wave introduces higher harmonics into the wave form of the eletromotive force generated in the armature conductors.

Non-synchronous generators have no distortion of field due to armature reaction, and so long as the iron in the magnetic circuit is not saturated the electromotive force wave form of these generators is virtually a sine wave for all conditions of load. This means that there can be no cross-current between non-synchronous generators, due to difference in wave form, and that they have no tendency to produce resonance in the circuit.

I have endeavored to show that the non-synchronous generator is very much superior to the synchronous generator from almost every point of view, for the purpose of supplying power to motor-generators and synchronous converters through an underground-cable system; and that synchronous converters are less liable to introduce line disturbances than synchronous motors. In some cases it might be considered advisable to install both synchronous and non-synchronous generators, or the station might be one in which the units first installed were synchronous generators, and the later extensions were non-synchronous generators. In such cases it is readily seen that the advantages are obtained to a degree which depends on the ratio of the number of non-synchronous to the synchronous generators. It should be remembered that the non-synchronous generator and synchronous converter give the best combination to insure freedom from line disturbances, and that the synchronous generator and synchronous motor give the worst; combinations of the two systems lie between these two.

With smaller power stations which supply power direct to motor and lighting circuits, the conditions are not so favorable to the non-synchronous generator, as this generator is primarily one for high power-factor loads, and it is at a distinct disadvantage in a station in which the load is of low power factor. The advantages of the non-synchronous generator as outlined above are, however, so great that each particular case should be considered to see whether it will allow of its use. Usually the load on such a station having low power factor consists mainly of motors during the daytime, whereas the heavy peak load is the lighting load at night. We can therefore install synchronous generators sufficient to carry the day motor load, and non-synchronous generators to assist in carrying the lighting load at night.

It is nearly always more economical to supply wattless current in a power station from unloaded high-speed synchronous motors, than from the main synchronous generators. This is more especially the case with steam-turbine or very slow-speed units, as such machines cannot be economically designed with the good regulation and the margin on the fields necessary to handle properly a low power-factor load. Such a machine to carry satisfactorily a certain kilowatt load at power factor 70 per cent. will be about double the size of a unit to carry the same kilowatt rating at unity power factor.

In the above remarks the non-synchronous generator has been dealt with more especially as a steam-turbine-driven unit for generating alternating current. This type of generator, however, often presents important advantages for other and more especial conditions. Two of the most important of such cases are gas-engine-driven alternators and steam-turbine-driven direct-current units. The advantage of the non-synchronous generator for gas-engine-driven units is, of course, that it does not require the extreme uniformity of speed required by a synchronous generator, and the advantage of its application for direct-current generation by turbine units is, that by the use of a non-synchronous generator and synchronous converter, we can avoid the use of a direct-current turbo-generator.

Non-synchronous generators are not put forward as the only possible solution of the gas-engine-driven alternator question, but as the most practical, and that which will recommend itself most highly to the conservative power-station engineer and manufacturer. It is by no means settled that extremely heavy flywheels and powerful dampers are a practical and advisable solution of the parallel-running difficulties.

The other special case for the use of the non-synchronous generator above referred to—the use of such a generator, together with a synchronous converter for the production of direct current—is to meet the special case in which a steam turbine is desired as a prime mover. Reasons which might compel the choice of the steam turbine are numerous: Small overhead space, small floor space, poor foundations, objection to the vibration of reciprocating engines, high steam economy required over a wide range of loads, reduced maintenance and supervision—all these might influence the choice of prime mover. And as the direct-current turbo-generator, particularly for 250 and 125 volts, has as yet hardly established its position as a conservative and reliable machine, some kind of alternating-current generator would be used in combination with a motor generator or synchronous converter.

In comparing a turbine-driven non-synchronous generator and synchronous converter, with a steam-engine-driven direct-current generator, the former is found to be a more flexible equipment, one which will carry heavier overloads, and is usually cheaper.

There are many indications that the day of the large engine-type direct-current generators is past. The inaccessibility of the brushes, the difficulty of building and maintaining a commutator of large diameter, and the numerous other drawbacks of

this type of machine, have caused it to be regarded as an undesirable addition to a power station. It is a question whether the non-synchronous generator and the synchronous converter are not superior to the engine-type direct-current generator in almost every case, and it should always be carefully considered when a new direct-current station is laid out or when any extensions are added to existing plants.

Administration Building for the American School of Correspondence.

The building recently erected for the American School of Correspondence, Chicago, is of interest from both the architectural and the educational point of view. It is the headquarters of the largest institution in the world exclusively devoted to correspondence instruction along technical lines, and its enlisted workers are to be found in all quarters of the globe.

The structure partakes to some extent of the nature of an office building as well as a school.

ADMINISTRATION BUILDING FOR THE AMERICAN SCHOOL OF CORRESPONDENCE.

Its design was therefore a complex problem, dictated by several different considerations. In the immediate vicinity of Washington Park and the Midway Plaisance, an essential link in Chicago's great boulevard system, it has the advantages of surroundings of great natural beauty, and, owing to its proximity to the University of Chicago, it occupies a place in what has been termed the educational center of the city.

This location for the school dictated a treatment in design that would in no wise conflict with the architectural scheme of the other educational structures which, in increasing numbers, are arising in the vicinity. The materials of the exterior are paving brick of two shades, with Bedford stone for enrichment, and moss-green tile in the roof. The building contains four stories and basement. The general interior plan is that of the letter E, the return of the east and west wings enclosing on two sides an open court walled in at the rear and entered through an arched driveway.

The general interior color scheme is seen to best advantage in the vestibule. The high oaken wainscoting, the ceiling beams, and the furnishings are tinted a soft green; the walls and ceiling panels a warm buff, relieved with unique, conventional flowered designs in red, green and purple—the whole blending harmoniously and in pleasing contrast with the general darker tinting of the tiled floor.

In all its interior arrangements and appointments the building is most admirably adapted to the uses for which it was designed. The facilities possessed by the institution for the imparting of thorough instruction in practical courses and the systematic methods that have been evolved as the result of years of experience in meeting the educational needs of those whom circumstances have denied the privileges of technical training at resident schools, are typical of American ingenuity and enterprise.

The offices of administration are on the second floor, the remainder of the building being used for the accommodation of the large staff of instructors, editors and other employes in charge of the various details of the work of the school. A most complete and modern interior telephone system has been put in, connecting all the departments. For facilitating the work of the business office and mailing room, several of the latest electrical appliances have been installed, including an adding machine, a folding machine and an envelope sealer—all operated by electric power. In the basement are the stock room, the shipping room, and also the steam-heating plant. The system of heating is known as the "direct-indirect," the larger radiators on the several floors being located in juxtaposition to cold-air ducts leading from the outside through the walls, an abundant supply of fresh [illegible] being provided at all times. Electricity is used throughout for lighting purposes, all the corridors and larger rooms being equipped with Nernst lamps, the other parts of the building with incandescent lamps. Lavatories with hot and cold water are located on [illegible]

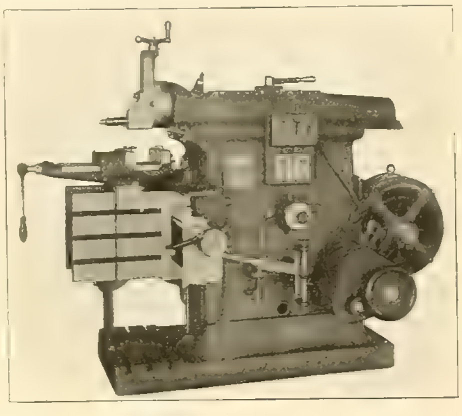
Pond & Pond of Chicago were the architects of the building.

A Westinghouse Receivership Dissolved

The Westinghouse Lamp Company announces that the New Jersey and New York circuit courts have ordered the discharge of the company's receivers and the return of the property to the stockholders. These orders became effective March 1st, and beginning on that date the management of the company will be conducted by the executive officers as prior to the receivership. The business of the company has been carried on at a considerable profit during the receivership, and there has been no cessation in the development and factory operations. The new factory of the company at Bloomfield is now in operation, and arrangements are being made to concentrate all of the manufacturing at that plant. The output of this admirably adapted plant will be about 15,000,000 lamps annually.

Advantages of Motor Drive to Shapers.

The application of electric motors to its shapers has been an important factor in making the plant of Gould & Eberhardt of Newark, N. J., one of the most up-to-date of its kind in the country. This company has kept abreast of rising requirements and has been a pioneer in advancing changes to meet modern necessities. Its line of shapers has been recently redesigned, each machine being made larger and heavier in the working parts, and power, strength, speed and rigidity added to obtain the fullest possible benefits from the new high-speed cutting steels.



HIGH-DUTY SHAPER WITH INDUCTION MOTOR.

The motor-driven shaper is, by all means, the most economical; for the long lines of shafting, countershafting, belting, pulleys, etc., with their incidental losses and waste of power, have been eliminated. Another point in favor of motor drive is the convenient and rapid method it affords for quickly adjusting the machine to suit the work. Gould & Eberhardt have used for the shaper illustrated herewith an Allis-Chalmers induction motor which is connected by means of a silent chain drive, enclosed in a guard. In connection with the advantages of quick speed change enjoyed through [illegible] is furnished for instantly stopping the machine [illegible] saves time in setting, adjusting and inspecting the [illegible] from frequent stopping and starting, the latter [illegible] chine.

Recent Developments in Single-phase Variable-speed Motors.[1]

By [illegible]

In modern motor installations the central-station manager is frequently [illegible] which require variable-speed motor. The advocate of direct current has for many years claimed as one of its distinctive advantages the possibility of obtaining and providing satisfactory variable-speed direct-current motors. On the other hand the alternating-current system of distribution has been very considerably handicapped by the difficulty of obtaining satisfactory variable-speed alternating-current motors.

While it is not yet true that the alternating-current, variable-speed motors are as satisfactory in every way as direct-current motors, yet in the writer's opinion the time is not far distant when some up-to-date and progressive manufacturer will provide and offer to the public alternating-current motors with satisfactory variable-speed characteristics.

So far as alternating-current distribution is concerned, I think it is fair to state that the tendency at the present time seems to be for quite a general distribution of alternating current by means of the three-phase system.

There has been and is yet a very decided difference of opinion as to the relative merits of single-phase, two-phase and three-phase system of distribution, and while it is not in my province in this necessarily short paper to discuss the merits or demerits of the different systems of distribution, I will mention some of the advantages of single-phase distribution.

The central-station manager furnishes the line connection and the transformer as well as the meter for measuring the customer's current consumption. Isn't the central-station manager investing money needlessly if he runs three wires and uses two transformers, or a polyphase transformer and two meters or a polyphase meter, to supply a motor customer which he could handle with two wires, one transformer and one single-phase meter?

The single-phase motor with starting rheostat takes less current from one phase of a polyphase circuit in starting than a polyphase motor would from each of the three phases.

My attention has recently been attracted to a variable-speed motor placed on the market by the Wagner Electric Manufacturing Company of St. Louis, manufacturer of the well-known Wagner single-phase motor. This motor is a modification of its well-known motors and may be furnished in sizes running from one-quarter to 15 horsepower for 60-cycle circuit for either 110 or 220 volts. This motor is built to operate as a repulsion motor and may be wound for reversible or non-reversible operation. With a given load the speed of the motor depends entirely on the voltage supplied to the field terminals.

These motors are designed to operate at full load and at their rated full speed at the normal voltage for which they are wound. In order to obtain the lower speed it is only necessary to reduce the voltage applied to the field circuit. This may be accomplished by inserting an ordinary "resistance-type" speed controller in the circuit supplying current to the motor. Preferably, however, the reduction of voltage to the motor terminals can be accomplished by using an auto-transformer connected to the line of supply and having a number of taps brought out to a switching head and controller arm. By means of this auto-transformer any desired voltage from the rated voltage down to zero may be obtained in steps of a few volts each.

The auto-transformer method of control is much more economical in the use of current than the straight resistance method of control. For example: A three-horsepower, variable-speed, single-phase motor operating a ventilating fan and provided with a resistance method of control, a 110-volt motor operating on 50 volts at approximately one-half its normal speed, would consume from the line 20 amperes of current. With the auto-transformer regulator, however, the current taken from the line would be reduced sufficiently to effect a saving of 10 cents per hour at a 10-cent rate.

The writer's recommendation, then, would be that in the use of single-phase, variable-speed motors, the auto-transformer method of control be used in every case, on account of its economy, as this amount of current consumed is practically in proportion to the speed and load of the motor. A speed reduction of at least 50 per cent., and in

1. Abstract of a paper read at the Milwaukee convention of the Northwestern Electrical Association on January 16, 1908. The author is superintendent of the Beloit (Wis.) Water, Gas and Electric Company.

many cases more, can easily be obtained, and the motors operate in an entirely satisfactory manner.

However, as any alternating-current motor tends to go to synchronism, these variable-speed motors are not particularly suited to conditions where there are wide variations in the load or work performed by the motor. They are, however, quite suitable to and may be satisfactorily employed in all load conditions which are somewhat constant, such as the operation of printing presses, blowers, pumps, conveyors, refrigerating plants and other applications.

Discussion (in part).

F. N. Jewett, Chicago (answering questions of Messrs. Pendell, Kaufman and Jackson): The current required for the single-phase motor, starting under full load, with a resistance starter, is never more than the full-load current, whereas, with the polyphase motors with starters, they are doing pretty well if they hold the starting current down to three times the full current for starting under full load. The starting torque of the single-phase motor, with full-load current, will be about 1½ times full-load torque. Of course, the starting torque of the single-phase motor, with resistance starter, will not be as great as in the case of starter and motor thrown directly on the current. But I am comparing it with the squirrel-cage motor. With the wound motor it will be different. I do not think I can answer the question with reference to the effect on the power factor for the variable-speed motors. They are comparatively new, and that is not a province that I have been particularly posted on.

J. R. Dishington, Racine, Wis.: Two years ago we changed from the direct to the alternating current and adopted the Wagner motor, and at that time the biggest proposition we were up against was the variable speed required for printing presses; but we overcame that by a simple method. When we install printing presses we also furnish sufficient sizes of pulleys to enable variable speed to be used. Generally printers run on one speed until the job is done. We did away entirely with autostarters or things of that kind, and our plan has given very great satisfaction. Printing-press men did not like it very well at first—they wanted a controller the same as in the case of the direct current—but it takes only a minute to change a pulley, and the printers are well satisfied now.

L. L. Tessier, Depere, Wis.: Supposing a plant was running along on a direct current, and the printing office is using four or five small motors, with speed regulation all right, and the plant wanted to change from direct to alternating current, that is, single-phase, how would that affect that man's bill in dollars and cents?

O. M. Rau, Milwaukee: I cannot tell much about this new motor. We made a change such as you suggest some three years ago in the city of Racine, and we were confronted with all these questions. Where we had to handle the matter from the point of view of satisfaction with present equipment we simply put a motor-generator in; and I do not believe in that case the customer's bill has been changed to any extent. He was on our books, for instance, as a direct-current customer, and he is now on as an alternating-current customer. He is operating his direct-current motor from a generator driven by a single-phase, 20-horsepower alternating motor. That was one way of taking care of a customer who was absolutely satisfied and would not want to put up with any experiment. There were quite a few printing presses in which we installed the pulley-changing equipment; and the results have been quite satisfactory. We hope as soon as these new-type motors are fully developed and we can feel sure that the installation is a success that we may be able to abandon such installation as the motor-generator set will furnish current for.

W. B. Voth, Sheboygan, Wis.: We have only put in two or three installations, and the latest one is the new type of the Wagner with the autostarter and a two-horsepower motor connected with Miehle printing press. We give them about six speeds, and the printers are entirely satisfied. It is simply an auto-starter, with a variable, two-horsepower motor. We had direct current, 500 volts, and it is gradually being abandoned, and of course that reduced the man's bill. The alternating-current rate was lower than the direct-current rate, and the customer, at least, is happier. The load is on the lighting circuit. It is in a business district, and the transformer capacity is [illegible] as 10-horsepower motors, with regular resistance [illegible] right with the variable-speed type.

[illegible] station to furnish the motor or translating device, [illegible] In changing, for instance, from 500 direct current [illegible]

everyone that such was contemplated, and that was what they might expect, and in that way we staved off, of course, any immediate installation, and took care of them either by loaning motors or something of that kind. When the time came to make the change we simply announced that we would give the present market price for their apparatus; that is, we would allow the present market price of the old apparatus on the apparatus they purchased from us. I might say that it took up to only about two months ago before we finally made the last change; and you can see from that how accommodating we were in our policy. We did not cut a man off at a minute's notice or anything of that kind. We were very careful to meet his pleasure in the matter. But we were absolute in our statements that we would cut them off. That is to say, the time would come when we would not furnish the service. The last installations that were changed were naturally the churches, and they had, of course, the organs and blowers, etc., connected, and it was very difficult to get them to change over. So we ran a small circuit on the direct current to take care of them. The last church was finally settled and turned over here a few months ago. In winding up, this entire change was handled on a work order. We estimated what it was going to cost us, and had a work order made out on which all the credits and charges pertaining to this matter were made. It is only a few months since it was wound up, and we find that the work order had a credit of something like $2,000.

Alleged Conspiracy in Patent Office Records.

The New York Times of February 28th publishes a Washington dispatch to the effect that Ned W. Burton, a Patent Office examiner; Henry E. Everding, a Philadelphia lawyer, and John A. Heany, an inventor of York, Pa., have been arrested on an indictment charging them with conspiracy to destroy government records and to defraud. The indictment alleges, in substance, that they were engaged in a plan to steal the work of inventors of electric-lighting devices. They were caught practically in the act, it is said, of gathering in for Heany's benefit the ideas of a score or more of electrical experts, some of whom have been working for the General Electric Company. It was at the instance of this company that detectives were put on the track of the three men some time ago, supplementing the work of the Pinkertons employed by the company.

The plan of operations alleged was that Heany filed application for a patent on filaments and electrodes for incandescent and arc lamps. Numerous other men filed similar applications. Burton, it is charged, held up these other applications, and furnished details of what they contained to Heany. Then he notified the defrauded applicants that their claims were already covered in the application filed by Heany.

GENERAL TELEPHONE NEWS.

The Missouri Independent Telephone Association will hold its annual meeting in Kansas City on May 6th and 7th. It is announced that the most interesting programme ever prepared by the association will be carried out. A half day will be devoted to farm mutuals. Houck McHenry of Jefferson City is president, G. W. Schweer of Windsor is secretary-treasurer, and W. R. Barkdull of Windsor is traveling secretary.

The Connecticut Home Telephone Company filed a certificate of incorporation in Hartford on February 24th. The statutes provide that a telephone company may incorporate under the general laws of the state, but that before it can begin business it must procure from a judge of the Superior Court a certificate that public necessity and convenience require the proposed service. The new company, which is an Independent concern, proposes to offer competition with the Southern New England Telephone Company, which for years has had an approximate monopoly in Connecticut. The incorporators are ex-Congressman Lewis Sperry of South Windsor, J. H. Hale of Glastonbury, R. P. Lyon of Hartford and ex-Senator Alembert O. Crosby of Glastonbury.

Negotiations are now being made, it is said, for the sale of the Bell telephone systems in Saskatchewan and Alberta provinces, Canada, to the provincial governments. Such was the announcement made at the annual meeting of the Bell company in Montreal by President Sise. He stated that the company was not anxious to sell, as it had already done in Manitoba, but thought it better to do this than enter into competition with the two governments, which had decided upon an active construction campaign for the coming summer. At the present time the lines and exchanges are being valued by government engineers. There is said to be a probability of a move being made for the purchase of the Bell system in Ontario, where it is exceptionally strong.

CORRESPONDENCE.

Continental Europe.

Paris, February 18.—In view of the great success which was obtained with the radio-telegraphic apparatus placed on board the French battleships Republique and Jules Ferry, the minister of war has now decided to equip the torpedo destroyers with the 1908 type of wireless apparatus. To this effect a series of trials was undertaken not long since on board the destroyers Arbalete and Mousqueton, and they will last until the end of February. These trials will be directed by a special commission sent from Paris, headed by Lieutenants Colin and Jeance. At the same time the battleship Republique will take part in the tests. The vessels will be located in the region of Toulon and neighboring points in the Mediterranean.

Of considerable interest is the new electric railway which is to pass up the slope of Mont Blanc, and the work is nearing completion. It will run from Chamonix to Montanvert, and will be the first French railway to attain the region of the glaciers. It is expected that the line will be opened for service by next July. Some difficult engineering work had to be carried out in connection with the road, and it is operated on the rack-rail system on account of the heavy grades which are met with on the slope of the mountain. The line will connect with the existing Fayet-St. Gervais-Chamonix electric railroad, which has been in operation for some years. There is a magnificent view to be had at the Montanvert station, which lies at an altitude of 1,921 meters, as one has an outlook over the great glacier known as the Mer de Glace, which descends the Chamonix Valley in a mass of ice over four miles long and from 2,000 to 6,000 feet in width, with some of the great mountain peaks in the distance. The new line will no doubt be well patronized by tourists for this reason.

The new method of transmitting photographic images to a distance which has been recently invented in France by Edouard Belin, has proved quite successful, and a considerable distance can now be covered. The method depends on the use of the slight differences in relief of certain photographic points, and over the surface runs a stylus which follows the relief and brings about a varying resistance in the line corresponding to the elevations and depressions. In an experiment which was recently carried out at Paris, the state telephone lines were utilized, passing in a circuit from Paris to Lyons and thence to Bordeaux and returning by way of Tours to Paris. The total length of the line was about 1,040 miles. The photograph of a landscape was very well transmitted over this distance, and the operation lasted for 22 minutes 17 seconds.

Work on the different lines of the Metropolitan subway is making good progress of late. At present, of the nine lines of the first network, there are five in actual operation. Line No. 4, which passes north and south from the Clignancourt to the Orleans Gates, has the standard tunnel portion nearly finished, and what is holding back the completion of the line is the extensive work with metallic caissons which is needed in crossing under the Seine. At present all the caissons have been sunk in place, and it will not be long before they are made to communicate. This part of the work is necessarily slow, and the whole of the line will not be finished before the end of the year. But it is not intended to wait until that time in order to utilize the part of the tunnel which runs from the Clignancourt Gate to the Central Market, lying near the Seine, and in this section it is proposed to have the trains running by the middle of April. It will connect with several of the already existing lines, and will give connection between the markets and one-half the city. As regards the additional lines which are to be added to the present project, the concession for these lines was voted last December by the Municipal Council. The date of commencing the work will depend upon the agreement which is made between the State Council and Parliament. It has now been decided to adopt elevators or moving platforms in some of the stations which lie at a great depth. Heretofore passengers were obliged to mount by staircases. This work will commence by placing an elevator in the Republique station and the construction of a moving platform at the Père Lachaise station. The two systems will be tried during a month in order to see how they work under these conditions. It is expected after that to use the system in about 20 stations.

A. de C.

Great Britain.

London, February 21.—All the British self-governing colonies have signified their intention of adhering to the terms of the radio-telegraphic convention of 1906 with the exception of Newfoundland (which has not yet communicated its decision to the home government), and the Orange River Colony, South Africa, which, as an inland country, sees no advantage in adhering at the present moment. There appear to have been some un

derstanding between certain of the great powers that each of them shall adhere to the convention only in the event of the others doing so. No list of the countries which have come to this agreement has been made public, but the information has been vouchsafed that the United States is not included.

A new surface-contact system of electric traction is being exploited in London just now, and capital for a new limited-liability company is being asked for by public subscription. Not a great deal of information concerning the system is available, but one of the chief points of it is that the line wire and the stud box are only a few inches from the surface of the roadway, thus reducing excavation work to a minimum. An endeavor is being made to arrange for an experimental track to be laid in London. Meanwhile the system has been reported upon very favorably by Mr. H. M. Sayers.

The affairs of the Metropolitan District Railway Company have just about reached a crisis, and at a meeting recently the chairman confessed that all possibility of raising further capital, which is necessary unless the undertaking be put into the hands of the official receiver, has gone, with the exception of the issue of prior-lien debenture stock, which will be practically a first charge upon the undertaking. The loss upon the last half-year's working was no less than $225,000, but there seems to be a very general feeling that the end of the recent cutthroat competition between the transport companies of London has now been seen and that a rather more prosperous future lies before them by reason of the greater co-operation which has been insured by the formation of the London traffic conference.

New types of metallic-filament lamps are making their appearance on the market every week, and there is little doubt that the general expectation that this lamp is to do for the electrical industry here what the incandescent mantle has done for the gas industry is about to be fulfilled.

Early last year a committee was appointed by the Treasury to inquire into the nature of the work carried on at the National Physical Laboratory with a view to ascertaining whether there was any truth in the complaints that testing work was being undertaken of a character that seriously competed with private testing laboratories and which was not intended at the time the Laboratory was inaugurated. This report has now been presented to Parliament, but has not yet been made public.

Swing bridges traversed by electric tramways worked upon the overhead-trolley system are not uncommon in this country, two examples being at Lowestoft and Dumbarton. Partly in connection with the Glasgow Corporation electric-tramway system, a swing bridge of some description is required over the river Clyde. Two engineers, however, have submitted a design for a lift bridge in which nine-tenths of the total weight of the bridge will be counterbalanced by weights, 32 in number, placed eight in each tower of the bridge on guides, and attached to girders by wire ropes working over pulleys. The actual lifting will be done by wire ropes placed at the four extremities of the girders, which form the superstructure, these ropes being connected to a double-barreled drum operated by electric motors. When lowered there would be a clearance between the river and the bridge of about 12 feet, and when the bridge is raised to its full height the clearance would be about 100 feet.

One of the first serious consequences of the industrial depression which has been so prevalent in British electrical engineering circles for the last few years is the announcement that Messrs. Bruce, Peebles & Co., the well-known firm of electrical manufacturers in Edinburgh, has been forced to go into voluntary liquidation in consequence of their inability to raise further capital. A meeting is to be held February 24th, when the whole position will be explained to the shareholders. A curious fact in connection with this affair is that the works at East Pilton are practically full of work, and that the difficulty of realizing advantageously on the securities in which much of the company's capital is locked up is the primary cause of the present unfortunate position in which the business now finds itself. The firm has at present in hand large contracts for the Athens tramways and is also interested in the scheme for the conversion of the Moscow tramways to electric traction, in which capital is involved to the extent of $10,000,000. In fact, the taking of part payment in shares is probably the weak spot, for I believe the company dealt in this manner with the North Wales electric power scheme, which was the first waterpower electrical installation of its kind to be put into operation in this country. With the payment of a dividend of 6 per cent. last year Bruce, Peebles & Co. were probably the last firm in the minds of many here who would first succumb to the difficulties which now beset the electrical industry in Great Britain.

The first train to be worked upon the single-phase electric-traction system in England was run last week upon the Morecambe-Heysham branch of the Midland Railway. The run was only for experimental purposes. G.

New York.

New York, [illegible] ... [illegible] ... Society was held in the [illegible] Building last night. Mr. [illegible] Post, [illegible] of the society and [illegible] of the [illegible] Club of America, lectured on "Navigating the Air." Mr. Post described the latest developments in the field of aeronautics, and gave illustrations with lantern slides and with moving pictures of some of the most noteworthy gatherings and performances in recent days. Models, apparatus and instruments used in air navigation were exhibited, and the method of inflating a balloon demonstrated.

At conferences between Chairman William R. Willcox of the Public Service Commission, August Belmont and Theodore P. Shonts, a definite offer was made by the Belmont interests to sell to the city the Steinway tunnel under the East River for a sum approximating $7,234,476.50, this being based upon the cost of construction, real estate necessary for rights-of-way, interest charges, etc. The offer was placed before the Public Service Commission and Board of Estimate this morning.

Burglars entered the home of Henry S. Pritchett, director of the Carnegie Foundation, early Monday morning and stole more than $1,500 worth of silverware.

Mr. and Mrs. Lee De Forest, who were married on Monday in Greenwich, Conn., sailed on Wednesday on the Cunarder Carmania on their honeymoon tour. They will be abroad about two months.

An intimation that if the Public Service Commission attempts to fix rates for the supplying of electricity furnished by companies doing business in this city, the board will be opposed in the courts, was the first development on Wednesday, at the inquiry the commission has instituted into the question. When Commissioner Maltbie called the first hearing on Wednesday, Charles F. Matthewson, for the United Electric Light and Power Company, and Henry J. Hemmens, for the Edison company, made a protest against it on the ground that the commission had no jurisdiction and was not empowered to fix service rates.

At 3:40 o'clock on Tuesday afternoon the official train that marked the opening of the McAdoo tunnel under the Hudson River, connecting New York and New Jersey, was started. Governor Charles E. Hughes met Governor J. Franklin Fort of New Jersey in the Manhattan station of the tunnel, and with their military staffs the two governors made the trip under the river in the first car of the eight-car train that was made up especially for the purpose. The regular service began at midnight with a great rush of people both ways. The trains are now run on schedule. The opening of this tunnel not only marks the completion of one of the greatest engineering undertakings ever attempted in any city, but it also solves one of the city's greatest transportation problems. W.

Eastern Canada.

Ottawa, February 29.—Hon. Adam Beck, chairman of the Ontario Hydro-electric Commission, in a letter to the premier of Ontario, says that if the proposed treaty between Britain and the United States, recently discussed at Ottawa by Ambassador Bryce, places any restriction on the further development of electrical energy at Niagara, it would be a fatal blow to the industrial interests of Western Ontario.

The special committee of the Toronto City Council on electrical power has recommended the appointment of an engineer to make an estimate on the cost of installing an electrical plant. The Hydro-electric Commission will be asked if it can supply power in seven months, and the Cataract Power Company will also be asked to explain its figures.

The annual statement of the Bell Telephone Company of Canada shows gross earnings of $4,829,000; net earnings, $1,043,000; paid in dividends, $871,000; balance, $172,000. At the close of 1907 the company had 111,118 stations, an increase of 15,973 over the year previous. Plant constructions cost during the year $2,647,000, while the investment in plant now stands at $16,385,000. The company earned 8.3 per cent. for dividend purposes.

Without a dissenting voice of the $4,800,000 of the $6,000,000 common stock voting, the control of the Electrical Development Company of Toronto has passed into the hands of William MacKenzie and his associates in the Toronto Street Railway Company. A special meeting of shareholders was presided over by Sir Henry Pellatt. In addressing the meeting he said that the company had been so harassed by the government and the Hydro-electric Commission, as well as the municipalities, that it had been found impossible to sell $2,000,000 of bonds. In this state of affairs the shareholders were fortunate in having such an offer submitted from Mr. MacKenzie.

At the annual meeting of the Mexican Light and Power Company, held in Montreal, C. H. Cahan, resident superintendent of the company in Mexico, explained that, at present, the operating expenses were high and uncertain, but he saw no reason why the company would not be earning eight per cent. on the stock and pay six per cent. in a very short time. W.

Western Canada.

[illegible] will leave the Bell lines in Saskatchewan completely [illegible] W. H. [illegible] Alb., has charge of negotiations.

The City Council of Edmonton, Alb., is said to [illegible] of telephones, with 1,200 instruments, to the Automatic Electric Company of Chicago.

The earnings of the Winnipeg Electric Company of Winnipeg [illegible] netting a profit of $946,675, which is the largest in the history of the company. Putting bond interest at $270,000, [illegible] this would leave a surplus of $676,675, equal to 11½ per cent. on an average paid-up capital of $5,000,000.

The Manitoba government has now been in possession of the Bell telephone system for nearly six weeks, and the promised reductions in rates have not been made and seem as far away as ever. During the last week a circular has been issued by the telephone commission and mailed to all doctors and nurses in Winnipeg stating that in the future the rates for their telephones will be $50 a year instead of $40, as previously charged. This action recalls the recent statement of Francis Dagger that, owing to the enormous price paid for the system, the government would not be able to operate it on a paying basis with the present rates. Doubtless Premier Roblin and his associates realized this, for no sooner was the deal completed than the announcement was made that all free telephones would be taken from the list unless paid for. It is understood that the Mantoba government is now revising the long-distance charges. The time is being cut from three to two minutes, while the charge is being very slightly reduced. Under the new tariff conversations will cost as much as before, as very few conversations can be completed in two minutes. F. C. Patterson, Winnipeg, is chairman of the telephone commission. R.

New England.

Boston, February 29.—The attempt to secure a law in Massachusetts compelling electric-lighting companies to make a flat rate to all consumers is attracting attention. It has many advocates, but is also encountering determined opposition. Counsel for the Municipal Service League, which is usually active in all efforts to curb the privileges of public-service corporations, surprised the advocates of the measure a few days ago by appearing in opposition thereto. The league representative stated that investigation had developed the fact that every public-ownership plant in this state charges differential rates according to the amount of consumption, and gives discounts. This brought the further statement from Everett W. Burdett, counsel for the Edison Electric Illuminating Company of Boston, that the only two localities he knew of where a flat rate is charged are Upper Sandusky, Ohio, and Newmarket, N. H.

The long legal controversy in Massachusetts over the right of the New Haven road to acquire street-railway lines located within the state, directly or indirectly, is apparently nearing a final decision. On Thursday the report of W. S. Slocum, special master in the suit of the attorney-general against the New Haven, was filed in the Supreme Court. The master finds that the evidence does not show direct acquisition of stock in the roads cited. On the question of whether the roads were held indirectly in such a manner as to make the New Haven's connection with the deals, through holding companies, illegal, the master does not undertake to pass judgment, but submits the evidence which he has obtained regarding such holdings and the indirect control of them by the New Haven officials, who are the chief officials also in the holding companies, to the Supreme Court for final judgment. The outcome of the court's deliberations is awaited with much interest, especially by those who are opposed to what is termed "foreign" control of Massachusetts trolley lines, the New Haven being a Connetcicut corporation.

The bill for the consolidation of the Boston Elevated and its leased company, the West End, has been reported upon favorably by the street-railway committee of the Massachusetts Legislature. B.

Ohio.

Toledo, February 29.—The Dayton Lighting Company has entered into a contract to furnish power for the Dayton Street Railway Company for a term of 10 years. The work on the new line will be commenced early in the coming autumn.

The Newark Telephone Company reports an in-

crease in its net earnings last year of 26 per cent. over the previous year. Rentals increased from $37,667 to $44,755; toll receipts from $8,199 to $9,336, and the gross income was increased 17.9 per cent. The company invested $25,789 in new construction, redeemed $5,000 in bonds, paid six per cent. interest on outstanding bonds, six per cent. dividends on preferred stock, eight per cent. on common, and closed the year with a balance of $80,829.

The Lake Shore Electric will remove the offices of the operating department from Norwalk to Sandusky, where it is believed its subsidiary properties can be operated to better advantage.

The Cleveland and Southwestern recently began running excursion cars from Mansfield through to Cleveland.

It is said that the Lake Shore Electric may equip its entire system with the safety device of the Telegraph Signal Company of Rochester, N. Y. Tests are now being conducted with this idea in view. H. L. S.

Indiana.

Indianapolis, February 29.—According to reports from Goshen, the officials of the Goshen-Battle Creek steam railroad are preparing to electrify the line. When this is done it will give the traction lines of Southern Michigan an outlet and connection with the great interurban systems of Indiana.

A company is being organized in Terre Haute for the construction of an interurban railway from Terre Haute, Ind., to Olney, Ill. It is the purpose to connect with the Evansville, Mt. Carmel and Olney Traction Company's line when completed, thus affording traction service from Evansville to Terre Haute and Indianapolis.

Work has been begun by the Terre Haute, Indianapolis and Western Traction Company to finish the seven miles of road necessary to connect Amo and Danville. When completed the company's cars will be run into Indianapolis over the Danville line instead of the Plainfield line.

Officials of the local street-railway company of Evansville have caused the arrest of William Berger, conductor, and Edward Schelhasse, formerly employed in the office of the company, on the charge of having stolen nearly 200,000 tickets from the company, valued at nearly $10,000. A short time ago it was noticed that conductors were turning in more tickets than they received from the office. A search of Schelhasse's room disclosed the hiding place of 50,000 tickets and the rubber stamp used in stamping the tickets. Schelhasse is said to have made a confession, stating that he had purchased a farm with his portion of the proceeds of the sale of the tickets, and that Berger, his accomplice, had received as much.

The rules committee and the maintenance of ways committee appointed by the Indiana Railroad Commission at the recent conference between the commission and the Indiana Traction men held a meeting in the State House, February 28th. The committees reported that they were making important changes in even the best rules that are now in vogue upon the lines in the state.

The Noblesville Light and Heat Company has been granted a franchise to light the town of Cicero. The company will erect a pole line along the public highway the entire distance of nine miles. The town is already wired, and the contracting company will install incandescent lamps.

The Terre Haute, Indianapolis and Eastern Traction Company is planning to enlarge its power house in Terre Haute and will install therein a new 500-kilowatt generator.

At a recent meeting of the executive committee and trustees of the Hanover College, at Hanover, it was decided to install a general water and lighting system in the college buildings and grounds. Plans and specifications were ordered prepared, and as soon as completed bids will be received for the work. S. S.

Illinois.

Peoria, February 29.—The United Light and Power Company of Moline has been incorporated with a capital of $60,000 to build and operate a heating and lighting plant. The incorporators are W. H. and David Downing and E. Burke.

A new electric pump has been placed in the power house at Divernon and the new tank is ready, giving the town one of the best equipments [illegible] of the Illinois Central.

The Western Insulation Company of Chicago has been incorporated with a capital of $10,000 to manufacture and deal in electrical apparatus and supplies. Incorporators are Francis T. Finney, Edward [illegible] and Charles W. [illegible]

[illegible] Council of Springfield has passed the Brinkerhoff ordinance, but the company will not [illegible] amendments were added to the ordinance, and John H. Brinkerhoff says that the amendments defeat its purpose.

The Bloomington-Pontiac electric interurban rail-[illegible] if the financial conditions remain in condition so the com-[illegible] the company will build a ten or twenty-mile extension toward Bloomington.

The Corn Belt Traction Company will probably build the line from Bloomington to Champaign this year. This company has resumed work on the proposed line from this city to Streator.

The Illinois Traction Company is conducting a series of schools of instruction for the men at the principal points on the lines of the company. The meetings are under the charge of C. F. Handshy, superintendent of transportation.

The Chicago and Alton Railway is preparing to observe the nine-hour law for telegraphers and the 16-hour law for the men on the road. Men are being placed now so that they will be prepared to handle the work when the law goes into effect. A few stations will be closed and the block system between Murrayville and Roodhouse will be abandoned. Operators at the block stations will be transferred to the other stations to make the desired number of men.

Monroe Siberling, the man who built the Prospect Heights car line in this city, died this week at his home in Oak Park, Ill. He built the line at the time to give access to his bicycle and rubber plant at the village of Peoria Heights. The line was later sold to the Central Railway Company, which in turn disposed of it to the Peoria Railway Company.

Mr. Hendershot of Montreal, Canada, has been selected as comptroller for the Illinois Traction Company and will make his headquarters at Champaign. He comes as the personal representative of the Canadian men interested in the company. V. N.

Michigan.

Detroit, February 29.—The Council committee on franchises has rejected the low-fare franchise ordinance submitted by William Baubie, acting for outside capitalists. It was thought that the bond of $50,000 was inadequate; that the term of the franchise, 30 years, was too long, and that the city should not pay half of the cost of paving. The basis of the proposed franchise was eight tickets for 25 cents, universal transfers and five cents for a single fare.

It is reported that work on the Mohawk extension of the Houghton Street Railway Company will be started this spring, the equipment having already been ordered. The road will be eight miles in length. The system may also be extended from Houghton to South Range.

The village of L'Anse will purchase a waterpower on Fall River and build a dam to give a head of 25 feet. The present lighting plant will be moved to the new location. With the waterpower plant it is thought that the system will be self-supporting.

The Detroit, Jackson and Chicago branch of the Detroit United Railway has been granted a franchise for a side track at Wayne and will erect a freight house this year. Permission has also been granted to connect with the line running to Plymouth and Northville. D.

Northwestern States.

Minneapolis, February 29.—The new dynamo for the city electric plant at Sleepy Eye, Minn., has been installed, furnishing current for the day service.

James J. Lambrecht, president of the Northwestern Railway Company of Detroit, Minn., recently addressed the Fargo Commercial Club, and the financial situation of the company was discussed.

An electric-railway company has been incorporated at Thief River Falls, Minn., with a capital stock of $50,000. D. N. Winton is president of the company.

The Hill City Electric Power Company of Hill City, S. D., has been formed to install an electric-light plant. The waters of Spring Creek will be utilized and a minimum of 175 horsepower can be secured.

The developing of a waterpower system about eight miles south of Aitkin, Minn., which the Aitkin Power and Light Company has had under consideration, may be submitted to the voters at the next election.

T. W. Alexander has bought the interests of J. C. Demick of the Stewartville electric-light plant at Stewartville, Minn., and has taken possession.

It is rumored that a project is under way to run a high-tension electric line from Hampton, Iowa, to Chapin and Geneva, giving those towns light and power from the Hampton plant. Union, Iowa, is also considering such a movement.

A. R. Wiswell, village recorder at Wadena, Minn., will introduce a resolution to the council for the purpose of keeping light and water accounts separate from other village business.

An electric line for the Northwestern Interurban Railway Company of Moorhead has been surveyed from Moorhead to the junction with the Soo line.

The municipal lighting plant at Altoona, Wis., is said to be a failure. Mismanagement is charged.

The Business Men's Associations of Glenwood, Wis., and Downing, Wis., are making an effort to secure a right-of-way for the extension of the Eau Claire and Menomonee electric railway line to these two places. R.

Pacific Slope.

San Francisco, February 26.—The Great Northern Railway Company has just closed a contract with the Pacific Coast Pipe Company of Tacoma, Wash., for two miles of stave pipe eight feet six inches in diameter. This is preliminary to the construction of the company's power plant in Tumwater Canyon, which will develop electric power to operate its trains over the mountains. The water will be carried six miles to the site of the power plant, where 12,000 horsepower will be developed.

The City Council of Oakland, Cal., has appointed a committee to confer with a similar committee from the City Council of Berkeley, Cal., with a view to the establishing of a municipal lighting plant to be owned and operated jointly by the two cities.

The City Council of Los Angeles, Cal., has authorized the Board of Public Works to enter into a contract with the Westinghouse company for electric locomotives, which are to be furnished in 75 days, for $3,500 each. They are to be used in connection with the construction of the Owens River water project.

The California Gas and Electric Company of San Francisco is preparing to put in an electric substation at Petaluma, Cal.

The Board of Supervisors of Butte County, Cal., has passed to print an ordinance granting to the Great Western Power Company a franchise for a transmission line through the county.

The Pacific Electrical Construction Company has been incorporated at San Francisco with a capital stock of $50,000. The incorporators are T. V. Morriss, A. St. John, C. E. Nestor, H. S. Johnson and T. L. Wright.

The San Diego Electric Railway Company has filed amended articles of incorporation increasing the capital stock to $5,000,000, in order to allow for the construction of the La Jolla and Point Loma line and other extensions.

Lange & Bergstrom of this city have been awarded the contract for a central fire-alarm station by the Board of Public Works on their bid of $14,248. This was the lowest of 10 bids received. The station will be built on Fulton Street near Polk.

The new packing plant of Swift & Co., near Portland, Ore., is to be operated and lighted by electricity furnished by the Portland Railway, Light and Power Company.

Leon Bly of Red Bluff, Cal., has filed a notice of appropriation of water to be taken from South Battle Creek and to be used for the generation of electricity.

The Del Mar Light, Water and Power Company has been incorporated at San Diego, Cal., with a capital stock of $100,000 by H. W. Kelley, H. E. Huntington, W. G. Kerckhoff and Ed. Fletcher. The company will develop power from the waters of San Luis Rey Creek at Warner's Ranch. The incorporation is the first official recognition of the fact that H. E. Huntington, the Los Angeles electric-railway owner, is connected with the operations of H. W. Kelley and W. G. Kerckhoff in San Diego County.

The Bryant Electric Company of Bridgeport, Conn., has taken a five-year lease on offices in this city.

The United States Forest Service has issued to the Forest Power Company of Silver City, N. M., a permit to construct and maintain an electric power house and transmission line in the Gila National Forest. The company will occupy a site 10 acres in extent. A.

PERSONAL.

Dr. S. D. Cushman, one of the claimants of the invention of the telephone, died in Minneapolis on March 2d at the age of 89.

Mr. Arthur West, formerly chief engineer of the Westinghouse Machine Company, severed his connection with that company recently.

Sir John Gavey, C. B., of London, who recently retired from the position of engineer-in-chief to the general postoffice, has been appointed consulting engineer to the postmaster-general.

Hon. James F. Shaw has resigned the presidency of the Boston and Worcester Electric Companies and of the Boston and Worcester Street Railway Company. William M. Butler has been chosen as his successor in office.

Mrs. Anney McElroy Brett of Lake Park, Iowa, is president of the Southern Independent Telephone and Telegraph Company and president and manager of the Brett Construction, Telephone and Telegraph companies, representing a capital of $500,000.

The Institution of Electrical Engineers has had under consideration a memorial to the late Lord Kelvin, and it is proposed to establish a Kelvin lectureship and that an annual lecture should be delivered. It is further proposed that steps be at once taken to raise the necessary funds for erect-

ing a statue of Lord Kelvin in some prominent place in London and further to establish Kelvin scholarships.

Mr. Alfred Collyer of the Wagner Electric Manufacturing Company of St. Louis, Mo., has been appointed district manager of Canada also for the Wagner company, with offices in the Bell Telephone Building, Montreal, Quebec. Mr Collyer's title will be "sales manager for Canada."

Thomas C. Barr, who had been prominent in street-railway circles in New Jersey for 20 years and who rebuilt the surface roads in Newark for electrical operation, died at his home in Orange, N. J., a few days ago at the age of 50. He gave up the practice of law in 1887 to take up the management and development of street railways in Philadelphia, and two years later went to Newark and soon became president of the street-railway company there.

Charles H. Dalton, one of the best-known men in Boston, Mass., died suddenly on February 24th at his home on Commonwealth Avenue. He was in his eighty-second year. When the Boston Subway Commission was appointed in 1894 he was made a member and chairman of the board, serving 12 years in that capacity. He was a man of means, and was identified during his long and eventful career with many business and public enterprises close to the heart of the city's mercantile and social life. The Boston subways, free from all taint of graft, are a monument to his public-spirited service to the community.

ELECTRIC LIGHTING.

Bonds of $12,000 are proposed for electric lights in Hartley, Iowa.

It is rumored that Aitkin, Minn., will dispose of its light and power plant.

The Downs Electric Light and Power Company has been incorporated in Downs, Kan.

The Blair (Neb.) Electric Light and Power Company is about to install new machinery.

It is reported that an electric-light and power plant may be located in New London, Wis.

The Harwood Electric Heating Company has been incorporated, with headquarters in Hutchinson, Kan.

A. Pace is interested in a company being organized to establish an electric-light plant in Danville, Ark.

The Hill City Electric Power and Mining Company will install a light and power plant in Hill City, N. D.

A municipal electric-lighting plant may be established in Eveleth, Minn., to cost in the neighborhood of $50,000.

The city of Aberdeen, S. D., according to report, will erect an electric-light and power plant at a cost of $200,000.

The North Platte (Neb.) Electric Light and Power Company will call for bids on improvements to the amount of $15,000 in July.

H. O. Woodruff, manager of the Electrical Supply Company of Sioux City, Iowa, has purchased the electric plant at Pender, Neb.

The town of Needham, Mass., has sold its municipal electric-light plant to the Edison Electric Illuminating Company of Boston for $11,000, and enters into a contract with the company for public lighting service.

The Minneapolis General Electric Company of Minneapolis, Minn., will, it is said, issue a ninecent minimum rate for electricity, decreasing from a rate of 14 cents per kilowatt-hour for the first 52 hours' use per month.

The Citizens' Electric Company was granted a franchise in Macon, Ga., recently and a contract has now been made to furnish light. The company, headed by W. A. Burney, is to begin construction work this year. The proposed plant will cost, it is said, $100,000.

Superintendent of Motive Power J. F. Dunn of the Southern Pacific Railroad Company announces that the company will expend about $30,000 in the equipping of an electric power plant at Sparks, Nev., for the operation and lighting of the company's shops at that place. A total of 540 horsepower will be developed.

A 10-year franchise has been granted to C. A. Sutliff and associates of South Pittsburg, Tenn., for operating an electric-light and power system in Bridgeport, Ala.; also to construct a streetrailway system. It is the intention of this company to construct an interurban system to connect the towns of Bridgeport, Ala., and Copenhagen, Richards City and South Pittsburg, Tenn. The company will be in the market for machinery in the near future.

At a recent meeting of the Common Council of Manistique, Mich., the Manistique Light and Power Company was granted [illegible] water for the city. The Council also created an ordinance protecting the company's property. This question has been before the people for the last four years and would come up at every spring election as a political issue. By the action of the Council the question has been settled to the satisfaction of all concerned. Mr. V. X. Lyon is superintendent of the plant.

ELECTRIC RAILWAYS.

The Chicago-New York Electric Air Line Railroad Company says that the statement of the Indiana correspondent of the Western Electrician in the issue of February 29th, to the effect that the Chicago-New York company's assets and franchises are to be acquired by the Murdock syndicate, is incorrect. The acquisition of the Air Line by the Murdock people has never been considered.

Judge Thompson of the Coles County Court at Charleston, Ill., on February 28th quashed all the indictments against the officers and directors of the Mattoon City Railway, and the judge denounced the action of the Coles County grand jury in holding these men liable for the deaths of 18 persons in a wreck on their line some months ago as unjustified and unwarranted. One of the directors who had been indicted is Federal Judge Grosscup of Chicago.

Three hundred "pay-as-you-enter" cars, which, it is said, will be more artistic in exterior appearance than those of the South Side, have been ordered for the North Side lines of the Chicago Railways Company by the Board of Supervising Engineers. The cars are to be six inches narrower than those on the South Side lines, but this, the engineers say, will be an improvement, and combined with a lengthening of the car body will give them much more graceful outlines.

The substance of a decision of the Supreme Court in Omaha, Neb., resulting from a damage suit brought by a woman who was injured in getting off a street car is to the effect that a woman may get off a street car backward, sideways or any other way she may choose and yet not lose her right to recover damages from the traction company if she is injured. The company maintained that the woman got off the car backward in direct violation of the plainly printed rules.

The Chicago City Railway Company has been testing a new fender which has proved so satisfactory that a number will be put in service. The new device resembles the wing of a snowplow. It is a board suspended from the car at an angle of 45 degrees from the rail and hangs about one inch above the pavement. The idea was taken from the fenders in use in Liverpool, England, and they now are being manufactured in the shops of the Chicago City Railway Company.

The Chase-Shawmut Company of Newburyport, Mass., has placed upon the market the Shawmut rail-bond protector, a device designed to protect both the soldered and plug type of bond from being sheared off by wagon wheels, damaged by paving stones or ballast, injured by track crews, and to discourage theft. This protector is made of heavy steel, securely fastened to the rail by means of bolts which hold the fishplate in place, thus making application of the simplest nature. It is of such shape as to allow inspection of the bond without removal of the fishplates, and can be applied to either new or old rails at a minimum cost without impeding traffic.

Ford, Bacon & Davis, engineers, of New York, have issued a report on the through-routing plan for the Chicago elevated railways suggested by the transportation committee of the City Council. President Starring did not think the plan feasible and employed the engineers to prove his assertions. The report says that through-routing of the Northwestern and South Side lines, thus sending each train only half way round the Loop, would double the capacity of that structure. Likewise, throughrouting of the cars of the two West Side companies would be a benefit. There should also be a single management of the different companies and a combination of the West Side companies.

POWER TRANSMISSION.

The Northern Colorado Power Company has begun the construction of an electric railroad up Middle Boulder Cañon.

An indication of increasing business activity on the North Pacific Coast may be found in the order recently placed for the account of the Seattle-Tacoma Power Company, covering an alternating-current generator of 1,000 kilowatts capacity. This machine, which is of Allis-Chalmers Company's standard engine-type, designed to deliver two-phase current at 60 cycles, 2,300 volts, will be put in service at the earliest possible date, and is expected to prove fully as efficient as the three large waterwheel generators installed by the same [illegible] plant at Cazadero, Ore.

[illegible] rated at Reno, Nev., by J. H. Richards, R. E. Cav- [illegible] lent water rights near Reno and will enter the local field.

[illegible] pany, which is controlled by the Union Pacific [illegible] erection of a power plant at Devil's Gate in Weber [illegible] developed will be transmitted to Ogden and Salt Lake. The entire system will cost in the neighborhood of [illegible]

PUBLICATIONS.

The American Conduit Company has issued a set of bulletins showing detailed plans for the construction of brick and concrete manholes. These bulletins show not only the details of construction, but contain data by which the quantities of materials required for their construction can be readily ascertained. These as well as other engineering bulletins issued by this company can be had upon application to its office, 502 Marquette Building, Chicago.

A very handsome catalogue of original design and revealing the highest skill in the printer's and engraver's art has just been issued by the Murray Iron Works Company of Burlington, Iowa, builder of engines, boilers and complete power plants. The catalogue is No. 60 and is devoted to safety water-tube boilers. There are some excellent illustrations of complete boilers, sectional views and of parts; also a large number of reproductions from photographs of large plants in various parts of the country where these boilers are in use. The catalogue contains valuable information for anyone interested in the subject of water-tube boilers. The company's shops are equipped with the heaviest and latest patterns of tools and laborsaving devices, and its knowledge of boilers comes from practical experience in their manufacture for a period of 38 years.

Notice of a publication entitled "The Hydro-Electric Plant at Trinity River, California," printed recently, has brought forth numerous inquiries for information on this installation, which shows that a project of this nature is of very general interest. The Allis-Chalmers Company will send to anyone interested a copy of its Bulletin No. 1050 on alternating-current generators, waterwheel type. The publication mentioned contains a complete description of machines adapted to meet continuous service in the largest waterpower plants, illustrations of some of which are shown in the bulletin.

Several new bulletins have recently been issued by the Allis-Chalmers Company. The growing demand for direct-current electric motors that can be applied to the individual drive of machinery of various kinds has led to a number of important changes in both the mechanical and electrical design of the motors heretofore used. Bulletin No. 1057 gives a complete description and also contains 21 illustrations showing motor-driven machine tools. A copy can be had upon application. The lighting transformers described in Bulletin No. 1061 are of recent design and include all the features that have proved most advantageous for lighting work. The bulletin not only contains a minute description of the transformers, that have established a notable record in economy, but information on insulating oil and insulation tests can be secured by consulting this publication. A complete description of Milwaukee's flushing system, with diagrams showing plan of pumping station, is given in Bulletin No. 1610, a copy of which will be sent to anyone interested.

A new semi-monthly German publication has appeared since October, 1907, under the name "Elektron." The journal is devoted to illustrated abstracts of the principal electrical patents granted by the leading countries. About 200 of these appear in each issue, and of this number about one-seventh are German patents and the remainder those issued by the United States, England, France, Austria, Hungary, Italy, Switzerland, Belgium, Sweden, Norway, Denmark, Russia, Spain, Australia and Portugal. It is said that only about five per cent. of the patents issued by foreign countries are also protected by domestic patent grants. The remaining 95 per cent. of foreign patented inventions can therefore be utilized with perfect freedom. The carefully prepared and well-illustrated abstracts in "Elektron" make these available. This valuable paper is edited by Dipl.-Ing. P. Wangemann, patent attorney, Berlin, and published by Carl Heymanns Verlag, Berlin.

SOCIETIES AND SCHOOLS.

The National Electrical Contractors' Association will hold its next meeting in Chicago, on July 15th,

16th and 17th. Mr. W. H. Morton of Utica, N. Y., is secretary of the association.

The next regular March meeting of the Armour Institute Branch (Chicago) of the American Institute of Electrical Engineers will be held on March 19th. Mr. E. W. Adams will present a paper on "An Electrically Controlled Interlocking System." A special meeting will be held on March 12th, when Mr. R. H. Rice will give a paper on "Chicago Traction Problems."

A special meeting of the American Institute of Electrical Engineers was scheduled to be held in the auditorium of the Engineers' Building, Thursday evening, March 5th, when Mr. Gifford Pinchot, forester of the United States Department of Agriculture, was to deliver an illustrated lecture on forest preservation. This lecture was open to the public and tickets were not required.

As a result of a recent revision of its constitution the Illinois Society of Engineers and Surveyors now admits to membership students in the College of Engineering of the University of Illinois. While this action was taken primarily for the good of the students, the society will no doubt be benefited in the end. The electrical students are already allowed to become affiliated with the American Institute of Electrical Engineers.

The Southwestern Electrical and Gas Association will hold its annual convention in El Paso, Tex., on May 7th, 8th and 9th. There has already been a large number of inquiries for floor space by supply and manufacturing companies, and a fine exhibit is assured. Indications are for a large attendance from the East and arrangements have been made for a special train to meet all visitors at Dallas on May 5th and take them through to El Paso. Special arrangements are being made to take care of the ladies. The programme will include a trip into Old Mexico to witness a real Mexican bullfight. Mr. R. B. Stichter, Juanita Building, Dallas, Tex., is secretary of the association.

The University of Michigan has authorized architects to draw up detailed plans and specifications for a new chemistry building. The structure, which will be three stories and a basement in height, is to be 270 feet long and 150 feet wide. It will include two large laboratories for general chemistry, two large laboratories for qualitative analysis, one for advanced general chemistry, one for beginning quantitative analysis, one for advanced quantitative analysis, one for beginning organic chemistry, and one for pharmaceutical chemistry, with smaller laboratories for advanced and special work, as well as offices and private laboratories for the instructing staff. Besides the numerous laboratories, there will be one large lecture amphitheater, which will seat 350, and three to seat 220, 160 and 100, respectively. Seven small rooms will be used for recitation.

TELEGRAPH.

The Interstate Commerce Commission has decided not to extend the time within which to comply with the nine-hour law for telegraphers which went into effect on March 4th. Many of the railroads have announced their intention to comply with the law. Many of the smaller offices of the railroads where operators are employed will be closed, but it is expected that thousands of extra telegraphers will be required to comply with the law.

The government of India, acting upon the recommendation of the telegraph committee, has authorized the employment of women operators. The candidates must be between 18 and 30 years of age and they must be unmarried or widows. They must undergo a training of 12 months in the telegraph training classes, during which time they will receive $6.65 a month. On appointment they will receive from $10 a month to $30, according to the term of service and location. The period of work will not exceed seven hours in the 24, and there will be exemption from duty on Sundays.

MISCELLANEOUS.

An opinion filed in the United States Circuit Court of Appeals for the District of New Jersey sustains the lower court in favor of the Westinghouse Electric and Manufacturing Company against the Prudential Insurance Company of Newark, N. J. This suit was to restrain the Prudential company from further infringement of Nolan patent No. 582,481, in the use of a direct-current generator of Bullock manufacture. The feature of the direct-current generator to which this patent relates is the means used for clamping the armature laminæ in place, and the particular feature is the means for holding the movable clamping ring or flange in position, a split ring partially located in a circumferential groove in the armature spider being used to hold the clamping plate in position.

Canadian statistics show a rapid growth in the exportation of mica from the Dominion. In the fiscal year 1896 the shipments were 558,419 pounds, valued at $55,627; in 1906, 1,329,634 pounds, worth $335,591, and in 1907, 1,732,903 pounds, valued at $632,560. The United States is the best customer, taking last year nearly 90 per cent., most of the balance going to Great Britain.

An inspection by Milwaukee city officials of the recently completed Kinnickinnic flushing tunnel was made on January 23d, on the occasion of the official 24-hour test of the big Allis-Chalmers screw pump installed there. The engine was guaranteed to force 30,000 cubic feet of clear Lake Michigan water into the black waters of the Kinnickinnic River every 60 seconds, and, although the official figures of the test are not yet available, it is known that this volume of water was exceeded by at least a thousand cubic feet per minute. During each day of 24 hours this pump forces 323,000,000 gallons of water into the river channel. The engine is of the vertical tandem-compound condensing type with Reynolds-Corliss liberating valve gear. The intake at the lake, from which the tunnel starts, consists of two parallel, rock-filled piers, which are 60 feet apart and extend 385 feet into the lake from the shore line, the channel between the piers having been dredged to a depth of 16 feet. The tunnel was built under city streets for almost its entire length. The invert of the tunnel is 16 feet below Milwaukee city datum, which is approximately the average water level in Lake Michigan, at the inlet end, and 20 feet below that level at the outlet end in the river.

TRADE NEWS.

J. C. Shellenberger of Portland, Ore., has purchased a half interest in the Bellingham (Wash.) Electric Supply Company.

An American consular officer in the Far East forwards a report touching on the possibility of selling American electric supplies in that territory. Further particulars may be obtained from the Bureau of Manufactures by referring to file No. 1979.

The Western Wire Sales Company, 356 Dearborn Street, Chicago, announces the retirement of J. Allen Haines and A. Conro Fiero. Richard Wick will succeed Mr. Haines as president, and F. B. Keller succeeds Mr. Fiero as vice-president. F. W. Pagel is sales manager.

The supervising architect, Washington, D. C., will receive sealed proposals until April 9th for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of a postoffice at Dixon, Ill., in accordance with the drawings and specifications, copies of which may be had at the office of the custodian of the site at Dixon, or at the above office.

An American consul reports that the proprietor of a large store in the European city in which he is located is about to open a general store in Egypt and would like to receive catalogues and price lists from American manufacturers of chandeliers for electric light, gas and oil, and also of general merchandise. Details are on file, No. 2003, at the Bureau of Manufactures.

At the office of the supervising architect, Washington, D. C., sealed proposals will be received until April 8th and April 11th, respectively, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the postoffices at Portsmouth, Va., and Bessemer, Ala., in accordance with drawings and specification, copies of which may be had at the office of the custodian of site at the two cities named, or at the above office.

The Wisconsin Engine Company, Corliss, Wis., manufacturer of Corliss steam engines, gas engines, pumping engines, air and gas compressors, has established a branch office in Atlanta, Ga., with offices and rooms in the Candler Building. Mr. Julius M. Dashiell has been appointed sales manager.

Mr. Arthur B. Shepard has been engaged to represent the Electric Machinery Company of Minneapolis in Northern Ohio. Mr. Shepard has been with the General Electric Company for many years, for the last seven years as manager at the Cleveland office, and before that as designing engineer at Schenectady, N. Y. He has just opened an office in Cleveland at 1207 New England Building. The Electric Machinery Company will build alternating-current generators, synchronous motors, motor-generator sets, direct-current generators and direct-current motors of all types and voltages.

BUSINESS.

As a means of increasing the efficiency of plug and pin bonds, the Chase-Shawmut Company of Newburyport, Mass., presents the Shawmut auxiliary bond, a copper cap with rail-engaging flange filled with solder, heated and applied to the end of the bond, and thus by giving additional contact surface reduces to a minimum the resistance at the rail joint. A recent test made with auxiliary bonds applied on new plug bonds just installed showed that an improvement of over 15 per cent. in conductivity resulted. The company believes that all railroad men will appreciate this means toward cost reduction.

Dossert & Co. are making further large shipments of their solderless two-way connectors, to be used in the wiring of the 85 steel passenger cars now being completed by the Pressed Steel Car Company at McKees Rocks, Pa., for the Pennsylvania Railroad. These cars will be used on the main line between New York and Chicago. They will be electrically lighted, and no solder will be used in the splicing. The Dossert joints are installed in junction boxes, underneath the car floors, where the No. 0000 feeder cables are connected up. Dossert solderless terminal lugs will be furnished on the switchboards now being manufactured by E. C. Tibbals & Co. for the new building of the Brooklyn Academy of Music.

Dossert & Co. of New York have received what is probably the largest order for terminal lugs ever used on a single installation in this country. The material is for use in the wiring of the immense terminal buildings at Cortlandt, Church and Fulton streets, New York, of the Hudson and Manhattan Railway Company, operating the tunnels under the Hudson River which have just been opened to the public. These terminals are all of the Dossert solderless type, comprising front connection, back connection, angle and swivel lugs, and range in size from 2,000,000 circular mils down to No. 4 cable. Part of the order comes from the Westinghouse Electric and Manufacturing Company and is for lugs to be used on its fuse blocks, enclosed type, 61 to 600 amperes. Approximately 1,000 Dossert solderless lugs are required for the switchboards and panel boards of these great twin buildings.

The business of the Westinghouse Machine Company during the month of February has continued to show the most encouraging signs of improvement. Quite a number of excellent orders have been received during the last week in the various departments. There is as a result much greater activity in the shops at East Pittsburg. Unusually large shipments were sent from the works a few days ago on export delivery, including several large steam engines. One shipment, consisting of five 125-horsepower compound engines, was consigned to Takata & Co., the Japanese agents of the Westinghouse Companies in Tokio, for delivery to a manufacturing plant in Canton, China. The receivers of the company are reporting very encouraging progress with the plan of rehabilitating the company, and it is now expected that its affairs will again be in the control of the stockholders within a very few days.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 25, 1908.

[illegible] Circuit Controlling Mechanism. Thaddeus [illegible], New York, N. Y. Application filed [illegible] 1907.

[illegible]

[illegible] adapted to close the circuit when a pile warp breaks, the drops being carried by the unbroken pile warps as they rise and fall with the [illegible] rods, a stop plate extending transversely of the loom, and means for moving this plate into position to receive the drops on their downward movement to temporarily release them from the supporting warps.

870,859. Apparatus for Producing Very Thin Sheet Metal. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Original application filed June 29, 1904. Divided and this application filed March 1, 1905.

An electrolytic bath contains a cathode, from which electrodeposited metal may be readily stripped. The cathode is formed of a copper-aluminum alloy in which the percentage of copper largely predominates.

870,873. Warp Stop-motion for Looms. Herbert Horsfall, Bridgeport, Conn., assignor to the Salts Textile Manufacturing Company, Bridgeport, Conn. Application filed August 10, 1906.

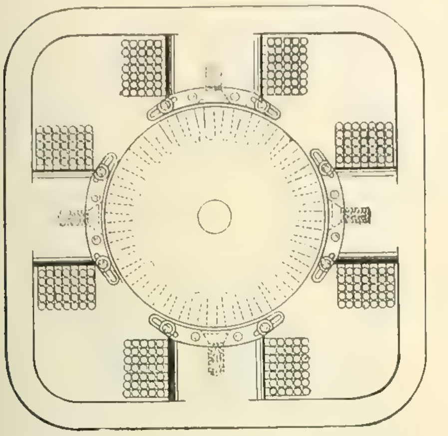
The device [illegible] No. [illegible], except that [illegible] plate [illegible] transversely of the loom below and in the path of travel of the drops for intermittently [illegible] them from the supporting warp threads [illegible] the loom.

879,878. Insulated Joint for Railway Rail. Kobe Kohn, New York, N. Y., assignor to the Rail Joint Company. Application filed June 14, 1906.

[illegible]

879,879. Electromagnetic Piano Player. Wesley B. Kraft, Milan, Kan. Application filed June 1[illegible], 1906.

[illegible] contact bar.



NO. 879,927.—DYNAMO POLE-SHOE.

879,885. Interlocking Relay. Edward McClintock, St. Paul, Minn. Application filed April 30, 1907.

One side of each track is divided into a series of insulated block sections, with each of which is connected a normally closed relay circuit. These relays are short-cuited upon the entrance of a train to a block in one direction and a signal circuit is closed thereby. A train moving in the opposite direction has no effect on the signal.

879,886. Highway-crossing Signal for Electric Roads. Edward McClintock, St. Paul, Minn. Application filed April 30, 1907.

The system described in the previous patent is modified so as to serve for ringing the signal for a certain time when a train approaches the crossing.

879,887. Method of Regulating Electric Generators. George S. Neeley, St. Louis, Mo. Application filed May 9, 1907.

The exciter for an alternator has a variable resistance in its field circuit which is controlled by a differential regulator. The two opposing coils of this regulator are, respectively, in the field circuits of the exciter and of the alternator; a third coil is controlled by the potential of the alternator so as to increase the resistance for an increase of potential.

879,913. Prepayment Arrangement for Meters. Henry W. Sayles, Peoria, Ill., assignor to George M. Willis, Chicago, Ill. Application filed December 4, 1905.

An escapement wheel in the path of the coins inserted into the meter carries a contact member on its shaft which closes the meter circuit when a coin is in contact with the wheel. The shaft is geared to the moving element and therefore keeps the circuit closed till a certain expenditure of energy has taken place.

879,924. Electrical Appliance for Clocks. Harry O. Swedberg and Amos T. Durbin, Rossville, Ill. Application filed October 11, 1906.

In combination with a pair of spaced disks is an annular series of contacts carried by each disk and arranged in opposing pairs, a clock-actuated arbor passing through the axis of the disks, a circuit-closing arm carried by the arbor and arranged to bridge the contacts, a switchboard having a number of rows of jacks equal to the number of contacts in each annular series and connected thereto, a battery in each of the connections and a series of alarms and alarm circuits, each including a separate plug insertible in any one of the jacks.

879,927. Pole-shoe for Dynamo-electric Machines. Robert B. Treat, Newark, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed April 9, 1906.

This pole-shoe is provided with pole-tips, each having an elongated perforation inclined to the face of the pole-shoe at the tip. (See cut.)

879,940. Ground-connected Clamp. William H. Blood, Jr., Wellesley, Mass. Application filed March 23, 1905.

A clamp for making connection between a ground wire and a pipe consists of two co-operating semicircular jaws hinged together at one end, then passing around the pipe and bolted together and to a cable terminal lug at the other end.

879,941. Wire Splice or Coupling. Ira M. Botkin, Carlos, Ind. Application filed September 16, 1907.

The coupling consists of a body substantially round in cross-section having perforations extending from its ends in diagonal directions through its opposite sides and diagonal peripheral grooves passing the perforations at substantially right angles.

879,943. Trolley-pole Support. James L. Chase, Ayer, Mass., assignor of one-half to Ralph J. Colin, Woburn, Mass. Application filed August [illegible], 1907.

[illegible]

879,962. Coil Retainer for Dynamo-electric Machines. Gaetano Dinna, [illegible], assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed [illegible], 1907.

[illegible]

880,008. Mail-pouch Receiving and Delivery Apparatus for Railway Cars. Chauncey W. Broughton, Carlton, Ill. Application filed December 6, 1907.

Each mail-pouch is provided with [illegible] so mounted that an electromagnet on the car [illegible] as the car goes by. The magnet is then [illegible] into the car and the pouch dropped.

880,011. Dynamo-electric Machine. Henry Chitty, Strand, London, England. Application filed June 2, 1904.

Each pole-piece is pierced with a hole in a direction transverse to that of rotation of the rotor of the machine and a bridge-piece of magnetic material extends between the tips of adjacent pole-pieces so as to form a shunt path for the magnetic flux.

880,020. Vault Lining. Jacob L. Grass, Minneapolis, Minn., assignor to the American Bank Protection Company, Minneapolis, Minn. Application filed July 13, 1907.

This vault lining comprises inner and outer plates insulated from each other and a normally open alarm circuit having its terminals connected with the plates respectively. Means are so arranged in relation to the plates that when pressure is applied to bend or buckle the vault-lining plates the alarm circuit will be closed.

880,021. Trolley. George H. Gross, Binghamton, N. Y. Application filed April 26, 1906.

A harp is journaled on the pole and has a limited rocking movement. A non-rotatable ring composed of annular sections has one of its sections attached to the harp and the trolley journaled on the ring.

880,027. Method of Making Electrodes. Ernst W. Jungner, Kneippbaden, Sweden, assignor to the Nya Ackumulator Aktiebolaget Jungner, Stockholm, Sweden. Application filed April 4, 1907.

The active material for a storage battery is made by binding small particles of nickel and graphite by means of nickel hydrate, converting this hydrate to a higher state of oxidation, treating the mass with a dissolved compound of nickel and finally subjecting the resulting mass to electrolysis in an alkaline solution.

880,037. Method of Treating Gases and Gas Mixtures by Means of Voltaic Arcs. Albert J. Petersson, Alby, Sweden. Application filed August 23, 1904.

The method consists in leading gases through a furnace chamber, creating arcs between electrodes in this chamber and creating electrodynamic forces by means of electric currents of greater intensity than that of the current creating the arcs and induced by the last-mentioned current for displacing the arcs.

880,044. Transmitter. Samuel W. Rothermel, New York, N. Y., assignor to Richard W. Barkley, trustee, Montclair, N. J. Application filed January 5, 1906.

In a telegraph transmitter there are in combination with a pair of percussive contact points a rotatable cam or telegraph wheel for actuating one of the points, a rotary driver having its axis of motion outside of the cam-wheel and a key-operated mechanism for connecting and disconnecting the cam-wheel to and from the driver.

880,046. High-frequency Discharge Apparatus. James E. Seeley, Los Angeles, Cal., assignor to the Synchronous Static Company, Los Angeles, Cal. Application filed November 26, 1906.

The apparatus comprises a discharge circuit, a charging circuit, a supply circuit, an induction apparatus having a number of windings, means for connecting one of the windings in the supply circuit and the other winding in the charging circuit, and means for connecting both of the windings in the charging circuit. (See cut.)

880,055. Arc-light Electrode Containing Metal Within the Same. Hermann Viertel, Charlottenburg, Germany, assignor to Gebrüder Siemens & Co., Charlottenburg, Germany. Application filed April 16, 1907.

This electrode is made by covering a core with a reticulated metal tube, impregnating the same with core material and inserting the core rod thus obtained into a carbon casing containing core material and drying the same.

880,072. Railway Signal Apparatus. Frank Graziano, New Orleans, La. Application filed June 15, 1907.

A casing adapted to be arranged crosswise in the bed of a railway has a cover, movable terminals arranged therein and adapted to form part of individual electric circuits, and vertical shafts extending through the cover and provided with triggers disposed above the cover and arms arranged in the casing in position to engage and move the terminals.

880,074. Electrical System of Measuring Temperatures. Ernst Haagn, Hanau, Germany, assignor to W. C. Heraeus, Hanau, Germany. Application filed May 27, 1907.

A Wheatstone bridge has a resistance thermometer included in one of its arms, a galvanometer included in its central branch and having a scale indicating the varia[illegible] index.

880,[illegible]. [illegible]

[illegible] toward the trolley wire.

880,121. Electrical Insulator. Daniel G. Bolton, Camden, N. J. Application filed November 23, 1906.

[illegible] bushing [illegible]

880,134. Alarm-signal Mechanism. Ellsworth E. Flora and Robert J. Zorge, Chicago, Ill., assignors to the Zorge Safety Railway Equipment Company. Application filed June 19, 1907.

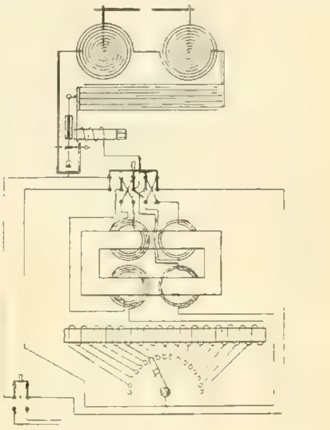
In combination with [illegible] mechanism is a gravity motor equipped with a circuit-maker and breaker, electrically controlled locking means normally restraining the motor from action, and a winding motor having a circuit controlled by the circuit-maker and breaker.

880,136. Signal System. Julien A. Gehrung, New York, N. Y. Application filed February 2, 1907.

A line having a number of signals selectively operated by different strengths of current has means for transmitting currents of varying strength to the line and means for automatically sending back a current of varying strength to send a repeat or checking signal back to the transmitting station.

880,152. Electric Signal for Elevators. Charles E. Moore, Los Angeles, Cal. Application filed March 7, 1906.

This signaling system comprises a number of sets of electrically operated chromatic signal devices, each set comprising signal devices of different colors arranged to display their distinctive colors when operated separately and to display a blended color when operated jointly, and corresponding sets of circuit-controlling devices at different landings.



NO. 880,046.—HIGH-FREQUENCY DISCHARGE APPARATUS.

880,155. Automatic Telephone Alarm. Milton L. Murdock and John C. Gallagher, Elmira, N. Y.; said Gallagher assignor to said Murdock. Application filed March 25, 1907.

A cabinet contains a telephone instrument, a clockwork, an audible signaling device, means actuated by the clockwork at the end of a determinate period of time to connect the instrument with the circuit and means for manually setting the clockwork back before the end of the period.

880,160. Burglar-alarm System and Apparatus Therefor. Milton R. Ney and Samuel S. Ullman, Washington, D. C. Application filed September 25, 1907.

This signaling apparatus has in combination a telephone transmitter and hook switch, a spring-actuated hook-raising device adapted to engage the hook, a detent for the hook-raising device, a magnet for operating the detent, an electric bell in transmitting proximity to the transmitter, and means for operating the detent magnet and bell comprising a protective circuit. (See cut on next page.)

880,167 and 880,168. Combined Lock and Electric Switch. William M. Shannon and George K. Taylor, Columbia, S. C. Applications filed July 1 and August 22, 1907.

In a door-lock switch for electric-lighting circuits there is a lock [illegible] the lock face when in advanced position and a switch located in the door jamb and having a movable mem[illegible]

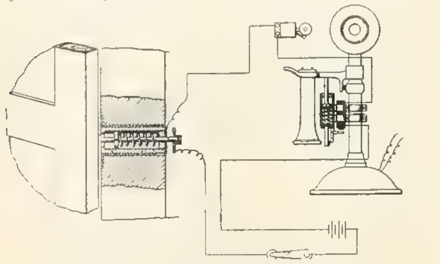
[illegible] the path of movement of the push button; whereby the switch is operated by the closing of the [illegible] second patent covers a modified form.

880,196. Battery. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed March 21, 1904.

The battery has a cell provided with a conduit, a shoulder socket intersecting the conduit, a tube connecting the cell and socket, a gasket surrounding the tube, and a hollow nut engaging the tube and jamming the gasket against the shoulder.

880,203. Insulator. John D. E. Duncan, Brooklyn, N. Y. Application filed September 9, 1907.

This insulator has a number of separate petticoats, one within the dome of the other. These are held together by a fastening means and locked by means of cement.



NO. 880,160.—BURGLAR-ALARM SYSTEM.

880,209. Electrically Operated Clock. Harleigh Gillette, Chicago, Ill. Application filed March 27, 1907.

A master clock controls a secondary clock through a synchronizing circuit and a motor at the secondary clock which receives periodic impulses from another circuit connecting with the master clock.

880,218. Signal Mechanism for Block-signal Systems. Harry L. Johnson, Topeka, Kan. Application filed April 2, 1907.

A pair of electromagnets has in each case an armature carrying a contact pin. When the main circuit energizes its electromagnet the pin on the latter contacts with the pin on the local magnet and thus completes a local circuit.

880,249. Electromagnetic Brake. Hiram Snodgrass, Oklahoma, Okla. Application filed June 1, 1907.

A spring is mounted between the brake beams and a rod so as to normally act upon the beams and apply the brake shoes. A solenoid is arranged to compress the spring and so release the brakes.

880,254. Advertising Device. Edward Van Antwerp, Dent, Minn. Application filed March 27, 1907.

A metallic track has an artificial elephant at each end thereof. Each elephant has a pivoted trunk, a metallic rolling body on the track, an electromagnet operatively related with the trunk to cause it to swing and impart motion to the rolling body, means for passing current to the magnet when the rolling body closes a circuit by touching the track and the trunk of either one of the elephants.

880,263. Electric Sign. Ignatz Young, San Francisco, Cal. Application filed November 7, 1903.

In connection with a revolving shaft are a number of drums normally revolving with the shaft, electrically operated mechanism for unlocking one or more of the drums from the shaft, and a locking device for each drum.

880,266. Electromagnetic Clutch. Heinrich Ast, Vienna, Austria-Hungary, assignor to Vulkan Maschinenfabrik Actien Gesellschaft, Vienna, Austria-Hungary. Application filed June 15, 1906.

The clutch part is provided with a friction member; a carrier is provided with a friction surface adapted to engage the friction member; a magnet member is secured to the carrier, and means are arranged to promote ventilation and to assist in dissipating the heat generated between the friction member and friction surface.

880,271. Method of Forming Railbonds, Etc. Eugene M. Bournonville, Jersey City, N. J. Application filed September 20, 1907.

This method of connecting bonds to rails consists first in heating the metal of the bond and the rail to a point [illegible] the melting point and then increasing the temperature of the bond until a portion of the metal at the [illegible] melts and becomes unified with the adja[illegible] rail to form a homogeneous connec[illegible]

880,272. Thermo-electrical System. William H. Bristol, New York, N. Y. Application filed November 11, 1907.

[illegible] adapted to be [illegible] and sudden [illegible] is adapted to [illegible] than the other [illegible]

880,273. Indicating and Recording System. William H. Bristol, New York, N. Y. Application filed [illegible] 1906.

[illegible]

[illegible]

880,329. Railway Signaling System. Wilmer W. Salmon, Rochester, N. Y., assignor to the General Railway Signal Company, Gates, N. Y. Application filed July 3, 1907.

In a signaling system for electric railways having a track in which one rail is the return conductor for the propulsion current there is a signaling circuit which includes a portion of the propulsion rail and contains signaling devices adapted to be energized by an alternating current and means for preventing the operation of the signaling devices while a break exists in the portion of the propulsion rail.

880,338. Electric-arc Furnace. Sidney D. Spence, Chattanooga, Tenn., assignor of one-fourth to Lewis Shepherd and one-fourth to David L. Snodgrass. Application filed December 17, 1906.

The furnace has vertically adjustable inner electrodes, side electrodes, pivotally mounted longitudinally adjustable arms carrying these side electrodes and means to raise and lower these arms.

880,366. Governor for Turbines. Charles W. Dake, Grand Rapids, Mich., assignor to the Dake-American Steam Turbine Company, Grand Rapids, Mich. Application filed March 22, 1906.

In combination with a suitable chamber is a receptacle containing mercury within the same, supported on a vertical axis, an electrical circuit with contact points within the chamber, a governing valve within the electrical circuit, the current through the circuit being controlled by the variations of the level of the mercury due to the rotation.

880,367. Battery. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed May 9, 1905.

This is a modification of No. 880,196.

880,368. Battery. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed March 21, 1904.

In this battery is a diaphragm having a bordering flange and a honeycombed body.

880,373. Process of Accelerating the Separation of Nitroglycerin from Acids. Richard Escales and Milano Novak, Munich, Germany. Application filed September 5, 1907.

The process consists in passing an electric current between electrodes through a liquid mixture of acids and nitroglycerin, thereby causing the evolution of gas bubbles from the electrodes which carry the nitroglycerin particles upward. The nitroglycerin is then removed from the surface of the liquid.

880,395. Trolley-wheel Spring. Ralph E. Noble, Chicago, Ill., assignor to the Morgan-Gardner Electric Company, Chicago, Ill. Original application filed January 13, 1905. Divided and this application filed July 3, 1907.

In combination with a trolley harp and wheel are folded springs between the wheel and harp, the springs being provided with projections engaging with the harp but not attached thereto.

880,398. Electromechanical Slot for Signals. George S. Pflasterer, Nashville, Tenn. Application filed August 29, 1907.

Two operating rods for the signals are mounted over each other. The lower one has a sleeve on top for receiving the upper rod. A slot in this rod engages a pin in the sleeve. Electromagnets interlock the rods.

880,405. Process for Producing Poreless and Well-adhering Electrodeposits. Harry Schmidt, Cologne, Germany. Application filed August 7, 1907.

This process consists in first providing the metal to be electroplated with a coating of a metal or alloy which melts at a lower temperature than the final electrodeposit, in then electrolytically depositing the final coating and in melting the intermediate coating.

880,418. Insulator for High-tension Conductors. Samuel H. Summerscales, Winnipeg, Manitoba, Canada. Application filed November 23, 1906.

The insulator has a body adapted to be mounted upon a support and shields attached to the body in the path of lines of leakage which might pass to the support, the shields having projecting portions adapted to prevent the formation of a continuous coating of water on them.

880,420 to 880,425. Storage-battery Plate. Alfred O. Tate, Toronto, Ontario, Canada, assignor to the Tate Electrolytic Company of America. Applications filed December 1, 1905; July 3, 1907, and October 29, 1907.

These six patents comprise a total of 50 claims on a pasted plate made of narrow strips containing alternately positive and negative active material and separated by intermediate porous insulating strips. The positive strips are connected on one edge of the plate and the negatives on the other edge. (See cut.)

880,429. Coil Retainer for Dynamo-electric Machines. Robert B. Treat, Newark, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed November 12, 1907.

In a slotted core, the walls of each slot near its mouth are notched and one of the walls cut away above its notch, thereby uncovering a shoulder. Coil-retainers are used capable of passing through the mouth of a slot [illegible] with the notches and of being expanded into engagement with the notches.

880,432. Electric-arc Lamp. [illegible] F. Adams, Cleveland, Ohio. Application filed August 11, 1905.

[illegible] chamber to form uninterrupted passages connecting the superposed compartments, the guide having an opening for the passage of the carbon.

880,437. Brush-holder. Albert Ball, Claremont, N. H., assignor to the Sullivan Machinery Company, Claremont, N. H. Application filed November 30, 1906.

A brush mechanism for electric motors comprises a motor frame, a base ring secured thereto, means to secure the base ring in any desired position of rotative adjustment to secure non-sparking, a rotatable brush supporting ring sustained by the base ring with capacity for rotative adjustment and brushes supported thereby.

880,464. Apparatus for Treating Gases and Gas Mixtures by Means of Voltaic Arcs. Albert J. Petersson, Alby, Sweden. Original application filed August 23, 1904. Divided and this application filed September 6, 1905.

This is a modification of No. 880,037.

880,477. Conducting Conduit for Vehicles. Francis M. Brinckerhoff, New York, N. Y. Application filed March 12, 1907.

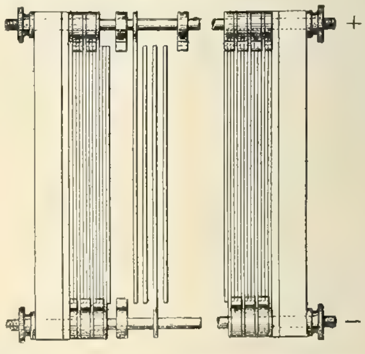
In an electric car the chamber containing the motor is cooled by causing a current of air at substantially atmospheric pressure to flow through the chamber. A conduit, consisting of flanged members having a universal movement in relation to the vehicle body and the motor, conveys the air to and from the chamber.

880,484. Process of Producing Very Thin Sheet Metal. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed June 29, 1904.

This is a modification of No. 879,859.

880,485. Magneto-electric Inductor. Martin Fischer, Zurich, Switzerland, assignor to Actiengesellschaft "Magneta," Zurich, Switzerland. Original application filed July 5, 1900. Divided and this application filed January 10, 1905.

The machine consists of a permanent magnet having two pairs of pole pieces, a coil arranged between them and a soft iron bar passing through the coil to close the magnetic circuit first between one pair of diagonally opposite pole pieces and then between the other pair of diagonally opposite pole pieces.



NO. 880,420.—STORAGE-BATTERY PLATE.

880,489. Process of Producing Magnesium. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va., assignors to the Virginia Laboratory Company, New York, N. Y. Application filed June 9, 1905.

This process of producing magnesium consists in dissolving magnesium oxid in a fused bath of mixed fluorides whose decomposition voltage is higher than that of magnesium oxid, subjecting the same to electrolysis and feeding magnesium oxid to replace that which is decomposed.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 2, 1908:

447,321. Electric Matrix-making Machine. T. C. Hargrave, Minneapolis, Minn.
447,332. Electric Railway. W. H. Knight, New York, N. Y.
447,350. Electrical Subway. J. C. Reilly, Brooklyn, N. Y.
447,353. Electric Heater. C. C. Rich, Mount Vernon, N. Y.
447,383. Electric Arc Lamp. E. Thomson, New Britain, Conn.
447,384. Dynamo-electric Motor or Generator. E. Thomson, Swampscott, Mass.
447,409. Electric Time Lock. J. H. Kaiser and A. B. Ledwith, Brownsville, Pa.
447,416. Telephone Switch System. C. C. Gould, Batavia, N. Y.
447,418. Electric-lighting System. B. B. Ward, New York, N. Y.
447,485. Telephone-exchange Apparatus. F. G. Beach, Chicago, Ill.
447,494. Rheostat. J. O'Meara, New York, N. Y.
447,[illegible]. Electromagnetic Cut-out. G. Taintor, Worcester, Mass.
447,[illegible]. Electrical Annunciator. W. C. Cram, Cambridge, Mass.
447,[illegible]. Electrical Transformer. R. Kennedy, Glasgow, Scotland.
447,[illegible]. Electric Cut-out. G. C. Gammon, Pawtucket, R. I.
447,[illegible]. Electrode for Electric Arc Lamps. A. C. Seibold, Mount Vernon, N. Y.
[illegible]. Electric Motor. R. W. Taylor, Richmond, Va.
[illegible]. Electric Stop-seat. G. W. Hatt, Kansas City, Mo.
[illegible]. Electric Motor. I. E. Meyrowitz, Ridgefield, N. J.
[illegible]. Electric Arc Lamp. L. H. Buchanan, Pasadena, Cal.
[illegible]. Electrical Doorbell Pull. L. W. Cleveland, Portland, Me.

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Caffaro-Brescia Electric Power Transmission Plant.

By Dr. Alfred Gradenwitz

The hydro-electric power station and high-tension power transmission plant of Caffaro-Brescia, which has been recently put into operation, is one of the most extensive and interesting plants of this kind in Northern Italy. It is intended for supplying the current required for the operation of the steel works in Brescia and also for transmitting electrical energy to the cities of Brescia, Manerbio, Cremona and Ponte Viggo.

The river Caffaro, the lower course of which

Fig. 1. Power House Showing Penstocks.

forms a portion of the boundary between Italy and Austria, and which terminates near Caffaro in Lake Idro, affords a suitable waterpower, both as to available head and volume of water. This river has been dammed in the neighborhood of Bagelino by a masonry sluice fitted with four iron gates, the water being conveyed to a reservoir situated 250 meters above the power station, partly in an open channel, but for the greater part in conduits. From this reservoir two parallel penstocks lead to the power station, which is situated immediately on the bank of the river in the neighborhood of Caffaro.

As shown in Fig. 1, the power station covers an area of about 500 square meters, and in its lower part contains a generator room 40.6 meters in length and 11 meters in width, above which there is arranged at a height of 3.25 meters above the floor the operating platform of the switching plant, which is several stories in height.

Ultimately, the plant is to contain five generating sets and two exciter sets, in addition to a hydro-electric lighting set, which has been installed in a side room. Four generating sets are at present in place, three of which are shown in Fig. 2. The prime movers of these sets are Pelton wheels, able under a head of 250 meters to yield 2,500 horsepower each. They are connected to the generators by elastic leather clutches of the Oerlikon system.

The generators are three-phase machines and have a normal output of 150 amperes at 9,000 to 10,500 volts, designed for 42 cycles per second and [illegible] revolutions per minute. [illegible] 37,000 kilograms [illegible] the rotating part being [illegible] pounds).

Each of the exciter [illegible] generator at full load and is coupled to a Pelton wheel of 150 horsepower running at 600 revolutions per minute.

A special hydro-electric set of 60 horsepower supplying polyphase current at 3,600 volts and 42 cycles per second is used for the lighting of the power station and the surroundings, as well as of the town of Caffaro.

The current generated by the alternators is raised to a tension of 46,000 volts by transformers. These transformers are fitted in cells and are movable on rollers to a truck running alongside the transformer set, in order to be conveyed by the latter to the repair shop, which forms an extension of the transformer room.

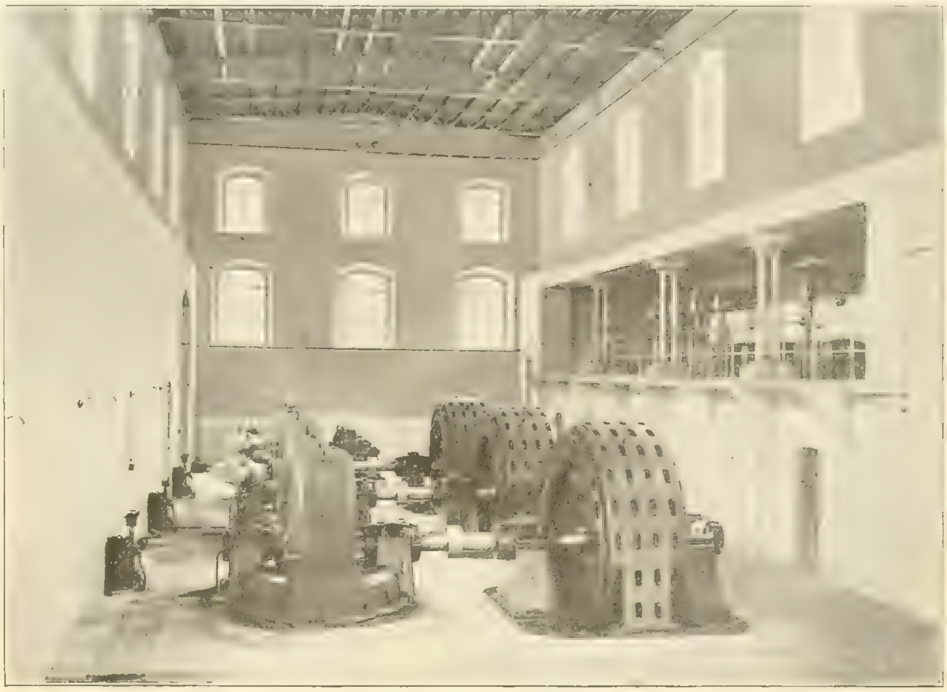


Fig. 2. Generator Room in Power House.

CAFFARO-BRESCIA ELECTRIC POWER TRANSMISSION PLANT.

The transformers are designed for oil and water cooling, the oil casings comprising three cast-iron boxes placed on top of one another, and the top one of which has two walls with ribs projecting inward. The hollow space between the two walls of the topmost box is divided by partition walls into chambers communicating with one another and which are uniformly rinsed by a water jet. (See Fig. 3, next page.)

The active part of the transformers consists of three iron cores of rectangular cross-section placed beside one another, with coils wound from bare copper tape with intermediary pasteboard strips. The high-tension coils are situated outside and consist of 35 elementary coils.

The normal output of the transformers is 9,000-40,000 volts to 10,500-46,000 volts, 150 amperes, 42 cycles per second, 2,720 kilovolt-amperes. The total weight of each transformer without its oil reservoir is 10,000 kilograms (22,000 pounds) and that of the oil vessel, inclusive of the oil, 12,000 kilograms. Fig. 4 shows one of the transformers.

On the operating platform of the switching plant there are arranged for each generator a special column, in addition to an exciter column and a general column. The generator columns carry on the top a wattmeter, to the right an ammeter for measuring the generator current, to the left an ammeter for the exciter current, and in front the two automatic signaling lamps for the generator switch.

The switchboard, situated behind the columns, [illegible] to be provided also with the levers serving to [illegible] existing station, the last two panels to the left hand being reserved for this purpose. The vertical levers arranged in front of the switchboard serve [illegible] former can be connected either directly to the corresponding generator or to the auxiliary bus-bars.

Each of the two distributing panels above referred to carries for the three phases of each line three ammeters and a blue as well as a red signaling lamp, the former burning in the event of the main switches of the starting conductor being thrown out of circuit, and the latter in the event of its being inserted. On the front side of the operating platform there is further arranged a small switchboard, comprising the apparatus necessary for operating an accumulator battery of 67 cells of 150 ampere-hours, in addition to the switches for lighting the central station.

The whole switching plant has been designed on the cellular system, the lines starting from the generators being taken to the lowermost room of the switching plant in the shape of copper bars laid out on rib insulators. In that compartment are arranged in the row of cells facing the generator room, the current converters, of which four have been provided for each machine. Two of these are set apart for the relays of the generator switches, one for the ammeter and one for the generator wattmeter.

The cells situated above the current-converter cells comprise the generator switches, which are disengaged magnetically, and in the next row of cells the two switches for the exciter machines. The high-tension switches of the Oerlikon system used in this station are of different kinds, viz., automatic pulling switches and oil switches. An oil switch with automatic release is shown by Fig. 5.

The upper story of the tower contains the lightning arresters. Two types of lightning arresters are used, viz., the continuous grounding type (consisting of two sheet-metal boxes filled with water placed on top of one another and connected through two glass tubes), and another type with non-con-

tinuous grounding, which will work only when struck by lightning, while the former apparatus serves to compensate any smaller atmospheric discharges and excesses in tension.

Each of the transmission lines leading to Brescia consists of three 6.5-millimeter copper wires fixed on insulators, which are carried either by lattice-work poles or double wooden poles or iron-pipe supports.

The line terminates at Brescia in a large distributing and transformer station, in which part of the current is transformed and part distributed to the cities before mentioned. In the upper story of this transformer station (in which the power-transmission line enters) there are arranged the same two kinds of lightning arresters as in the power station, while the switching plant is designed on exactly the same lines as in the power station but for the altered arrangement.

In this sub-station is installed a centrifugal pump driven by a 2.5-horsepower three-phase motor supplying the circulation water for the lightning arresters. This is derived from a tank installed beside the pump and which is connected to the water mains of the buildings. The cooling water for the transformers is derived from this reservoir, and the circulation water escaping from the lightning arresters is carried back to it.

The current required for operating the soda works of the city of Brescia is derived from a converter station situated near the transformer station, and to which current at 3,600 volts is supplied from the latter.

Government Commission Adverse to Power Development at Twin Cities.

Some rather interesting facts are contained in the report of the commission appointed by Congress to ascertain whether any surplus water flowing over the dams in the Mississippi River, between St. Paul and Minneapolis, not needed for navigation, may be utilized for the production of electric power to be used in the buildings and property of the United States in the cities named and at Fort Snelling. This commission consisted of two army officers—Major W. V. Judson and Major A. W. Kimball, the former of the Corps of Engineers—and Mr. J. E. Woodwell, inspector of electric-lighting plants for the Treasury Department, well known to the electrical fraternity. The commission conducted its investigation last year and drew up its report last autumn. This report was presented to the House of Representatives last December, the commissioners recommending that no power de-

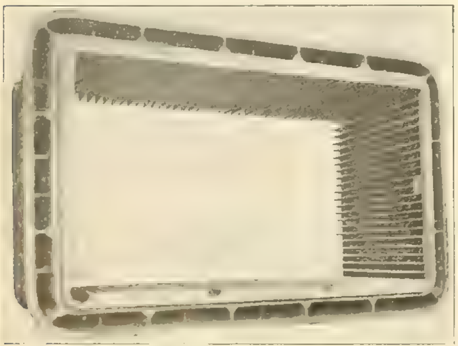


FIG. 3. CAFFARO-BRESCIA PLANT.—PART OF TRANSFORMER CASING, SHOWING WATER-CIRCULATING ARRANGEMENT.

velopment whatever be undertaken by the government at the site named at the present time. The following data are taken from the report.

With a view to improving the Mississippi River for purposes of navigation between St. Paul and Minneapolis, Minn., the United States has com- [illegible] known as Lock and Dam No. 2, at a point 2.18 miles below the Washington Avenue Bridge in the city of Minneapolis. A second lock and dam, known as Lock and Dam No. 1, are under construction at a point 2.88 miles far- [illegible] mentioned which are referred to in the act creating this commission.

[illegible] a soft sand rock, occasionally overlaid by clay, sand, gravel and bowlders. The sand rock is of a peculiar formation—soft, friable, porous, readily eroded, and seamy. It is practically without tensile strength, but its compressive strength when confined or in large masses is great.

The flow of the Mississippi is practically the same at each of the two dams, ranging from less than 2,000 to more than 55,000 cubic feet per second.

At a cost exceeding $1,500,000 the United States has constructed and now operates upon the upper Mississippi River a system of five reservoirs of a combined capacity of 93,237,100,000 cubic feet. The watersheds of these reservoirs constitute 21.5 per cent. of the total watershed above Minneapolis. These reservoirs are operated with a view to main-

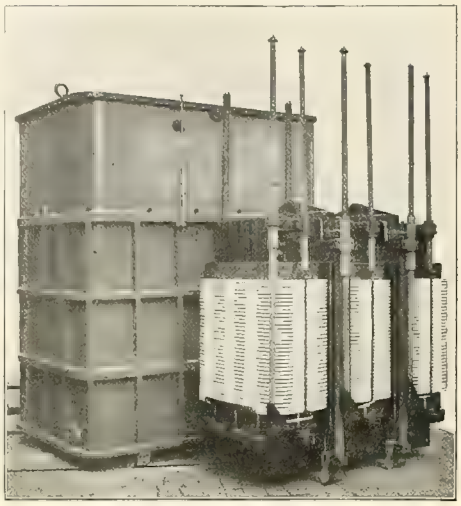


FIG. 4. TRANSFORMER OF CAFFARO-BRESCIA TRANSMISSION PLANT.

taining a three-foot stage at St. Paul during the season of navigation.

The reservoirs have never, until within the last two years, been in a state of complete efficiency and amply provided with storage water.

There is every reason to believe that the United States will continue to maintain the reservoirs in a state of efficiency, and, as an incident to maintaining three feet on the gauge at St. Paul, will insure a minimum flow at dams Nos. 1 and 2 of 5,000 cubic feet per second from March 20th to December 20th. This is a conservative estimate, as the flow during the period mentioned will very rarely fall below 6,000 cubic feet per second.

During the ice period the minimum flow may be expected to descend to 1,200 cubic feet per second. This low record, however, has not been reached during the last seven years.

If Lock and Dam No. 1 be built as planned, with a guard of 11.9 feet and no sluices, the gross head will vary from 10.2 feet at 5,000 discharge to about four feet at high stages; and the duration of the low heads will be prolonged, due to backwater from the Minnesota River.

Consideration of the low heads that will be available at Dam No. 1, and of the disadvantages pertaining to its site, makes it readily apparent to the commission that no power can be economically developed at Dam No. 1; certainly not for many years after its completion, nor until the value of power in its vicinity has increased very largely beyond that now obtaining. The real problem before the commission, therefore, is to determine what power, if any, can be economically developed at Dam No. 2.

At a discharge of 5,000 cubic feet per second the gross head at Dam No. 2, after Dam No. 1 has been constructed, will be 12.2 feet. While the discharge curve increases to 34,000 cubic feet per second, the gross head decreases to 10.6 feet. At 36,000 discharge the gross head is 9.1 feet, it becoming necessary to sluice water to avoid drowning out the lock walls. At 46,000 discharge both sluices must be opened, thus reducing the gross head to 7.8 feet, from which it decreases to about 7.4 feet by the time the maximum discharge is reached.

The guard of the lock (i. e., the distance measured vertically between the crest of the dam and the top of the lock walls) is 8.25 feet. Flashboards may, therefore, be used at low stages to increase the head and to obtain a very limited storage above the crest of the dam. At higher stages, when the head is reduced, flashboards could not be used, lest the lock walls be drowned out.

Conditions adverse to power development, but necessarily imposed to guard the permanent interest of navigation, are as follows:

First.—The water must never be drawn below the crest of the dam during the season of navigation.

Second.—Water must be reserved during the navigation season for the operation of the lock. If the privileges of small pleasure launches be suitably restricted, there will probably not be required more than 50 cubic feet per second for this purpose.

Third—The lock is situated on the left bank of the river, adjacent to the shore. There must be no currents created near either end of the lock which would be detrimental to navigation.

Fourth—There must be no work done that will endanger the stability of any of the existing structures.

Fifth—The capacity of the sluices and dam crest to discharge water in time of flood must not be restricted without due compensation, lest the lock be drowned out.

Careful consideration of the conditions above stated convinces the commission that if a power development at Dam No. 2 is practicable at all, the requisite space for the same must be found between the sluices and the right bank of the river. Attention is invited to accompanying sketch, upon which is shown the location of the sluices with reference to the bluff.

If attempt were made to utilize the entire 5,000 cubic feet per second that will be available during the season of navigation, a canal 250 feet wide and seven feet deep would be required to allow of the proper setting of the turbines and to reduce the velocity of approach thereto to permissible limits. The tailrace would require an equal sectional area. Inspection of the sketch readily indicates the enormous excavation from the bluff that would be required to prepare the necessary waterways.

In the case of the tailrace, the excavation would have to be carried to a depth of from 19 to 20 feet below the crest of the dam, and an excavation of this character in the soft and seamy sand rock would be a hazardous undertaking, in view of the head maintained so short a distance above.

In view of the great amount of excavation that would be required, the probable necessity of an enormous retaining wall, and the hazardous nature of the whole undertaking, the commission is of the opinion that no development of the kind is practicable or advisable at the present time or until the value of power in the locality of the dam has considerably increased.

An alternative plan for a development that would utilize the flow of 5,000 cubic feet per second has also received attention. According to this plan an additional sluice would be constructed on the river side of the present sluices, and the power house would be located on the site of the present dam, adjoining the proposed new sluice, and extending to within about 250 feet of the river wall of the lock. A long trailing dam would be required to separate sluice and tail-water. Such development could probably be made within reasonable limits of cost, with good luck and if no unforeseen accidents occurred. But the commission hesitates to recommend this plan by reason of the risks that would be run in excavating and maintaining the tailrace in the soft sand rock along the lower side of the power house for a width of more than 200 feet, measured perpendicularly to the current.

There remains for consideration a small develop-

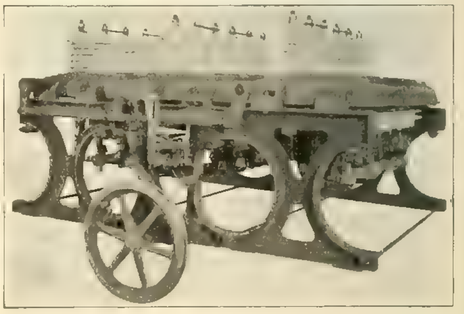


FIG. 5. CAFFARO-BRESCIA PLANT.—OIL SWITCH WITH AUTOMATIC RELEASE.

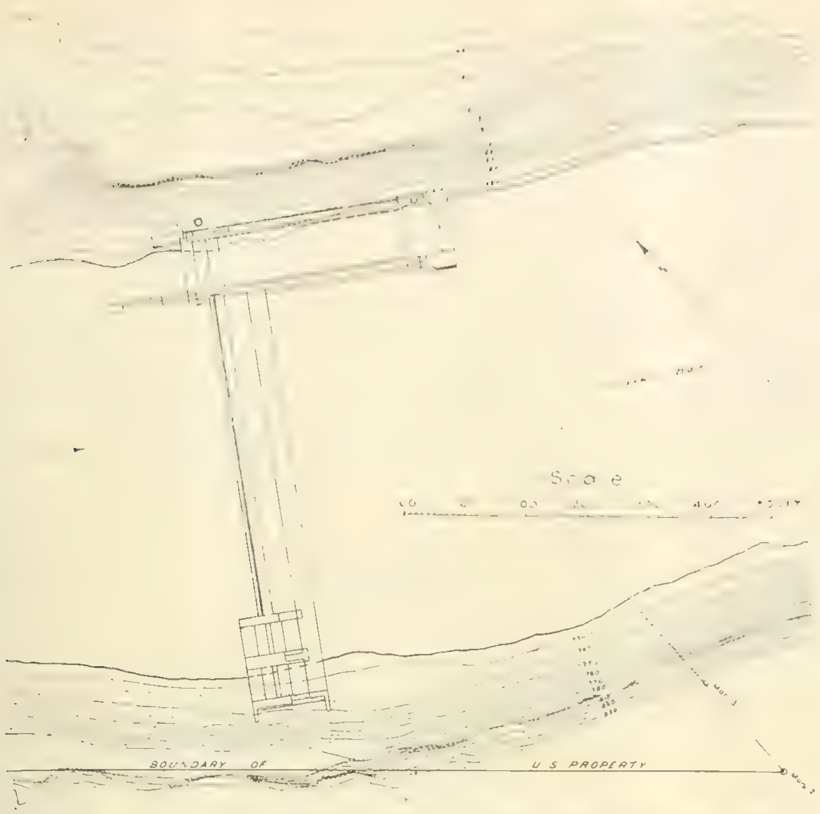
ment, say, of 1,300 horsepower, corresponding to the minimum flow of the river in winter.

Such development could best be made at the side of the river opposite the lock.

For such a power a canal and a tailrace each 70 feet wide and seven feet deep would suffice. The excavation into the bluff would not be excessive, and the cost of the retaining wall would be much reduced, as would also any risk due to excavation of tailrace, such as was alluded to when discussing the larger development in this same location.

Thirteen hundred horsepower developed at the dynamos would much more than provide for lighting the government buildings at St. Paul, Minneapolis and Fort Snelling, and for supplying the limited number of small motors that will probably be installed therein, even if large allowance be made for future increases. The surplus of power developed might be so disposed of as to offset line charges and maintenance of service from other plants during the breakdowns that must be anticipated.

The cost of the development of 1,300 electric



LOCK AND DAM NO. 2 IN MISSISSIPPI RIVER BETWEEN MINNEAPOLIS AND ST. PAUL.

horsepower in the manner above described is estimated by the commission at $160,000.

The cost of maintenance and operation, not counting beyond the dynamos, would be about $4,000 per annum. The fixed charges would include $4,800 for interest and $9,600 for deterioration, making a total annual operating cost of $18,400.

The consumption of electric power at United States buildings in St. Paul and Minneapolis, Minn., and vicinity for the fiscal year ending June 30, 1907, is shown in the following table:

Building.	Kilowatts.	Cost
Courthouse and postoffice, St. Paul	114,072	$ 5,1[illegible]
Custom house, St. Paul	8,599	386.05
Courthouse and postoffice, Minneapolis	70,715	3,889.33
Fort Snelling	30[illegible],300	10,631.72
Total	502,686	$20,041.2[illegible]

Allowing for line and other losses incident to the generation and transformation of electric current, the above consumption corresponds to an average of 175 to 200 horsepower, with a maximum demand of about 600 horsepower at the waterwheel.

From the foregoing figures it is evident that a probable saving of less than $2,000 would result from the 1,300-horsepower development.

To offset this probable saving are the risks to the present works, necessarily incident to new work in the soft and seamy rock that constitutes the bed and banks of the river.

If it should assume that no radical steps will be taken in the future to develop, in a comprehensive and economical way, the entire power available in the Mississippi River between Minneapolis and St. Paul, this commission might give further consideration to a development of 1,300 horsepower at Dam No. 2; but in view of all the circumstances, and having in mind what the future may bring forth, the commission is constrained to recommend that no power development whatever be attempted at the present time, either at Dam No. 2 or Dam No. 1.

The value of waterpower converted into electric units and disposed of in any community such as that comprised in and about St. Paul and Minneapolis is rapidly increasing, due to the increase of population and of industry and the increased cost of coal. Many projects that are not now feasible may be expected to become so with the lapse of time. It appears reasonable to the commission to believe that within 20 or 25 years, and perhaps within a much shorter period, it will be economically desirable that there be erected a high dam at the lowest suitable point between St. Paul and the site of Dam No. 1, the backwater from which would extend to the lower tailrace at Minneapolis. In this way there could be obtained a head of probably 35 feet at lower stages, and it would be practicable to develop from 15,000 to 20,000 horsepower.

Such a dam would drown out locks and dams Nos. 1 and 2 and any works appurtenant thereto. In connection with such a dam there would be required a single high-lift lock to care for navigation.

Any small power development now undertaken at either of the existing dam sites would be destroyed if the comprehensive development were made. Thus, any small development made at the present time would be obstructive and stand in the way of what the commission believes may be the final solution of the problem.

The act creating this commission did not provide funds with which to obtain data or prepare extensive plans relating to the comprehensive development above alluded to. It is probable that by the time such a development becomes economically advisable, private individuals or corporations will approach the United States, submitting plans and requesting the permission of Congress for their execution. At that time consideration should be given to the conditions under which the work should be permitted to be done. Such conditions might well embrace the furnishing of such power as is needed for the lighting of government buildings and reservations in the neighborhood, including the furnishing of power for motors thereat.

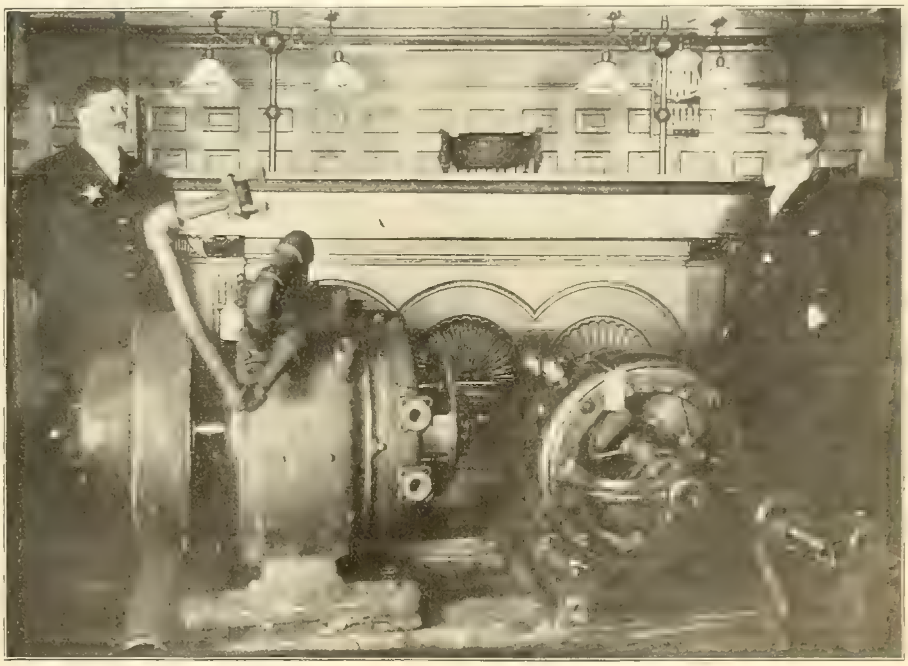
The Oconee River Mills of Milledgeville, Ga., will expend about $60,000 to develop waterpower on the Oconee River and establish an electric-light and power plant. The company has secured a franchise from the city and will also bid on a contract for lighting Milledgeville.

Bidwell "Cold Motor" in Court.

[illegible] refrigerating attachment using carbonic acid it pro- [illegible] which covered the motor casing. The outfit ex- [illegible] set, has been brought from the company's factory [illegible] picture shows the unit in Judge Chetlain's court, [illegible] repair shop.

[illegible] the complaint of certain stockholders, and charges the obtaining of money by false pretenses through the sale of stock for the promotion of the manufacture and sale of the "cold motor." A practical device which would keep a motor or generator cold at all times would, of course, be a very valuable asset. The frost and ice which the company's device was capable of producing on the outside of the machine was the strong point on which, the complainants allege, investors were induced to invest their money. But, as the state will attempt to prove, the device was known to be impractical when investments were accepted. The defendants, however, maintain that the device will do all that is claimed for it, even to the freezing of ice cream within the casing of the motor.

The trial has been in progress about two weeks and attracts a variety of interests. Casual spectators who look upon any electrical device as a mystery are present daily, expecting to see some wonderful revelations. Then there are a large number of persons directly interested in the case and many witnesses. Electrical men are also seen to drop in frequently to see or hear what the alleged "cold motor" is like.



BIDWELL "COLD MOTOR" IN COURT.

Electrical experts and others have been on the witness stand. Some of these, including former employes of the company, have testified that the refrigerating device never could keep the motors from burning out on overload. The "cold motors" are simply ordinary motors surrounded by iron pipes and a shell of cast-iron. The large quantities of frost congealed on the shell, the witnesses testified, is melted by the heat within and the moisture thus produced is very injurious to any motor.

As the trial progressed the jurymen, rather amazedly, examined the machine and tried to grasp the meaning of the technical terms of the witnesses.

One of the jurymen discovered two holes in the bottom of the cast-iron shell, and his questions brought out the statement from a witness that these were for the purpose of draining off the water produced by the melting frost. H. A. Madsen, who was employed by the Bidwells and had to do with designing, being especially familiar with the refrigerating device, said that even if the motor could do what was claimed for it it would never be more than a novelty because the cost of refrigeration was extravagant. It was declared that it would require an input of over eight horsepower of energy to deliver five horsepower. One witness, a former employe, said that to his knowledge castings for six or eight machines had been made, but, so far as he knew, no completed machines had been sold.

The main contention of the state is that a device purporting to prevent the burning out of a motor when subjected to an overload by the application of external refrigeration is an absurdity and a scientific impossibility, as no degree of cold can prevent the destruction of the insulation when the wire is subjected to greater current than it can carry.

The trial is still in progress, and disinterested technical experts are to testify.

The daily papers are devoting columns to the case; one of them, in summing up the proceedings of a day in court, says:

"Attorney Brady still asserts that if he can get the power from the Edison company he will make ice cream in the motors and produce such a drop in the temperature of the courtroom that court and jury will wear overcoats and fur hats like Benson Bidwell.

"Attorney Popham declares that if the motors run at all he will show that he can make them so hot that he can fry eggs on them."

Power Development on Feather River.

The Great Western Power Company, which has been making rapid progress on its hydraulic work at its hydro-electric plant at the Big Bend of the Feather River in California, will probably be ready to turn over the generators of its initial installation some time next fall. According to the plans of the company a steam reserve plant of moderate capacity, equipped with turbo-generators, is to be installed in Oakland, Cal., on a site already secured near the water front. From this station current could be transmitted north into the territory now covered by the Bay Counties transmission system of the California Gas and Electric Corporation. The construction of this station has not yet been commenced.

At Big Bend a tunnel three miles long and 18½ by 20 feet in the clear has been completed through rock. This greatest waterpower conduit in the world conducts a large portion of the river's flow under a mountain that extends 3,021 feet above the tunnel. The intake of this tunnel is at Whisky Bar on the north fork of the Feather River. The direct line of the tunnel saves 19 miles over the natural curve of the Big Bend. There is to be a drop of about 540 feet between the upper end of the tunnel and the water wheels in the power house. The ultimate development at this site will be 120,000 horsepower, according to estimates. The transmission line is to run in a direct course from the plant to Oroville, to Marysville, to Sacramento, to Antioch, and thence to Oakland. The main transmission wires will be carried entirely on steel towers, 75 feet high, erected 750 feet apart.

Electric Campaign Cane.

An electric novelty that may be used during the coming presidential campaign is an electric campaign cane patented on February 18th by George C. Hockenberry of Ravenna, O. This cane has a sleeve secured to the upper end of the stick so as to extend beyond it. A hollow transparent handle is removably fitted into the outer end of the sleeve. An incandescent lamp bulb extends into the hollow handle and has its plug engaging internal threads in the handle. A storage battery is placed within the sleeve between the lamp anl outer end of the stick. A stationary contact is carried by the bat- [illegible] battery terminal to the lamp. When this button [illegible] candidate in whose interests the cane is being carried. In a parade the use of this cane bids fair to be a striking feature.

The Eiffel Tower Fire.

A fire which caused some damage occurred recently at the radio-telegraph post located at the Eiffel Tower, Paris. The sheds which are used to house the apparatus are situated in one corner of the Champ de Mars and not far from the base of the tower. Here are located two large sheds of frame and plaster construction, besides two smaller sheds built entirely of wood. In the latter are installed the more delicate apparatus for the system. One of the two others serves as a storehouse and the second is used for experiments. On the day of the fire three officers were occupied in the latter building in experimenting with a new set of apparatus, which was recently constructed in order to be sent to Dakar, in Africa, where the government decided to place a radio-telegraph post so as to make connection with the Eiffel Tower. This apparatus consisted mainly of a motor, a transformer and a condenser. The insulation was carried out by means of receptacles filled with petroleum.

In making the experiments, Captains Vivet and Fraque and Engineer Teisser were occupied in finding what would be the maximum voltage given by the apparatus. Suddenly, about three o'clock, a spark set fire to the oil in one of the vessels, and soon all the petroleum of the condenser was burning and could not be put out, so that the men were obliged to abandon the shed, which was then closed to prevent the fire from spreading. The firemen arrived in time to prevent the fire from extending to the other sheds, and thus prevented a disaster. Most of the material in the shed was destroyed, and the damage is estimated at $10,000. However, the main part of the Eiffel Tower post did not receive the least damage and messages are being sent and received as usual.

The post is in permanent communication with Admiral Philibert, who has command of the French war fleet, which is now lying before Casablanca in Morocco, in view of the recent military operations which are being carried out by the French troops in that country.

Gas-engine and Gas-producer Guarantees.

Before the new Gas Power Section of the American Society of Mechanical Engineers Dr. Charles E. Lucke of Columbia University, the president of the section, presented a paper last month on "Gas-engine and Producer Guarantees." In this paper Dr. Lucke called attention to the obscure and indefinite nature of existing specifications and guarantees given in connection with the efficiency and performance of gas producers and engines, quoting from a number of actual guarantees now used by various makers. He urged the importance of framing such documents so that there need be no opportunity for difference of opinion, or, if such differences arise, the guarantee should be so framed as to render the points described to be of easy and positive determination. After considerable discussion, in which the importance of greater definiteness in such guarantees was generally admitted and urged, it was moved by Mr. H. L. Doherty that the chair be directed to appoint a committee, of which he (Dr. Lucke) should be a member, to examine the subject and report to the Section.

Richmond and Chesapeake Bay Single-phase Railway.

Recently completed so far as the first section is concerned, the Richmond and Chesapeake Bay Railway brings to notice several novel features in connection with the equipment and construction of an up-to-date single-phase road. At present it extends only from Richmond, Va., to Ashland, in the same state, a distance of 14.8 miles, but it is highly probable that it will later be extended to serve the territory lying between Richmond and Washington, or a considerable portion of it.

The Richmond and Chesapeake Bay Railway is a single-track road with turnouts. The use of a trolley potential of 6,600 volts is an indication of the extent to which higher trolley potentials is being used. The employment of the pantagraph trolley with a steel pan is also worthy of special attention. There are no sub-stations for operating the railway, but a lighting sub-station is situated at the Ashland terminus.

At present the railway has no power station of its own, but the generating apparatus is installed in the Twelfth Street power house of the Virginia Passenger and Power Company of Richmond. This equipment is of special interest, owing to the manner in which provision is made for securing operation under varying conditions at the power house. The generating apparatus consists of two 750-kilowatt, 25-cycle, three-phase generators running at

REINFORCED CONCRETE VIADUCT ON RICHMOND AND CHESAPEAKE BAY SINGLE-PHASE RAILWAY.

128.5 revolutions per minute and designed to give 6,600 and 13,200 volts.

One of these generators is direct-connected to a 1,450-horsepower hydraulic turbine at one end of the shaft and to a 750-kilowatt, 60-cycle, 2,300-volt, three-phase generator at the other end, both of the units being mounted on a common base. Should there be insufficient water to operate the turbine the 60-cycle generator will be run as a motor. The other 25-cycle machine is coupled to a hydraulic turbine and also to a 750-kilowatt direct-current generator, the latter machine being used as a motor in the event of low water.

From the above it will be seen that when waterpower is plentiful the 60-cycle generator and the direct-current generator can be used for city lighting. The switchboard panels for controlling the output of these machines are of blue Vermont marble and are provided with the necessary indicating and measuring instruments.

Under the present operating conditions only one phase of the generators is used to supply the line voltage of 6,600 volts. The transmission cable is laid underground in a vitrified earthenware conduit a distance of approximately 1.6 miles to the terminal depot. It is a three-core lead-covered cable, each core having a capacity of No. 0. One core is used for the line feeder and the others are connected to the rails and serve as a return circuit. At the Richmond terminal depot the cable enters a high-tension cabinet before being connected to the trolley.

The electrical equipment of each of the four motor cars which at present comprise the rolling stock consists of four GEA-603-A railway motors and a full complement of control apparatus.

Of special interest in the electrical equipment are the motors. These are of the latest pattern developed by the General Electric Company and are of what is known as the series repulsion type. These motors have excellent commutating qualities, which have been secured by the fractional pitch winding of the armatures. This winding performs the same function as do commutating poles in direct-current motors. Each motor has a capacity of 125 horsepower. The power and high starting torque of these motors were well illustrated on one of the trial trips. On this occasion one car was coupled to a train of five Norfolk and Western standard railroad passenger coaches carrying 300 passengers

Company and [illegible] the standard Pullman car as used in [illegible] car [illegible] people. The combination passenger and [illegible] seating capacity of the combination passenger and baggage car is slightly [illegible]

The trucks are of the inside-suspension type and were manufactured by the Baldwin Locomotive [illegible]

[illegible] splitting device to the induction-motor end of a [illegible] 25-cycle, 440-volt, single-phase induction motor direct connected to a 100-kilowatt, 2,300-volt, 60 cycle, single-phase generator. A four-kilowatt, 125-volt exciter is mounted on the common shaft at the generator end. [illegible]

A Typical Turnout.

Interior of Ashland Sub-station for Lighting Town.

THE RICHMOND AND CHESAPEAKE BAY SINGLE-PHASE RAILWAY.

and hauled the load with ease. To test their capacity further two of the motors were cut out and the remaining two started this same train on a one per cent. grade.

The control is of special interest on account of the features that make it a duplicate control. Each pair of motors, with their compensator and contactors, forms a practically independent equipment. This feature has the advantage that should one motor or any part of one-half of the equipment become damaged the car can then be operated as a two-motor equipment by throwing one blade of a double knife disconnecting switch. The actual control apparatus is practically standard throughout.

Company. The air brakes possess the feature of graduated release which is found in the straight air type and can also be operated as an automatic system.

The overhead construction is of the catenary suspended type, the trolley itself being of No. 0000 grooved copper wire. The messenger cable is of steel and has seven strands. On the first section of the road between the Richmond depot and the car barns the track is laid on a reinforced concrete viaduct, the trolley being supported by a system of steel spans. Bracket supports are used on the other sections of the road.

The sub-station at the Ashland terminus is unique,

COMBINATION PASSENGER AND BAGGAGE CAR ON RICHMOND AND CHESAPEAKE BAY RAILWAY.

The master controller is type C-40-A and the contactors are of the ordinary alternating-current type.

These are the first equipments of this make put in operation with two compensators. The compensators are oil-cooled and are provided with taps to give 600, 450, 400, 340, 280 and 113 volts. The 600-volt taps are used only on the auxiliary circuits. All the high-tension apparatus is enclosed in a specially constructed asbestos-lined cabinet. Each car is equipped with two trolleys of the pantagraph type. The trolleys are constructed with steel pans, this material having been found to give greater satisfaction than either copper or aluminum.

The car bodies were built by the St. Louis Car

inasmuch as its function is to provide for the lighting of the town from the high-tension, single-phase trolley. This is probably the first time that an attempt has been made to supply a lighting system from a high-tension single-phase trolley subjected to severe load fluctuations, and the satisfactory results that have been attained speak well for the design of the regulating apparatus in both the sub-station and main station. The Tirrill regulators in both the sub-station and the power house give close voltage regulation.

The 6,600-volt single-phase current is transformed to 440 volts by two 25-cycle oil-cooled transformers of 150 kilowatts each. From the low-tension side

feeder panel for general lighting purposes in the town of Ashland.

All oil switches are designed for 6,600 volts and are enclosed in cells constructed of brick and fiber floors. All the machinery, switchboards, indicating and measuring instruments are of General Electric manufacture.

Exceptional Performance of an Induction Motor.

The general sturdiness and endurance of the induction motor under adverse conditions are well known, and the following incident serves to illustrate these traits.

A five-horsepower, 440-volt, squirrel-cage General Electric induction motor was belt-connected to a centrifugal pump in the quarry of the G. H. Perry Company, Sioux Falls, S. D., the capacity of the pump being 158 gallons per minute and the lift about 45 feet. The motor was operated continuously during the rainy season, and was often allowed to run without attention during the night. One Sunday morning an operative noticed that the quarry pit was full of water, the motor being partly submerged. The necessity of clearing the pit of water being evident, the current was turned on. To the surprise of all, the motor came up to speed and carried the load until the pit was clear, apparently none the worse for its prolonged bath. On examining the motor the next day, that portion of the paper pulley which had been under water was found to be softened and considerably warped out of shape. This motor gave excellent service until two months later, at which time it was completely destroyed in a fire which consumed several of the company's buildings.

Electricity on Modern Warships.

In an article in The World Today on "The Fighting Ships of the Future," Mr. Daniel T. Pierce notes that the progress of the use of electricity aboard war vessels continues without interruption. On the Vermont type of battleship only the steering, windlass and ash-hoist engines, the force-draft blowers, ice-plant, distilling and heating system are run by steam. All the other auxiliaries are operated by electricity. Lighting, ventilation, ammunition hoists, fire-room indicators, the laundries, the power bulkhead doors, and the thousand-and-one auxiliaries of the battleship of the future will depend upon the ship's generators for power.

Further, Mr. Pierce speaks of an inventor who says that he has perfected a device which may be moved from one part of the ship to another at need and placed in contact with conductors running to the electrical steering apparatus. If this invention proves practicable, it will be possible to steer the vessel from any one of a dozen locations.

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[illegible] practical railroad men. The telephone is more economical, and with proper precautions is considered as safe as the telegraph for train orders. Mr. Albert S. Engals of the Lake Shore Railroad is reported to have said that the new law regulating working hours will bring about in one year what it would have taken ten years to accomplish in the way of introducing telephones in operating trains.

ELECTROLYTIC PROCESSES are being constantly extended in scope. Thus at a recent meeting of the Société des Electriciens in Paris an interesting paper was read by Mr. Chaumat upon the electrolytic preparation of indigo. Over 1,000,000 pounds of this product are manufactured annually in France, and it is thought that the electric method will be a great improvement. The industry of indigo dyeing in France uses $1,000,000 worth of raw material per annum, and in Germany this reaches $20,000,000.

A SENSIBLE CONCLUSION was reached by the government commission appointed to ascertain whether the surplus water flowing over the dams in the Mississippi River between St. Paul and Minneapolis, and not needed for navigation, could be utilized for light and power for nearby government buildings and government property. The commission's recommendation was in the negative, and it was shown that the comparatively small amount of current needed, or apt to be needed, would cost nearly as much from the hydro-electric development as from existing sources. The saving would be small, while there would be the added risk of injury to the existing dams, owing to the character of the rock constituting the bed and banks of the river.

As we have frequently pointed out, every proposed hydro-electric development forms a problem to be studied by itself in view of all the local conditions, such as the demand for power, the cost of fuel, the character of development necessary, the length of transmission, the stage of water all the year round, and the like. It will not do to assume, because the cost of fuel is eliminated, that every waterfall affords a profitable site for hydro-electric development. Many other considerations enter into the calculation, and the whole situation should be studied carefully.

GAS-ENGINE guarantees are said by Prof. Charles E. Lucke of Columbia University to be rather indefinite. This is not surprising, in view of the rapid development of the art of gas-engine design within the last few years. The same remark applies to gas producers. The subject is one well worthy of the attention of a body of disinterested engineers, such as one may suppose the new Gas Power Section of the American Society of Mechanical Engineers to be, and the section is to be commended for its action in appointing a committee to examine the subject. This action was taken on the motion of Mr. H. L. Doherty as the result of a recent paper by Dr. Lucke, president of the section, on the subject. It is important that the specifications and guarantees of gas engines and gas producers be exact, so that purchasers may know just what to expect in service and reliability. It is to be borne in mind, however, that in the case of gas engines it is particularly true that the performance of the machine is due in a large degree on the intelligence and fidelity of the attendant. This point will no doubt be covered in the report of the committee, which will be awaited with interest, for the use of the gas engine is not only widespread but steadily increasing.

IN NO BRANCH of the art of generating and selling electricity is there greater need for the dissemination of dependable information among the general public than on the subject of rates of charging for electric light and power. Electrical men, also, are eager to obtain reliable data on the subject. We take pleasure, therefore, in presenting in this issue a condensed report of the discussion before the City Club of Chicago on March 7th.

This discussion related to the ordinance pending in the Chicago City Council which is designed to fix for five years the rates to be charged by the Commonwealth Edison Company. The two principal figures in the discussion were Mr. Robert R. McCormick, president of the Sanitary District, and Mr. Samuel Insull, president of the Commonwealth Edison Company. From its waterpower plant on the Drainage Canal the Sanitary District (a public body formed of trustees elected by the people) is supplying a considerable amount of electric current, although small, of course, when compared to the business of the central-station company. Mr. McCormick, who is a fine example of the best class of public servants, has evidently made a study of the question of electric power rates, and is entitled to credit for his thoroughness and broad-mindedness.

Mr. Insull's remarks were of particular interest. Among electrical men the president of the Commonwealth Edison Company of Chicago has the reputation of being one of the most enterprising, liberal and sagacious men in the business, and what he says is listened to with attention and respect. Mr. Insull gave a clear exposition of the relation of the central-station company and the public, and showed the broad, simple lines on which the business of his company, at any rate, is conducted. He was frank and direct and did not hesitate to disclose freely the very low rate made to the street railways and to tell how it was possible to make this rate. The address made an excellent impression, and electrical men generally, we are sure, will read it with attention.

IN LARGE CITIES the provision of adequate transportation facilities in the congested districts is an ever-present and pressing problem. It was realized long ago that the removal of surface cars from the main streets in the business centers was highly desirable, in order to provide for the rapidly increasing street traffic. Out of this conviction grew the construction of elevated and underground transportation lines, as seen in New York, Boston, Philadelphia, Chicago and other American cities. These facilities above and below street level were constructed at great expense and were believed to have solved the problem permanently.

Now New York finds its subway cars as crowded as were its surface and elevated cars before construction of the subway was completed but a few years ago. Chicago has for some time found its elevated Union Loop, constructed about a decade ago, entirely inadequate for the great traffic upon it during the rush hours. These conditions have brought forth ideas from many sources as to further plans for relief, many of which are either so radical or shortsighted as to call for a word of warning, lest, in the public clamor on the subject, they be hastily adopted. The fact should be borne in mind that this is mainly an engineering problem, whose solution should be left to broad-minded, experienced engineers that are competent to devise plans for immediate relief that will not conflict with the provision for greatly increased facilities in the future. In Chicago it has been urged that the Loop be torn down, and the elevated trains brought to or through the business center in subways. Now it is evident that a steadily growing metropolitan city will always have a traction problem to contend with, even when it makes use of surface, elevated and subway lines. It would evidently be an ill-advised policy for Chicago to discard a good but inadequate elevated system and try to jam most of its traffic into a system of subways that would itself soon prove inadequate.

A wiser course to pursue would be to improve the facilities of the Union Loop and make it less objectionable to the eye and ear, and later to construct a number of subways in the business district for the principal surface car lines, which could be gradually extended into a comprehensive system as conditions required it. On the other hand, the present facilities could be made to accommodate a great many more passengers comfortably during the rush hours, if the peak traffic could be diminished a little and extended over two or three times its present duration. This would require concerted action by the larger business houses to so adjust their opening and closing hours that employes would come and leave it in small groups at short intervals for, say, an hour and a half, instead of in swarms during half an hour.

Progress of the Institute.

By recent resolution of the board of directors of the American Institute of Electrical Engineers the office of assistant secretary was created and Mr. Frederick L. Hutchinson was appointed to that position, dating from March 1st.

Mr. Hutchinson began his business experience in the service of the Pennsylvania Railroad Company in one of its largest freight offices in New York city, where he had several years' experience in general office work. In 1889 he resigned to enter Cornell University in the electrical engineering course. Immediately after graduation in 1893 he entered the employment of the Westinghouse Electric and Manufacturing Company. After a few years' experience in the factory, testing, drafting and sales departments, he was transferred to the publication department, where for several years he had charge of the preparation of the technical publications of the company. In 1901 he resigned to become manager of the publication department of the C. W. Hunt Company, Staten Island. The following year he went with the National Electric Company of Milwaukee, as advertising manager, and a year later was made manager of electrical sales for the same company. Since 1904 Mr. Hutchinson has been connected with the Institute offices under Secretary Ralph W. Pope.

This action of the board of directors marks another step in the development of the Institute, the activities of which are constantly increasing. The membership of the organization has increased more than 25 per cent. during the last year, and now exceeds 5,400. There are now 37 active sections or branches located in the principal electrical centers of the country.

The diversity and amount of work that is being carried on by various committees of the Institute is also steadily increasing. The work of many of these committees is of great and lasting benefit, not only to the electrical profession, but also indirectly to the general public; and without doubt the influence of the Institute is greater now than ever before.

Death of A. C. Durborow.

Allan C. Durborow of Chicago, well known to electrical men in the period from 1888 to 1891, at which time he was business manager of the Western Electrician, died at the Robert Burns Hospital in Chicago on March 10th. Mr. Durborow had been ill for some time, but there were many of his friends who did not realize his serious condition, and to them the news of his death came as a shock.

For a number of years Mr. Durborow was active in Democratic political circles in Chicago. He was elected to Congress from a West Side district in 1890 while connected with the Western Electrician, and in 1892 he was re-elected. He served his constituents faithfully in Congress, and was popular with his fellow-members. for he was a man who easily made and retained friends. Born in Pennsylvania in 1857, Mr. Durborow moved with his family shortly after the Civil War to Warren County, Ind. He graduated from the University of Indiana in 1877. His first business experience was with a publishing firm in Indianapolis. Seeking a larger field, he came to Chicago, where his first employment was with Field, Leiter & Co. After his service in Congress Mr. Durborow was with the Illinois Steel Company until 1898, when he entered the insurance field, in which business he continued until stricken by the illness that proved fatal. He was unmarried, and of late years he spent much of his spare time at the Chicago Athletic Club.

Mr. Durborow had a wide acquaintance and was well liked for his cheeriness, generosity and even temper. His untimely death is sincerely regretted.

Spokane and Inland Empire Railway Completes Power Dam.

A new lake within the limits of Spokane, Wash., formed of waters from the Bitter Root Mountains, has peacefully taken its place among the topographical features of the great Northwest, and so clear is its water that the slender pines and moss-grown boulders on the steep slopes find their reflections on the quiet surface.

The new lake, which gives promise of being developed as the chief summer resort contiguous to Spokane, is formed by the backwater in the Spokane River, held by a large dam at Nine Mile by the Spokane and Inland Empire Electric Railway Company for the development of electric power. In rising to its new level the river has spread over a large area, covering shoals and bars projecting into the water, and these will be ideal bathing places the coming summer

The dam is a concrete wall 60 feet high, causing backwater for three miles up the stream. It required less than 24 hours after the floodgates of [illegible]

[illegible]

Power Company, but it needs the additional power.

The dam is 225 feet in width and varies in thickness [illegible] at the top. It contains 42,000 cubic yards of concrete. The power house, [illegible] foundations in the bed of the river, is 100 feet above the surface of the water. Two of the four turbines, each with a capacity of 5,000 horsepower, are now being installed When all the turbines are in place the full current of the river during the minimum flow will be utilized. Progress is being made in the installing of the generators, and the power house will be ready for operation before the transmission line is completed.

Zambesi-Johannesburg Transmission.

On March 4th the Pittsburg Section of the American Institute of Electrical Engineers held the largest and most interesting meeting of the season in the Carnegie Institute Lecture Hall. The meeting was unusually successful from a social point of view, there being a large number of prominent engineers and other professional men present, making an audience of over 400. Just preceding the meeting an enjoyable informal dinner was held at the University Club, 65 members being present, who represented some of the largest industries in the Pittsburg district. Among them were Mr. Davis of the Aluminum company, Mr. Keller of the Westinghouse Machine Company, Mr. Uhlenhaut of the Pittsburg Railways Company, Mr. Orr of the Allegheny County Light Company, Mr. Longbranch of the Western Electric Company, Mr. Paul Lincoln of the Westinghouse Electric and Manufacturing Company, Mr. Grace of the Bell Telephone Company, and Mr. Gibbs of the Pennsylvania Railroad Company.

Mr. C. E. Skinner, chairman of the section, introduced Mr. Ralph D. Mershon of New York, the speaker of the evening, and called attention to the fact that Mr. Mershon is an old Pittsburger and that he used to surprise his colleagues with his mathematical ability, one of his specialties being the binomial theorem, upon which he had written an essay.

Mr. Mershon said that he and the audience were brought together under false pretenses. First, he had been asked to give an informal talk before a few members of the society, while, secondly, there was no Zambesi-Johannesburg transmission, and not likely to be any for several years. However, he had collected some pictures upon which he would talk.

While Mr. Mershon gave very little data in figures, he showed that he had considered thoroughly the business and labor conditions which often count more in engineering than figures. Merely a beginning has been made in tapping the mineral wealth of the country and nobody knows how great it is. The Victoria Falls Power Company is a company formed of British capitalists for the purpose of transmitting power from Victoria Falls (the African Niagara) on the Zambesi River to Johannesburg, a distance of 700 miles, for use in mining gold. Mr. Mershon was retained by this company, with several European engineers, to make a report on the feasibility of such transmission. The European engineers reported favorably on the direct-current (Thury) system, while Mr. Mershon favors an alternating-current system, which will eventually be installed.

For the present, Mr. Mershon has advised installing generating stations operated by steam on the Rand, near Johannesburg, and by that means build up a market for electrical energy. At present the actual power used along the Rand is 85,000 horsepower, with prospects that it will be largely increased before long. The idea is that after the mine owners become accustomed to the use of electric power and the market is assured the transmission power plant and line can be built for conveying the power from the falls, and it will not be necessary to carry a heavy investment for a long time with only a partial earning capacity.

Kaffir labor is quite good, but very peculiar. Laborers get two shillings and bosses £1 a day. Even at this, it is said that white labor is equally as cheap. General Botha, who employs a great deal of Kaffir labor, gave Mr. Mershon full details of all troubles he would have to contend with.

Victoria Falls are on the Zambesi River at a point where the river is a mile wide, and there is an ideal location for a power house and raceway where the river makes a sharp bend. The Rhodesia Railway (forming a portion of the so-called Cape to Cairo Route) at present extends 400 miles north of the falls and crosses the Zambesi River at the falls by a magnificent bridge 600 feet long and 400 feet above the river. The height of the falls is 400 feet, or two and one-half times as high as [illegible]

Omaha and St. Louis Electrical Shows.

[illegible]

The Nebraska Electrical Trades Association, conducting the [illegible] tions are now under way, and promises, perhaps, the best electrical exhibition ever held west of Chicago. The Auditorium is a building of large proportions and admirably adapted for the purpose The decorative lighting will be superb, and among the more attractive features of the show will be an electric cottage equipped with devices of an electrical nature. Demands for space at this show have been very encouraging, and the association is already assured of a large number of exhibits. Considerable choice space is still to be had, however, and exhibitors should apply at once to J. M. Gillan, manager of the show, at Omaha.

All booths will be enclosed with posts and railings and furnished with sufficient light for ordinary purposes. Exhibitors will be required to pay a reasonable charge for extra light or power. Booths 8 by 10 feet in size will cost $40, and larger ones, 10 by 12 feet, $60.

In addition to the exhibits of electrical appliances and machinery, good music and other entertaining features will be furnished.

From St. Louis the latest news in relation to the projected electrical show is that it is to be transferred from the First Regiment Armory to the New Coliseum, on the ground that it was found that the floors of the armory would hardly sustain the weight of heavy machinery exhibits. The Western Electrician is not advised whether any further change has been made in the date of holding the show.

Electricity for Car Lighting.

In a recent discussion before the American Society of Mechanical Engineers, Mr. Lamar Lyndon of New York said that for some years he had been engaged in this class of work, and he believed that the present systems of lighting are in a transition stage and that eventually electricity will supplant all other methods of lighting railway trains. Furthermore, trains will be lighted by individual units, axle driven; but no system which carries a commutator, brushes, pole changer and a driving mechanism underneath the truck can ever be successful. A system can and will be designed in which all of these elements and disadvantageous factors will be eliminated, and when such a system is produced, that is absolutely reliable, possessing none of the troubles of the present axle-lighting systems, no other system will be used, and the question as to whether Pintsch or acetylene gas is the better, will be a discussion of the past.

It may be of interest to know that the Railway Mail Association has petitioned Congress to light all mail cars by electricity, because it considers any form of gas illumination dangerous. This bill, however, never passed.

Electrical Committee of Underwriters' Association.

The sixteenth annual meeting of the Electrical Committee of the Underwriters' National Electric Association will be held on March 25th and 26th, beginning at 10 a. m., at the rooms of the New York Board of Fire Underwriters, 32 Nassau Street, New York city. This is an important meeting, for many suggested changes in the National Electrical Code will be considered. Mr. C. M. Goddard of 55 Kilby Street, Boston, secretary of the committee, has issued a bulletin of committee reports and suggested changes relating to the Code which he will no doubt send to responsible persons on request. It is strongly urged that all persons suggesting changes or opposed to suggested changes be present at the general meeting to support their recommendations. Mr. Goddard says: "It has always been the endeavor of our Electrical Committee to make only such changes in the Code as are made necessary by progress in the art or such as have been shown by some field experience to be necessary to safeguard against hazard."

Electricity Rates Discussed at the City Club of Chicago.

The City Club of Chicago devoted its meeting of Saturday afternoon, March 7th, to a discussion of the new contract ordinance for the Commonwealth Edison Company now pending before the City Council, the ordinance having been favorably reported from the committee on gas, oil and electric light. Mr. Victor Elting presided at the meeting, which was one of common-sense reasoning. There was an apparent disposition on the part of all interests represented to be fair, and the discussion was along the lines of good business principles, such as should be productive of a satisfactory agreement on the basis of a fair return for good service.

The principal speakers at the meeting were Mr. Robert R. McCormick, president of the Sanitary District of Chicago, and Mr. Samuel Insull, president of the Commonwealth Edison Company.

That the situation may be clearly understood it may be well to recall the salient features of the pending contract ordinance. The measure legalizes the consolidation of the Commonwealth Electric Company and the Chicago Edison Company and provides three per cent. of gross receipts as compensation to the city. The rates named are for a term of five years, and the maximum authorized is as follows: For the first 30 hours' use per month of the maximum demand, 15 cents a kilowatt-hour during the first year of the ordinance; after the first year, 13 cents a kilowatt-hour. For consumption in excess of 30 hours per month of the maximum demand, 9 cents during the first year, 8 cents during the second year, and 7 cents during the last three.

Mr. McCormick's Remarks.

Mr. Robert R. McCormick was the first speaker, and his remarks, in part, are as follows:

The cost of the production of any commodity is dependent, of course, upon fixed charges and operating expenses and material. The cost of electricity as a commodity, as far as fixed charges go, is fixed upon the cost of the power house and the equipment needed, cost of the transmission lines, storage batteries, transformers when used, and other minor matters which need not be mentioned. The cost of administration includes salaries, repairs, advertising, coal, water, taxes, etc. When we get the original cost of the investment, when we get the cost of the operating expenses, we can say, now we have the cost of production of electricity, but there we are in error.

If it were true that all the current generated by the plant of an electrical company was sold during the whole 24 hours of each day, then we could take the amount of electricity produced during those 24 hours, take the cost, and by comparing the two we would get the actual cost of producing current. But, excepting in very rare instances, no power is sold from the producer to any consumer upon a 24-hour basis. No power is sold, we will say, to the extent of 100 horsepower to one consumer for 24 hours, except in very rare instances. On the contrary, power is sold in many different ways from that. I will run over in a few words the different methods in which power is sold.

Take first street-railway companies, which are big consumers of power. Beginning about half-past 6 or 7 o'clock in the morning, when people are going to work, there is a big demand for electricity on the street railways, which lasts through the rush hours, and, we will say, until about 9 o'clock. Then from 9 until about 5 o'clock nowhere near so large a use of electricity as during the rush hours is needed; and then again from 5 o'clock on to about 7 we have rush hours; from 7 o'clock until midnight we have considerable use, and then from midnight until 5 or 6 in the morning very small use. Therefore the producer, in order to pay his expenses, has to charge a rate which will cover his interest charge and his depreciation, which run 24 hours a day.

Information as to the amount charged the electric railroads has come to me unsolicited and not in confidence; therefore I can see no objection to [illegible] the information I have received. I am informed that the street railways are furnished power on this basis: For the maximum amount used at any time during the peak load a charge of $15 per kilowatt-year is made, and on top of that a half cent for each kilowatt-hour used. How this works out as to the cost per kilowatt-year the engineers of the Sanitary District are figuring closely, with the idea that the Sanitary District [illegible] of the power. They have not [illegible] the figures to such a point, they [illegible] the best of my knowledge and [illegible] approximately, $30 per kilowatt [illegible] in that statement.

[illegible] downtown. They [illegible] amount of [illegible] I suppose [illegible] until a late hour in the night. For stores of this kind it [illegible] four, possibly more, possibly less, cents per kilo-[illegible]

Good-sized factories which expect to run 10 hours a day or more, or perhaps eight hours a day, which have a certain amount of machinery and understand their business, will also guarantee a certain use of power during the day upon which the producing company can base its charge to be sure of covering its expenses. It is customary also to charge these people upon the flat-rate basis.

Going from them to smaller manufacturers or smaller stores we find people who are not prepared to guarantee a certain use per day. Perhaps they do not know themselves what the use will be, or perhaps they are afraid to make a guaranty. In this case the company has to protect itself for its investment and puts in what is called a maximum-demand charge. If the customer uses but little power he pays for it at a high rate, and in that way in a measure protects the producer. If he finds after this contract has expired that he does not use it for a longer number of hours, then he gives up the use of the company's current to the mutual satisfaction of both parties.

Proceeding from the small manufacturer and the storekeeper to the small consumer for light in his home, we come to a still more disorganized situation for the producer. A house may be wired and lamped for anywhere from five to 5,000 lamps. These lights, it is perfectly evident, are not used all the time. The hours of use are indeterminate and variable and it becomes far more difficult for the producer, whether it be the Commonwealth Edison Company or whether it be the Sanitary District of Chicago, to know how they are coming out at the end of the year with such consumers than with the other people I have mentioned. Therefore, it has been customary to charge a higher rate for house lighting than for other uses of power. However, I am inclined to think that the producer is inclined to be very timorous on the subject of house lighting.

Now, these people are charged on the maximum-demand basis. The first charge, 15 cents per kilowatt-hour, is based upon the maximum amount of electricity used during any part of the month, although that may be for but one hour in 30 days, or perhaps for four or five hours, we will say, in the case of an entertainment being given in the house. Now, it is stated, with what degree of accuracy I am not sure, that the producing company must hold itself ready to supply this full amount of power for entertainment in people's houses; but I wish to call this to your attention as a fact beyond dispute, that when Mr. Jones is giving a party and has the house all lighted up, Mr. Smith and Mr. Brown and Mr. Johnson and 10 or 11 other gentlemen are dining with Mr. Jones, and there is practically no light in their houses, so there is not a peak load, as it might seem, because the other people are not using power at that time.

Students of the use of electricity find that to a certain extent power and lighting loads cross each other. I mean by that that the lighting load in the evening is turned on before the power load of the day is turned off, and so during a certain time in the day, about 5 or 6 o'clock, we find the power load and the lighting load being used to a considerable extent at the same time. That is called the peak load and it is made the worst when you have the street-railway load on top of it, because every power producer, whether it be the Chicago Edison Company or any other, of course, has to have power enough to take care of the peak load. But what this peak load is I am not prepared to say until I have had a great deal more experience than I have to this date, because of the reason that the power load is being cut down before the lighting load reaches its maximum. However, there is a peak which is the controlling item in the output of electricity and which must be guarded against in a power house in taking care of these fixed charges of the company.

Again, this peak load is not so serious as it might seem to us, for the reason that manufacturers of electrical apparatus have learned so to construct their machinery that for a period of two or three or more hours the plant can run at an overload. Again, we find other mitigating circumstances. We find there are consumers the nature of whose business or whose industry is such that they do not take power at all during the peak hours. I am informed by our engineers that the best illustration of these people is the newspapers.

Take again a theater. On matinee days a theater turns on its light about 1:30 and runs until about 5 in the evening; turns on its light about 7:30 and runs until toward midnight. Then there are undoubtedly a great many other consumers who take power in many different ways, and many customers whose business I do not know of and whose use I know nothing about, and I have an idea which comes to me very strongly that we will find in the electrical business as it has been found in banking and in insurance. If every depositor in every bank in this country went for his money at the same time the banks would "go broke." But we know by the law of averages that people do not all draw their money at the same time. There is a law of averages on the consumption of power, which law I do not know, which varies with cities and probably varies from year to year. This law of averages can only be known to some one who is very close to the production and sale of power.

Three years ago, during Mayor Dunne's administration, in my second year in the Council, I was a member of the committee on local transportation. The mayor had brought before our committee an ordinance for the municipal ownership and operation of street railways. I remember as one of the committee saying that as an alderman of Chicago and a member of the City Council I would consider that I was making myself ridiculous if I presumed to recommend the ordinance or to act upon it in legislating for the whole city unless I had before me such information as President Mitten of the South Side street-railway company would demand before he would propose the installation of a street railway for a private corporation. And it seems to me today that if I were sitting in the City Council again, legislating again for the whole city of Chicago, I would feel that I was not doing myself or my constituents justice if I proposed to legislate to fix rates to the consumers of the whole city unless I had before me information upon which I knew that all rates were fair, and not because I had information upon rates in other cities, or because one or ten or one hundred men who had studied similar questions gave expert opinions upon the merits or demerits of the proposition

Mr. Insull's Argument.

In introducing Mr. Samuel Insull, president of the Commonwealth Edison Company, Mr. Elting said that the City Club has no opinion and has reached no decision whatsoever in the matter being discussed. The club and its members are only desirous that the City Council act understandingly on the subject and act only with such delay as is necessary to acquire that knowledge of the subject which the council should have in all its official actions. Whatever may have appeared in the public prints concerning the City Club, Mr. Elting said, was without authority of the club as a club. Mr. Insull said:

I had some hesitation in appearing before this club because I do not want to be placed in the position of being a special pleader for the ordinance which is now before the City Council. The ordinance is not of our seeking. Our one object in life is to keep out of contact with the legislative body governing this city, and all that we want is to be left quietly alone. With relation to the speech of my friend, Mr. McCormick, except on one or two minor details, all I can say to you, gentlemen, is that I endorse all that he had to say. I do not think the question of rates is quite as intricate as he seems to think it is, and when he has been in the business as long as I have I think he will agree with me; and I will try to explain to you as I go along what I have to say.

Before, however, coming to what I assume is the real kernel of the matter, namely, rates, I would like to say a few words not in any sense in defense of the committee on gas, oil and electric light, but in defense of the corporation that I have the honor to represent. This subject, instead of being dealt with in a summary way, has occupied the attention of the legislative department of the city government for upward of two years. With the exception of a very short period that attention has been given almost continuously. The matter came up in Mayor Dunne's administration, and an ordinance was proposed and passed by the City Council and vetoed by the mayor, which ordinance was adopted after months of discussion and months of investigation and met with the general approval, I think, of the community. It did not happen to meet with the approval of Mayor Dunne. That veto was rendered, I think, in June, 1906.

Late in the autumn of 1906 Mayor Dunne asked Marwick, Mitchell & Co., chartered accountants of this city and New York, their opinion as to what should be done in relation to an investigation of the rates of the then Commonwealth Electric Company and the Chicago Edison Company. I believe their report is in the hands of the committee on gas, oil and electric light. Marwick, Mitchell & Co. in their report, if I am correctly informed, after reviewing the rates of the Chicago Edison Company and the Commonwealth Electric Company, pronounced them as reasonable and advised Mayor Dunne that to make an investigation into the affairs of the two companies, even if he had the right to make it, would be expensive and entirely unnecessary. And this report was rendered, gentlemen, by a firm of accountants who would have been employed and would have made money out of that investigation. I do not suppose that Mayor Dunne, after his veto, would have cared to publish that as a reason for not taking any further action, so nothing further was done until the present administration came into office, and the mayor drew attention to the consolidation of the Edison and Commonwealth companies and advised the gas, oil and electric-light committee of the council to take the matter up. It was referred to the gas, oil and electric-light committee and they have been at work on it more or less ever since; so that instead of this affair being a matter of a few months and hav-

ing received very little or no attention, it has received the attention of the authorities practically during a period of two years.

The question of rates is simply a question of getting a fair return upon a given investment. That is all there is to it. We do not want anything more. The company has been in this community longer than I have, but I have been in it long enough to look around me and see at least 50 men here who know full well that all we are looking for, and all we get, is such a return on our investment as no man in this room would accept on his private business. Retail rates, I am speaking of now, and I will deal mainly with them. The wholesale rates I have never heard anyone object to, and I will deal with retail rates. [Mr. Insull here produced a chart, previously published in the Western Electrician, showing the decrease in the cost of electric light and the increase in the price of other commodities.] Some of you gentlemen have seen this chart in the newspapers and in the street cars. That was put out for the purpose of getting business. I presume I have spent from first to last $20,000 on that curve in advertising.

Our rates in 1896 were on about an average with the rates of all the companies on both sides of the Atlantic. Practically nothing at that time was known about the cost or about the principle governing the cost of electric current. We started in, and, while we have not that reputation here, judging from one or two of the newspapers, outside of Chicago we have the reputation of being the pioneers in low prices for electric current. I have just this last week come back from a hurried trip to London, and it is probably very good discipline for me to come back here and see all these adverse comments that have been made with reference to our rates, because while I was on the other side, as is usually the case, I was introduced to everybody as the man who was furnishing electric current cheaper than anyone anywhere in the world.

Our reduction in rates down to the present time show a reduction of between 40 and 50 per cent. since 1896, extending over a period of about 10 years, when every class of material we use, every class of labor we use, has gone up so much in price that I would scarcely dare to quote the difference between now and 10 years ago. Under this new ordinance they would go down in 1908 to about 55 per cent. of what they were in 1896. In 1909 they would go down 60 per cent., or down to about 40 per cent. of what they were in 1896. What will happen after this, gentlemen, I haven't any idea. I do know this, that under no circumstances can we expect nor do we expect to get more than a fair return on the absolute cash invested, a return, as I have stated before, which would be less than any of you gentlemen would expect to get on your own capital invested in your own private business.

In summer our average load bears the relation of say 35,000 to the maximum of 48,000 kilowatts. In winter the average bears the relation of 48,000 to 95,000. Now, gentlemen, that is the governing point of our interest account. That is the governing point of all charges that are not absolutely dependent upon the amount of our load. For instance, probably two-thirds of the amount of coal is dependent upon exactly how much load we have on as a maximum. The other third we figure in with what we might call a fixed expense, or part of our fixed charges, just as much as interest is part of our fixed charges.

Just take this load [indicating a chart] and it will give you some interesting information on one point that Mr. McCormick referred to. The greatest peak is when the railroads combine with the lighting and power on a working day. That dip is when everybody goes out to lunch, whether it be a lighting customer or a power customer. The dip comes every day of the year; you will find every day the dip is about the same. That is the controlling thing, gentlemen, as to whether we make money or whether we lose money. The question of maximum load is the main cause of all the trouble in electric-lighting rates.

The gas company would be subject to precisely the same condition if it was not for the cheapness of storage. Storage with us is practically an impossibility. The Commonwealth Edison Company has about $1,500,000 invested in storage batteries in this downtown district. We do not carry that investment to insure us a continuity of service. We cannot afford to use the batteries unless it is absolutely essential for our existence that we should. We do not use them every day.

In the small office building the relation of the maximum to the average load is only 10 per cent., or the use of our service would be equal to say 2½ hours a day. In order to get even we would have to get about 21½ cents. You see, the greater part of our expense is the metering, bookkeeping and collecting, the other expenses following in the same relation. With the small flat, where the consumption of current is very small, we come out a little better. We would not come out quite so well under the new rate as under the rate that is in existence now. Our maximum would be about 15 cents, and we are getting now about 14 cents, and it is proposed under the new ordinance to make that 12 cents a maximum [illegible] we don't make much money out of small [illegible] and [illegible]. The average flat [illegible], the larger [illegible], we can almost get out at cost on the new rate. You can take it as certain that all the [illegible] at a loss, that is, figuring [illegible] per cent on money, [illegible] per cent depreciation, [illegible] per cent for taxes and a half per cent for insurance.

We come next to the average store. That man uses light about 20 per cent. of the time, or about four, nearly five hours a day, and we begin to get a little profit out of him. As a matter of fact, our money is really made out of our long-hour users, people who use it 40 per cent. of the time, 9½ hours a day [illegible]. Let me tell you that the avowed policy of the company is to do its small business at a loss and make its profits out of its big customers. An investigation of our rates, let it be ever so extensive, can only give you that information finally. It will show you that we are discriminating against the large concerns on State Street in favor of the small flats and small people in the suburban territory. I don't know that we have a right to do that, but that is the avowed policy of our company, and if it does not suit the community, all they have to do is to put up our maximum rate to about 20 cents and the secondary would of course come—the big man would be protected and the small man would be compelled to pay more for his light. The same operation would give the big man a big discount.

Mr. McCormick stated that he had heard, without its being in any way confidential, that our rates for railway power are $15 a kilowatt per year and a half-cent a kilowatt-hour. That is so, with a certain guaranty as to consumption. That is the first time it has ever been made public, but I have never objected to its being made public. It is far better for us and far more satisfactory for us than supplying private houses, because it can be done without coming in contact with any branch of the city government, and, as I say, any man who has to deal with public affairs, I do not care whether it is the mayor or the council, or the officials of the city hall, or the public service corporation man, will tell you the one absolutely desirable thing to do is to be able to conduct your affairs without coming in contact with the government.

There is another phase of our business. The general assumption is that we enjoy a monopoly. [Mr. Insull here produced a plat showing a portion of the city of Chicago.] There is the territory from Twelfth Street to the Chicago River and from the river to the lake. There are 190 separate plants in that territory. That is the best evidence as to whether we have a monopoly or not. I don't think I need make any comment on that.

There are a large number of people who sell their extra current who are not in any way controlled by the city, and there are a great many concerns downtown, a few of which are owned by people interested with us, who have a right to sell electric current, quite a number.

I want you to understand that I am very much in accord with the regulation of such utilities as I run by the proper authorities. I think I was one of the first men in this community to advocate their proper regulation, but there is one great mistake that is being made at the present time. You are trying to preserve competition and at the same time you are trying to regulate on a monopoly basis.

Now, in the business that I run there is no justification for competition. The building up of a separate distribution system, for instance, by the Sanitary District, is a financial absurdity. Either they ought to own us or we ought to buy their power—one of the two. I say exactly the same to them as I say when I am dealing with the street-railway property in the city of Chicago—either we ought to produce all the power necessary for the whole community, or somebody else ought to own us, and they ought to produce all the power necessary for the whole community. There cannot be two ways about it. It is the only economical way to do the thing. It has got to come finally. It has either got to come by private ownership, a monopoly thoroughly protected, with regulation of the most minute character and publication of all the figures of the operating property, or else it has to come by municipal ownership. The latter, I think, would be a calamity; but it has got to come one way or the other. As believers in proper regulation we have done all we could to co-operate with the authorities to look into our affairs and study them thoroughly and to come to a wise conclusion. The only error, I think, that has been made in the matter has been that the maximum rate is pretty low, as it is possible to do quite a large amount of business and a growing amount of our business at a loss.

Discussion.

Speakers who took part in the discussion agreed that the company furnishing light and power in Chicago should be a monopoly and should be regulated as such. Walter L. Fisher was pleased to have Mr. Insull add his voice to this idea. He thought that [illegible]

Mr. Insull added that during this year the Commonwealth Edison Company [illegible] on the ordinance question was costing the company perhaps [illegible] it had to [illegible] the entire question settled. He said that all the company asked was [illegible] invested, and in his judgment no public-service company wisely administered would in the future make more than 6 per cent. on its investment.

William G. Beale, counsel for the Edison company, spoke of the work done by the City Council committee in preparing the ordinance. He showed about a thousand pages of transcript of the stenographic notes of the committee sessions on the ordinance. About 25 meetings were held, and Mr. Beale offered the committee the freedom of the company's books and aided it with data compiled by him from the company's records. Besides this the committee had the Arnold-Carroll report and a report from Marwick, Mitchell & Co. of New York on which to base its conclusions. Mr. Beale said that he had proved to the committee that the company had an actual cash investment of over $30,000,000, and the earnings of last year, allowing nothing for dividends, interest on bonds and depreciation, were less than 9 per cent. He also said that on its highest rates, 14 cents a kilowatt-hour, the company was actually losing $100,000 a year. Therefore, if the committee had persisted in adversely reducing the maximum rate he would have resorted to legal proceedings. The result was that negotiations were taken up resulting in the ordinance now pending.

Secretary Hooker of the City Club was one of the speakers. He did not express an opinion as to the merits of the ordinance, but thought that the council committee, in the interest of the city and the consumers of electricity, should have had more advice and assistance from technical experts entirely disinterested in the subject. Several other gentlemen participated in the discussion.

Important Electric Railway for British Columbia.

The British Columbia Electric Street Railroad Company, of which R. H. Sperling of Vancouver is general superintendent, has planned an extensive construction campaign for 1908. One of the most important of the works to be undertaken by the company during the present year is the line from New Westminster to Cloverdale. This line will be 63 miles long and will tap some of the most important towns in Southern British Columbia, which are now without transportation facilities of any kind. The first section to be completed will be 12 miles long. Plans for this section are ready, and the contracts will be let at an early date. The roadbed, gradients, curvature and bridges will follow standard railway practice and will carry 70-pound rails. It is proposed to operate passenger trains on the multiple-unit system hourly, making the run of 63 miles in an hour and a quarter. Express and freight trains will be run as the service demands. In addition to the railway, the company proposes to supply electric light and power in every town and district through which the line will run, departing, wherever circumstances warrant, for a considerable distance on each side of the track. Current at 40,000 volts will be supplied from the company's generating station at Lake Buntzen to sub-stations at convenient places along the line. The transmission line will be erected on 50-foot poles and will be in duplicate throughout. The total length of the power transmission line from the generating station to the end of the line at Chilliwac will be 75 miles. It has not yet been decided whether the road will be a single-phase or operated on the 500-volt, direct-current system.

Bellefontaine Has Its Troubles.

The city of Bellefontaine, Ohio, said to be the only one in the United States owning all its public-service plants and therefore being the only strictly municipal-ownership town, is having its difficulties. Hundreds are delinquent in paying their bills for city gas, electric light and water service. The new service board made a ruling that all delinquents must pay up before March 1st, but the date has been deferred, and a storm of protest has arisen from those who have paid promptly. Under orders from the mayor the new electric light works will be inspected by an expert. It is asserted that the plant, which recently cost $40,000, has not the capacity the taxpayers were led to believe when the bond issue was voted

Single-phase Motors vs. Multiphase Motors.[1]

By R. J. Russell.

The central station, with its auxiliary distribution system, is a manufacturing plant to which the same general principles of investment in equipment and operation apply as to any other form of factory. Hence there must be the greatest possible simplification of output, the production must be on as nearly a uniform basis as possible, and the full productive capacity must be sold to insure the best returns on the investment.

The prevailing tendency of central-station engineers has been to follow the practice of others, and, after a slight investigation discloses the fact that multiphase generators are cheaper than single-phase generators, and that the saving in copper on a multiphase transmission line is about 25 per cent., they install multiphase generators and feeders irrespective of the size of the plant, the territory to be covered or the probable maximum size of motor that might be installed on their circuits, with the result that many have come to realize that their investment has greatly exceeded what was actually necessary to enable them to render satisfactory service to their customers.

I advocate the following arrangement of central-station service:

(A) For large plants polyphase generators with:

First—Polyphase feeders for all large motors and rotary converters.

Second—Single-phase feeders for all general lighting and small motors, the switchboard being arranged to permit a feeder being switched on to any phase of the generator.

Third—Feeder regulators for all polyphase and single-phase feeders.

(B) For small stations:

First—Either polyphase generators, with single-phase feeders, which may be switched on to any phase of the generator, and each feeder provided with an independent pressure regulator, or

Second—Single-phase generators and each feeder provided with an independent pressure regulator.

The above is advocated because it is an acknowledged fact that the single-phase motor has been proved satisfactory and affords an alternating-current central station, single-phase or polyphase, the ideal means of distributing power.

The principal advantages of single-phase distribution are simplicity, flexibility and saving in the cost of supplying current to the consumer. The chances of breakdowns are reduced in direct proportion to the number of wires used to transmit the current.

If polyphase motors are used exclusively the flexibility of the system is reduced to a minimum. Single-phase motors on existing lighting lines mean maximum flexibility. Usually the lines that are run to new territory are single-phase. First, lighting business is taken on; then these customers want power, which should be furnished single-phase, as you will agree that scattered power cannot be profitably connected if one or two more primary wires have to be run to the customer.

By distributing current single-phase there is a saving in the cost of the line. The fact that power can be transmitted with the same loss, with 25 per cent. less copper by using three-phase rather than single-phase must not be the deciding factor. The cost of insulation must be paid for, which brings the saving to about 15 per cent. actual. Then the extra labor installing the third wire, brackets, insulation, etc., must receive consideration.

On a polyphase system the problem of balancing is simplified, because of the even loading of the phases, but single-phase distribution from polyphase generators is not a serious objection if properly carried out.

It is a fact that single-phase motors cost more than multiphase motors, but not so much more as to make it probable that the usual customer having to use power cannot afford to pay it, and if the solicitor is any kind of a salesman he should not have any trouble in convincing the customer of the advantage and advisability of paying this extra price rather than purchase a gasoline or steam engine

It is not always advantageous for the central station to supply multiphase current to its customers, even though it may have its multiphase line in the immediate vicinity of the prospective customer. Many central stations have found this to [illegible] of the [illegible] advocates of single-phase motors are central-station managers having multiphase generators only, who concede the great advantage of installing single-phase motors in many places, the only difference of opinion between them being as to the limit in size they will permit to be installed on their multiphase circuits. The size of motor that the various central stations permit to be installed on their circuits is usually gov- [illegible] generator and secondary network of distribution in concentrated districts, the location of the motor [illegible] cinity, and the peculiar notions of the individual.

[illegible]

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[1] [illegible]

should require that his customers use single-phase motors are, that unless the load is of such magnitude as seriously to disturb the regulation on the different phases of the generator, it is an unnecessary investment and an unnecessary expense to the central station to prepare to furnish current to an individual multiphase motor installation. If proper attention is given to making installations on different phases, no serious effect will result from unbalancing.

The cost of one transformer to operate a single-phase motor is less than the two or three smaller transformers required to operate a multiphase motor. You will note by Fig. 1 that this excess first transformer cost averages about 25 per cent. for two-phase motors and about 50 per cent. for three-phase motors operating on two transformers.

You will readily appreciate that this will amount

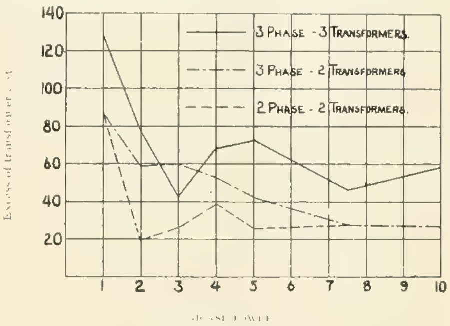


FIG. 1. CURVES SHOWING EXCESS OF COST OF POLYPHASE MOTORS.

to a large unnecessary investment where a large number of installations are made. A much less transformer core loss will naturally result where only one transformer is used, and consequently a much higher transformer efficiency. A comparison of transformer losses is given in Fig. 2, and is based on standard transformers of a prominent make.

When only two transformers are used to furnish current to a three-phase motor, considerable care must be used not to overload the transformers, as a full-energy load on the transformers gives a current overload of approximately 15 per cent. with a consequent copper loss of approximately 30 per cent. in excess of full-load copper losses.

You will note by Fig. 2 that the average transformer losses for two transformers for a three-phase motor exceed those of one transformer for a single-phase motor by an average of about 30 per cent.

A further saving of considerable amount is usually effected in a single-phase installation by the need for only one single-phase recording wattmeter, as in a multiphase installation, which is usually made up of both motors and lights or other single-phase apparatus, either two single-phase meters or an expensive polyphase meter is needed. The installation of a single-phase meter on a straight polyphase motor load using a constant to arrive at the total power consumption is in use in only remote cases.

In making a single-phase motor installation only

FIG. 2. CURVES SHOWING EXCESS OF TRANSFORMER LOSSES OF POLYPHASE MOTORS.

two wires, a less number of fixtures, such as insulators and fuse blocks, a two-pole switch and less labor will be required to install not only the transformers but the motor as well.

The excess cost to the central station for equipment necessary to furnish current to a five-horsepower, 208-volt, three-phase motor installation, where the transformers are located only 50 feet from the meter is about $48. If the central station furnishes the wiring inside the building to the motor located only 30 feet from the meter the total excess cost is about $54. Other sizes are in similar proportion.

As the average power bill for a five-horsepower motor is only $15 a month, and assuming that of this amount 25 per cent. is net profit, it will take the central station about 14 months to pay for this increased investment from such an installation.

In addition to this, as cited before, there are the excess transformer losses going on all the time.

This increased investment is all right in a way, [illegible] thing the central station manager has a hard time to make a creditable financial showing, and the stockholder is not so much interested in seeing the value of his holdings increase, due to an increased amount of equipment (the value of which is constantly decreasing), as he is in getting regular and good-sized dividends.

Many central-station managers are particularly impressed with the ease with which the starting current of the repulsion induction form of single-phase motor can be controlled by means of a non-inductive starting box, which differs only slightly from the familiar direct-current motor starting box. The judicious use of this non-inductive starter enables the use of large-size motors without injurious unbalancing effects on a polyphase system, as it permits this type of motor to start under full load, with a current consumption of not to exceed 25 per cent. in excess of full-load current and with a power factor from 70 per cent. to 80 per cent., depending on the size of the motor.

On the other hand, a polyphase motor requires a more complicated form of starter, which, if in the form of resistance, owing to having two or three circuits to control instead of one, is of a rather complicated character, and if not in the form of resistance, is not nearly so effective.

If this repulsion induction type of single-phase motor is started without a starter in circuit it will not take more than 250 per cent. of its full-load current from the line when the switch is first closed, and during acceleration will develop at certain periods a torque of approximately 500 per cent. of full-load torque, while some makes of multiphase motors of three horsepower and smaller started without any auxiliary starting device, will take 500 per cent. of full-load current and only develop at starting a maximum of 125 per cent. of full-load torque. Larger sizes are invariably provided with some form of starter, either external or internal, as without they would take so much current as to make their installation prohibitive in most cases.

Thus you will note that the repulsion induction

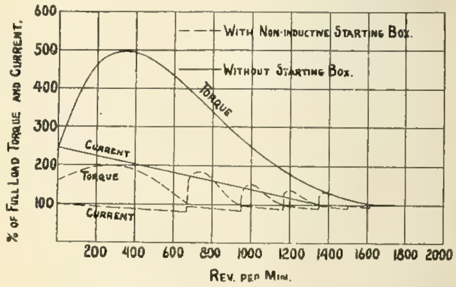


FIG. 3. STARTING TORQUE AND CURRENT OF REPULSION-INDUCTION SINGLE-PHASE MOTORS.

type of single-phase motor has a distinct advantage in the amount of starting current when used without a starter and in static torque under all conditions.

Some central stations have a three-phase secondary system of distribution fed from several banks of transformers and all tied together in the congested district, and they limit the single-phase motors to five-horsepower sizes in that district. In other cities they allow larger motors on such circuits, using of course some care in connecting the load to different phases so as to have each phase carrying as near an equal a load as possible, but even in such places there are many installations where it is undesirable to use a multiphase motor for some classes of service, even though the multiphase secondary circuits are at hand, such as automatic pumping outfits for sprinkler systems used for fire protection, house pumps, pumps used for automatically handling seepage and sewerage in basements, etc. I will admit that automatic starters are on the market for use with multiphase motors, but the results have been far from satisfactory in many cases that I have investigated. On the other hand the repulsion induction type of single-phase motors has the advantage of being able to develop an enormous starting torque without an excessive starting current, consequently do not require any such complicated apparatus to insure their starting. Placed in the hands of the usually inexperienced operator, the repulsion induction type of single-phase motor will not cause any more line disturbance even when installed without a starter than the usual multiphase motor with an auto starter, because the operator is anxious to get the motor under way, and if the fuses hold he will throw the lever on the starter over to running position in the shortest possible time.

The single-phase motor is now, to some extent, entering the direct-current motor field for variable-speed work, such as the driving of ventilating fans, printing presses, machine tools, laundry machinery and other machinery requiring variable speed. This variable speed is accomplished by using a repulsion or series single-phase motor and a resistance box or auto transformer. Single-phase motors have even entered into competition for traveling cranes, hoists, freight and passenger elevator service, and I am told they are quite a success.

The single-phase interurban railway systems are entering the field very rapidly on account of the

lower cost of sub-station equipment and attendance and the saving in many other ways that are effected over the old direct-current system would lead me to believe that as they get these lines distributed around the country thy will be able to distribute current to the small towns, farmers, etc. Even though this current will be of low frequency, it will give fairly satisfactory results for most kinds of lights except arc lights, and is entirely satisfactory for single-phase motors.

I confidently believe that inside of ten years the single-phase motor will have reached such a degree of perfection, and ways will have been found to build it that will, when taken together with the simple single-phase transmission system, make it much more popular than the multiphase motor.

QUESTIONS AND ANSWERS.

Approved Wiring in Chicago.

R. D. L., Lockport, Ill.: 1. Kindly inform me what is the approved and standard wiring in Chicago, conduit or "knob and tube" work?

2. Will "knob and tube" work be approved by the Fire Underwriters in a house that was not wired when built some time ago?

3. Is it possible for me to get a generator of from 200 to 250-light capacity? If so, which will run with the least expense in fuel?

ANSWERS.

1. Conduit wiring is the approved and standard practice in Chicago.

2. "Knob and tube" work will be approved by the Fire Underwriters if done in strict accordance with rule 24 of the National Electrical Code. However, "knob and tube" work is not approved under any circumstances by the Department of Electricity of the city of Chicago. As no current can be used in Chicago without the approval of the installation by the city electrician, it is evident that the consent of the Fire Underwriters will be of no avail.

3. The generator desired is probably of about 12.5-kilowatt capacity. This is a common size made by most manufacturers. The latter half of the question is not clear. The Western Electrician does not undertake to say which manufacturer makes the most efficient machine. The fact is that generators of the same size and type made by all reliable makers do not differ much in efficiency.

Single and Polyphase Alternating Currents.

H. C. C., Chicago: What is the difference between single-phase, two-phase, three-phase and polyphase alternating-current systems?

ANSWER.

When the currents in two alternating-current circuits make the same number of complete reversals or cycles per second they are said to have the same frequency. If these currents have the same frequency but do not increase, decrease and reverse at the same instant, they are said to be out of phase or to have a difference in phase. This means, in other words, that they do not change in strict unison and that there is a difference in aspect between them. When the difference in phase between two currents coming from the same generator in separate circuits is one-fourth of a complete cycle, then the two circuits constitute a two-phase system. When the difference in phase between three currents coming from the same generator in separate circuits is one-third of a complete cycle, then these three circuits constitute a three-phase system. In a single-phase system there is but one main circuit carrying one alternating current. The term single-phase is used only to distinguish it from the two-phase or three-phase systems, which are commonly called polyphase or multi-phase, meaning more than one phase. The two-phase system was also defined in question 3 for "G. H." in the Western Electrician of October 12, 1907, page 292.

Not for Lafayette, Thank You.

The City Council of Lafayette, Ind., has voted down the municipal electric-light project, the vote standing 5 to 5, lacking one of being a majority. The meeting was interesting and was attended by a large number of citizens, who are divided in their views of municipal electric lighting. The councilmen who voted against the project say that they were induced to do so after visiting the municipal plants in Logansport, Peru, Marion, Bluffton and Muncie, where they said they received indisputable evidences that the municipal plants have been failures. The one exception, they said, was at Richmond, and that is too expensive a plant to be copied in Lafayette.

The Conservation of Our Natural Resources.[1]

By Gifford Pinchot.

[illegible] which are not renewable [illegible] renewable resources [illegible]. What [illegible] happen [illegible] after [illegible] when the coal is gone [illegible] for about [illegible]

Not only that, but in certain kinds of coal mining, and some men say that the average will bear out the statement I am about to make, only about half the coal in the ground is actually mined before the roof is allowed to fall in, and what remains is permanently inaccessible for all time to come. In other words, our methods of mining are such as to eliminate from consideration at the start one-half of that which is absolutely indispensable as a necessity for our present kind of civilization.

What may happen in the future it is difficult to predict, but we know, so long as present methods continue, that coal is a necessity, and we know that the supply of coal is limited, and we are acting as if it made no difference whatever that that supply should be exhausted.

More than that, of the 50 per cent. which is mined, on an average about 90 per cent. is wasted; or, to put it in another way—and this is a fact you will know far better than I—I am told that only about 10 per cent., and in many cases only five per cent., of the energy of the coal is actually transformed into work.

The sum total remains that under our present methods an excessively small quantity of the value of the coal to all our people is ever put to use, and there is in such a statement as this, it seems to me, a very serious indictment of our whole people; and with all due allowance for the necessities of the case, for the rapidity with which we have reached this stage, there is a definite indictment of the intelligence of our people as a whole for that, judging from the point of view of the single individual. I do not know that we have the right to, but I do know that any man who knew that one of the first necessities of his existence was about to disappear in, say, five years, or two years, and went on using it as if there was all he could ever want, would speedily earn a very unenviable reputation among his members.

What should any of us say of a man adrift at sea in an open boat with a little barrel of water, or with a keg of water, enough water to last him with ordinary use for five days, and he knew that the chances of his being picked up at sea were infinitesimal, he was out of the track of ships, and he knew with the best time he could make it would take twenty days to reach land, what should we think of that kind of a man if, under these circumstances, he not only drank all the water he wanted, but used the rest of it to wash his hands with? And yet we are not only using all the coal we want, but we are throwing a lot of it away.

Take natural gas. We have handled it in precisely the same way. Many of you know better than I how the great flambeaux have been kept burning day and night, year in and year out, in certain gas fields, until what had been foreseen as an inexhaustible supply, and so described until people really came to believe it, was all gone. How many oil fields of the United States are already exhausted, and with the utmost hopefulness in forecasting the discovery of new fields, is it not fairly reasonable to suppose that within a comparatively short time, the oil, too, will have gone the way of much of the gas?

I suppose that in no other case except that of the forests have we as a people so distinctly emphasized our lack of foresight as we have in the case of the mineral fuels, and the result is especially important, because, as I have said, in our present state of civilization we must have them to go on with our work. I make the indictment definite, because it seems to me the facts are absolutely incontrovertible and the conclusion inevitable. We ought to have known better, and the time is easily come, when, instead of the limitations which are imposed upon us by commercial conditions, we ought ourselves, as a nation, to grasp this question of mineral fuels definitely and attempt its definite and foresighted regulation. It is one of the great problems which we must meet, one of the most difficult ones, and one of the most essential ones; for, when our mineral fuels are gone, so far as we can see now, the only practicable source of power will be waterpower, and will be difficult to use for many of the purposes for which coal is now employed. We have done, to some extent, this thing with our metal ores, but I will not dwell on that aspect of the subject tonight.

There are a good many other types of conservation which we must keep in mind in relation to the land. For example, it has been said over and

[illegible]

[illegible] mineral fuel, we have been vastly more shortsighted in the matter of the forests. Wood, I conceive, is not less necessary to our present civilization than coal, and the best figures which the Forest Service [illegible] correct) is that at our present rate of consumption we have standing timber for only about twenty years, and in this connection it is well to add, just as in the case of the man floating in the open boat, that there is no other supply from which we can expect to meet our demands. The Canadians are coming to need all the wood they have; so with the Mexicans. South America is a wonderfully rich continent in forests, but to import timber from that country means that it would be at an expense to our people vastly greater than that of timber grown at home.

We have permitted ourselves to get into a condition where a timber famine is not only likely, but certain, and where the best we can expect to do is to somewhat mitigate the famine; but how much we can mitigate it I do not yet know. How much the use of reinforced concrete and the use of steel and the employment of other constructions will help cannot be said, but that these will help to a great extent there can be no doubt; but the curious fact remains that there never has been a large substitute for wood that I know, and it is a peculiar fact with the employment of these other methods of construction that there is vastly more wood used for construction in the United States today than when all the construction was of wood; in other words, we have gotten ourselves into a place where we must suffer, and in this case we must pay the bill.

Fortunately, it is not altogether too late, because the forest is a renewable resource, and so we have a chance to correct the faults of the past. That we are trying to do so, I am very glad to tell you. We have about 165,000,000 of acres of national forests established in the West, and shall have others in the East, and naturally these forests will be brought to the point where they will produce the most timber possible from their physical situation, but we cannot expect to meet from one-fifth of the forests of the United States a demand which is exceeding five-fifths, and which is consuming that five-fifths three times faster than it is being produced. In other words, there is distinctly trouble ahead. I said a little while ago that a change in public sentiment was the essential and indispensable factor in this movement of conservation. It is nowhere truer than in the case of the forests. Four-fifths of the forests are in private hands, and unless the owners of these four-fifths will join in the movement to minimize the timber famine, use their forests rightly, we shall have vastly more trouble than we shall have if they will help us.

It certainly is true that as our forests are destroyed at the headwaters of our streams, our waterpowers suffer, the navigability of our streams suffer, irrigation suffers, and the domestic and manufacturing water supply suffers. Wherever our streams flow, and they flow from wherever the stream rises in the mountains or in the forests, and they do so pretty much all over the country, there forest preservation is just as important because of the streams as it is because of the other services which the forest renders to the community.

We have been equally shortsighted, as I think—some of you, perhaps, will not agree with me in this—in allowing great monopolies to be formed for the use of waterpower from these streams without the possibility of government control. I speak, perhaps feelingly, about this, because I am fresh from a contest in Washington with a number of lawyers representing great electrical concerns who were anxious to obtain rights from the government which would give their concerns a virtual monopoly of waterpower throughout the public land of the states. We have been having a very lively time of it. I believe the conservation point of view is going to win, and I think the idea is growing that it is a fair thing which should win, that the interest of the people at large is greater than the interest of any single man or single body of men less than all the people, and that when Uncle Sam gives us his natural resources it is no more than fair that he should acquire the use of them in a way to do as much good on the one side and as little harm on the other as possible.

1. From an address to the American Institute of Electrical Engineers in New York on March 5, 1908. Mr. Pinchot is the forester of the United States government.

New Madeline Blast Furnace at Indiana Harbor.

Since blowing in the new Madeline blast furnace at Indiana Harbor, Ind., last August, the Inland Steel Company has produced its own pig-iron for use in steel making, instead of buying the iron from outside, as was formerly the custom. The new furnace has a nominal capacity of 400 tons of pig-iron per day, and the equipment of the plant auxiliary to the furnace, as well as the facilities for handling, the blowing engines, power equipment, etc., are all of the most approved standard design and latest construction.

The new plant is located alongside of the company's steel plant, and a portion of the power generated in the newly installed power station is transmitted to it for use in operating various machinery. The works have a protected harbor 300 feet wide for receiving raw material, a good dock 1,000 feet long and plenty of Lake Michigan water for cooling purposes.

Ore is taken directly from lake boats by means of electrically driven hoists and carriers and deposited in storage piles or bins. Scale cars on motor-driven trucks handle ore between the bins and the furnace. The furnace proper is 85 feet high, with a diameter below the hearth top of 20½ feet. As far as possible the furnace filling and distribution are done automatically.

The open-hearth plant is located across the tracks of the Lake Shore and Michigan Southern Railway, and a concrete-lined hot-metal tunnel, built under the railroad tracks, communicates with it.

Coke is stored in a 60-foot bin, and six bins 91 feet 9 inches long hold limestone and ore. The cast-house is 108 feet long, with an additional length of 104 feet for claw mixing and ladle-drying purposes.

The boiler plant, situated directly back of the furnace, comprises eight 500-horsepower Stirling boilers, each with individual stacks. There are two pairs of Allis-Chalmers vertical furnace blowing engines installed, whose steam cylinders are 44 and 84 inches in diameter and air cylinders 84 and 84 inches in diameter, with 60-inch stroke. These engines are designed to operate either singly or in compound condensing pairs. The steam may pass through a reducing valve when the low-pressure side is run singly.

The power plant is further equipped with three Allis-Chalmers cross-compound Corliss engines, each direct-connected to a 550-kilowatt direct-current generator of the same build. Power is transmitted from the power house to a distributing station at the steel mills, a distance of about 1,200 feet, by conducting cables supported on steel towers, to the property line of the blast-furnace plant, and from this point by underground conduit beneath the intervening tracks.

In addition to the engines already enumerated, there is installed in this plant a horizontal cross-compound Reynolds-Corliss pumping engine, used for hydraulic transmission in the mills, operating lifts, stands and other handling apparatus. The water end of this unit has a capacity of 800 gallons of water per minute against a working pressure of 500 pounds per square inch under severe continuous service.

Mr. Arthur G. McKee, engineer, of Cleveland, designed and superintended the erection of the plant.

Litigation Relating to Moving-picture Films.

A suit which may affect thousands of moving-picture theaters was filed in the Federal Court in Chicago on March 7th by the Edison Manufacturing Company of West Orange, N. J., against the Kleine Optical Company of Chicago. The suit asks for an injunction against the handling of moving-picture films on the grounds that the Edison company has the exclusive right, based on a patent issued several years ago to Thomas A. Edison.

Recently a suit was filed in New York against the Edison company by the Biograph company, alleging that the Edison company is infringing on a patent held by the Biograph company. The two interests represent the entire industry. Each asks that the other be put out of the moving-picture business by injunction.

There are some 10,000 moving picture machines in the country, and the film business alone represents an annual investment of about $10,000,000.

Report on Geological Chemistry.

[illegible]

The various chemical changes taking place in the [illegible] reactions which take place in it he classes, for convenience, under three heads: First, reactions between the essential constituents of the crust itself; second, reactions due to the aqueous envelope; and third, reactions produced by the atmosphere. That the three classes are not sharply defined but grade into one another is admitted, but the distinction between them is valid enough to serve a good purpose in the arrangement and discussion of the data.

Free Lamp Renewals.

[From the Question Box of the National Electric Light Association.]

With companies that furnish free-lamp renewals, what do member companies think is the best policy in reference to the varieties of candlepower that shall be furnished free; do any member companies think there should be a charge for certain lamps, and what should this charge be?

ANSWERS.

H. Clyde Parrish: We renew lamps of the regular carbon-filament type, 16-candlepower and larger, free. We charge 10 cents extra for 8 and 10-candlepower and 15 cents extra for 4 and 6-candlepower for the following reasons: Lamps of 4, 6, 8 and 10-candlepower cost the same as those of 16 candlepower. They consume practically only a proportionate amount of current and the life is about the same and often much shorter. For example, a 16-candlepower 3.5-watt lamp has a life, we will say, of 800 hours, and consumes 44 kilowatt-hours. An 8-candlepower 4-watt lamp we assume has the same life and consumes 25.6 kilowatt-hours, or a little more than half the amount consumed by the 16 candlepower. Therefore, unless we make a charge for the smaller sizes we shall have to furnish two 8-candlepower lamps, four 4-candlepower lamps, etc., for practically the same number of kilowatt-hours sold. For frosted lamps, Gem and other special types we charge the difference between the cost of same and the regular carbon-type lamp of equal wattage.

D. Thomson: We renew 16-candlepower, 32-candlepower, 100, 125 and 187-watt lamps free, but charge half price on 6 and 8-candlepower renewals, and full price on 2 or 4-candlepower renewals. Any specials, such as Meridian, reflector or colored-glass lamps, are charged for at cost price.

W. R. Putnam: Our company furnishes free-lamp renewals for all candlepowers from 8 to 32 in plain carbon-filament lamps. We charge the extra cost for frosted and colored lamps in the above candlepowers, and list price for all other lamps.

Port Deposit Electric Company: We furnish free-lamp renewals for 8-candlepower and 16-candlepower lamps. We have very little call for 4-candlepower.

Chicago Street-railway Bonds.

The syndicate of banks which offered the $5,000,000 Chicago Railways Company 5 per cent. first mortgage bonds, $2,500,000 of which were disposed of at 93½ in less than an hour some 10 days ago, and which on March 5th offered the interim certificates for the remaining $2,500,000 at 95½, reported Monday that all of the bonds had been disposed of.

The traction bonds have gone with remarkable rapidity. In addition to the $5,000,000 Chicago Railways first mortgage the company has also sold $5,000,000 collateral notes, which, as near as can be learned, have nearly all been placed among investors.

Besides these bonds the Chicago City Railway Company has disposed of virtually $5,000,000 first mortgage bonds, in addition to about $7,000,000 of the same class of securities sold last year. This condition indicates that the local situation is improving. The bonds and notes have not been sold entirely in Chicago, but blocks of them have been placed all over the United States and in Europe. More could be sold if the companies should choose to offer them.

A New Plan of Collecting Car Fares.

A mechanic of East Orange, N. J., George Bopp, is said to have invented a street car which he thinks will solve the problem of congestion, save much time and insure the collection of every fare. The car is designed with the idea of collecting the fares as the passengers leave the car, the direct opposite of the pay-as-you-enter plan.

The car, it is said, will be of the regular dimensions, but its seating capacity will be greater on account of utilizing the waste platform space. There is a door in the middle of the car, which [illegible] by the front door, and for women by the rear. The doors [illegible] on the front end, who operates a push button with his foot, which slides the door open and lets down a step. The rear door works the same way, but is controlled by the conductor from his post at the exit door. The middle door is the only opening through which a person can leave the car, and no one can pass through without paying his nickel and operating a turnstile, which works the register.

Commercial Day at Chicago Convention.

Thursday, May 21st, has been set aside by President Farrand as "Commercial Day" at the National Electric Light Association's convention in Chicago.

The committee in charge, composed of C. W. Lee (1408 West Street Building, New York city), J. Robert Crouse, John F. Gilchrist, George Williams, Howard K. Mohr and Frank B. Rae, Jr., has been busily engaged in preparing the programme for the day. It is the purpose of the committee to have the papers which will be presented consume the least possible time; the major portion of the two sessions being devoted to discussion. The following is the programme as outlined by the committee:

(1) Special Feature.—"Relationship Between the Engineering and Commercial Departments." By a prominent electrical engineer.

(2) Preparation for a Campaign.—(a) Field Work and Other Essentials. (b) Analysis of Customers' Accounts. (c) Proportion of Lamp Equivalents Lost to Lamps Connected, Showing Percentage in Cities of Varied Population. (d) Policy of Handling Complaints. (e) Policy of Handling Collections.

(3) The Contract Agent and the Representative.—(a) The Contract Agent—His Possibilities. (b) The District Representative—His Possibilities. (c) The Special Representative: 1, The Sign Expert; 2, The Power Expert; 3, The Woman Representative. (d) Solicitors' Meetings; Their Objects.

(4) The Display Room.—(a) Appointments and Methods. (b) Value of Special Demonstrations. (c) Value of Electrical and Food Show Exhibits.

(5) Advertising.—(a) What Is Being Done. (b) Why. (c) Results.

(6) Publicity.—(a) Methods to Create Proper Public Sentiment. (b) Dormant Publicity Opportunities of Lighting Companies.

(7) Creating Demands for Electricity.—(a) The Creative Principle. (b) Notable Examples. (c) Stereopticon Talk Upon Outline and Sign Lighting, Showing Progress in Large and Small Cities.

(8) Evolution of New Business Building.—(a) Examples of Central Stations That Have Continued Methods During Depression. (b) Strong Plea for Up-keep of Commercial Departments and Advertising. (c) Opportunities for Creating Business Along Existing Lines.

(9) The Electrical Contractor.—(a) What He Is Doing to Assist in Creating Greater Demands for Electricity. (b) Specific Examples.

(10) "Co-operative Commercialism." By J. Robert Crouse.

(11) "Illuminating Engineering as a Commercial Factor." Illustrated. By V. R. Lansingh.

(12) Report of Committee on Solicitors' Handbook.—Award of prizes offered by Co-operative Electrical Development Association.

Electric Power for Polishing Stoves.

By means of an electrically operated polishing apparatus manufacturers of stoves are now enabled to carry the polishing machine from point to point and thus avoid a great deal of heavy handling in taking the stoves to the polishing apparatus, which is not only expensive but frequently results in more or less damage to the goods handled. Several manufacturers of gas and coal stoves have adopted these equipments and find them of great utility. In the General Electric Review for March is shown a one-half-horsepower single-phase motor and starting box, mounted on a special truck provided with swiveling castors. Connected to the motor is a Coates flexible shaft, leather-covered, carrying an angle head to which various polishing brushes, suitable to the work in hand, may be immediately attached or removed. The motor is fed from the electric supply through a long, heavily insulated, flexible cord, adapted to the rough handling incident to its usage in a stove works. Outfits of this character not only serve a useful purpose in connection with the manufacture of stoves, but may also be used to advantage in stove stores for keeping the stock free from dust and dirt and for renewing the polish of the black portion of the stove, as well as that of the nickel trimmings.

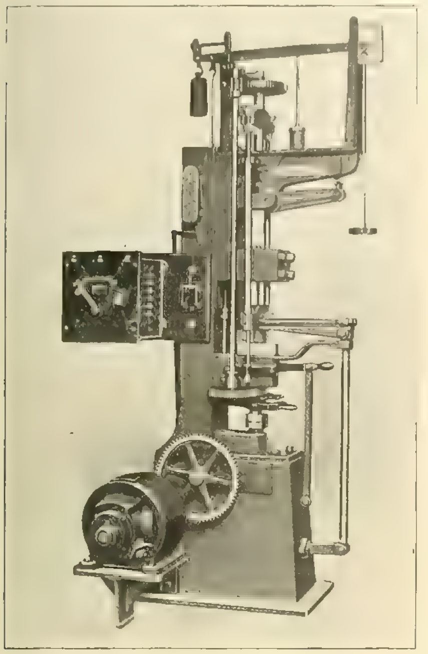
Senator Smith of Michigan, in a speech at Washington opposing the Aldrich financial bill, said that the acceptance of railroad bonds as security for national bank circulation is a long step in the direction of government ownership, because the government might have to take over the railroads on foreclosure.

Motor-driven Vibratory Testing Machine.

The illustration shows Olsen's new vibratory and endurance testing machine driven by a type "R" Westinghouse motor. This machine is designed for testing staybolt material under conditions exactly duplicating those met with in actual use.

Staybolts as used in locomotives are subjected to severe strains due to vibrations and temperature effects, and thus a simple tensile test does not answer all the requirements. Early tests of the material vibrated the specimen in a to-and-fro motion only, and the results thus obtained were not comprehensive enough to be reliable. The Olsen machine makes the test complete by subjecting the specimen to an oscillating vibratory motion while under a tensile load.

This machine will test staybolts up to 1¼ inches in diameter, and it grips the threaded bar so that no preparation of test piece is necessary. The specimen is held firmly in the frame of the machine at one end and the other end is clamped in a ball, around which a bearing is rotated eccentrically to produce the desired strain. A total eccentricity of ⅜ inch may be placed on specimen (as is indicated on a scale) while under a tensile load reaching 4,000 pounds as a maximum. The revolutions or number of vibrations necessary to cause rupture are shown by a counter. Specimens of from five to eight inches in length, from point of application of eccentricity to fixed support, may be tested.



MOTOR-DRIVEN VIBRATORY TESTING MACHINE.

In addition to this test for staybolt, the illustration shows an attachment by which the ordinary pendulum motion may be transmitted to specimen when required. An attachment may also be obtained with this machine by which an initial fiber stress may be placed on specimen and thus vibrated, if preferable to subjecting specimen to a known eccentricity. The machine is exceedingly compact. Its direct connection to a Westinghouse type "R" motor affords a form of drive that is exactly suited to its requirements.

The motor may be attached to a convenient lighting circuit and run day and night throughout the test without special attention. A comparison between power from a line shaft and individual electric motor drive demonstrates at once the superiority of the latter in every point. The simplicity and reliability of the type "R" motor, and its uniform performance, adapt it especially for this class of work. The economy and convenience of using electric power from the lighting circuit, instead of keeping a line shaft running all night, can be readily appreciated.

The annual balance sheet of the Postoffice telephone and telegraph departments of Great Britain again shows a considerable deficit, viz., $3,250,000, although this is nearly $500,000 less than in the previous year. The total deficiency on this account since the state took over the telegraphs in 1870 is $75,000,000. Curiously enough, for no less than 13 years after the acquisition there was a small profit shown annually, but since then the deficit has been very heavy. During the year under review, viz., to March 31, 1907, the National Telephone Company paid to the Postoffice as royalties nearly $1,250,000.

Indiana Telephone Items.

The Clarksville Telephone Company, recently incorporated, [illegible] with construction companies with a view of constructing a plant at Clarksville. [illegible] is president.

The Marion and [illegible] Telephone Company, incorporated with a capital stock of [illegible], proposes to erect a telephone system in New Marion and the surrounding country. Jos. M. Hess and Lawrence Miller are directors.

Injunction proceedings have been filed against the Cumberland Telephone Company at Oakland City to enjoin the company from further operations in the town, it being alleged that the company is operating under an old charter granted to the American Telephone Company.

About 60 telephone men from cities and towns in the Second District of the Indiana Telephone Association held a meeting in Fort Wayne recently and laid plans for the establishment of a telephone clearing house. The purpose is to expedite the settlement for interchange of long-distance business between the companies. The district includes nine counties. Prominent telephone men from Ohio and Indiana were present.

According to press reports, the Delaware and Madison Counties Telephone Company has purchased the Central Bell company's plant, including exchange, poles, wires, etc., at Elwood. The Bell company made the announcement recently that it was ready to buy or sell. The Bell property involved is valued at $100,000, and if taken over by the Delaware and Madison company it will have the largest Independent plant in Indiana.

The Home Telephone Company of Goshen, which has just expended $50,000 in improvements in the city, has taken over the Central Union telephone system. The Bell company retains its long-distance service, which will be handled by the Independent company. The Home company at once raised its rates from $1 to $1.25. The Bell company had planned to expend $75,000 in improvements, but abandoned the idea and shipped its material to Indianapolis.

The Lake Shore Railroad Company has begun work at Elkhart, on the building of a simultaneous telephone and telegraph system along its entire line from Buffalo to Chicago. The system is one whereby a telephone and telegraph message may be sent over the same wire at the same time. It is the intention to use these lines only for long-distance communication, and consequently only the larger cities will be connected. S.

Telephone News from the Northwest.

A local telephone exchange has been formed at Fisher, Minn., with A. E. Wentzel as secretary.

The Winifred Telephone Company has been formed at Winifred, S. D.

A local company has been formed at Glyndon, Minn.

The Clara City Telephone Company of Clara City, Minn., has been incorporated with a capital stock of $20,000.

The Sisseton Telephone Company of Sisseton, S. D., has been incorporated with a capital stock of $10,000, by Ingelman Sverre and others.

The Union Electric Telephone Company of Davenport, Iowa, has increased the telephone rates, business telephones being increased from $36 to $52 per year and residence telephones from $18 to $27.

Telephone taxes amounting to $30,000, it is said, were not paid in Cedar Rapids during the years 1902, 1903 and 1904.

An ordinance is before the Council of Minneapolis to restrict the telephone companies from charging more than the rate prescribed in the city ordinance for service. This is aimed at the Tri-State Telephone Company, whose rate is limited by its franchise to $4 for business service and $2.50 for residence connection. The company now adds an extra 25 cents for collection if the bill is not paid by the 15th of any month. The Northwestern Telephone Exchange Company has no such limitations in its franchise, and can therefore make such charges as it will. It makes a total charge with a discount if paid by the 15th.

The Dakota Central Telephone Company has brought an action in the Federal court to restrain the city of Huron, S. D., from attempting to remove its poles and wires from the streets.

The Council of Willmar, Minn., has voted to proceed against the Northwestern Telephone Exchange Company, and will order the company to vacate the streets by April 25th.

The city of Anoka, Minn., will drop the litigation following its attempt at regulating the rates of the Northwestern Telephone Exchange Company, in which the city was worsted, and is now considering granting a franchise to a competing company, with the right to purchase the exchange.

The Mutual Telephone Company of Des Moines, Iowa, opened bids for the sale of $475,000 telephone stock recently, bearing six per cent., 1 to 10 years, $250,000 of the issue being purchased by old stockholders. R.

CORRESPONDENCE.

Continental Europe.

Paris, February [illegible] the Plaisance region.

Among the mining plants [illegible] with electric plants, [illegible] which have [illegible] groups. One of these [illegible] power steam turbine coupled on the same base with a 1,000-kilowatt alternator of the [illegible]. It delivers current at 3,000 volts. The second turbine set uses a direct-current generator of [illegible] kilowatts, which works at 500 volts. The latter group furnishes current for operating the motors in the mine, which are used for elevating the [illegible] shafts.

A large syndicate has been formed in Italy which has its headquarters at Rome, and intends to carry out electric light and power projects in the district of Puglia. The company is capitalized at $4,000,000. A great development in electric matters is expected in that province, and among these electric traction occupies a large place. One of the first operations of the company will be to erect a large hydraulic plant at Trani, which it is estimated will give near 25,000 horsepower.

Electrical affairs are very active in Spain at the present time, and I note several projects which are soon to be carried out. One of these is the erection of a large turbine plant in order to secure a supply of current for the city of Seville. The station will be located at a distance of 75 miles from the city, and it will contain a number of turbine units of 1,500 horsepower. The current of the machines, which is furnished at 500 volts, three-phase, will be transformed to 50,000 volts for the power line. Madrid is also to use current coming from a hydraulic plant located at some distance. The power is to be taken from the Isabel Canal, and the plans provide for a 450-foot head of water. An outlay of about $1,000,000 will be needed for the work on the canal and the erection of the hydraulic plant. The Administration of Public Works at Madrid has recently authorized the local railroads company to transform the tramways of Alicante to electric traction. On the traction line from Las Ventas to Cuatro Caminos the steam system will be replaced by an electric system, and it is expected to carry this out by the end of June.

A new idea which is being tried at Paris is that of mailing telegrams at the postoffice or in the letter boxes without having to present them at the telegraph office. This will be a great convenience in many cases. The telegrams on reaching the postoffice will be sent in the usual way to their destination. Stamps to the right amount are placed on the telegram. Any deficit (within certain limits) is collected at the other end. A. DE C.

Great Britain.

London, February 29.—Before the Institution of Civil Engineers on Tuesday Mr. W. Barclay Parsons of New York read a paper descriptive of the Rapid Transit subways in that city. At the end of the paper the opinion was expressed that the cost of shallow-subway construction does not exceed deep-tunnel construction, unless the former is burdened by heavy charges for vault easements, and that the success of the New York subway is due to the high-speed service and the convenient arrangement of the stations, with their short, direct means of access.

A new type of electric capstan has been adopted at the Rothesay Dock in Scotland, the design of which is due to the consulting engineers for the Clyde Navigation Trust. The principal feature is a fixed rope and loose head. A wire rope is permanently fixed to the capstan head, which is made to run loose on the spindle, but when required is connected to the spindle by a clutch sliding upon the upper end of the spindle inside the capstan head. The starting switch and clutch are controlled by a long lever, which in the backward position releases the head by throwing out the clutch; and in the other direction puts in the clutch and operates the starting switch. The man is thus free to work his starting switch in an upright position and see all that is going on, as against ordinarily having one foot and two hands engaged. In places where a number of wagons have to be drawn up and used one at a time, as in a coal hoist, this is a very good arrangement, as there is great saving in ropes and no wear on the capstan head.

A motion will be put before the House of Lords next week to send all the bills relating to electric power supply in London to a joint committee of the House of Lords and the House of Commons. Unless the deliberations of this committee are expedited in an unusual manner, this course of action

[illegible] mean that [illegible] of the bills will [illegible] this session.

[illegible] lamps for alternating currents are now being put up on the market here.

The high price of coal during the last year has [illegible] a very marked effect upon the accounts of electric supply undertakings, and particularly upon those stations situated in the South of England. For instance, at Brighton, the extra coal cost, due to the higher price compared with the previous year, amounted to $15,000.

The Birmingham Corporation has experimentally adopted a brake for its tramcars which dispenses with the use of blocks upon the wheels. This particular type of brake is the invention of a member of the Leeds Corporation tramway staff, and was more or less described in these notes last year. It carries out a principle advocated by some tramway engineers and managers for a long time, and if successful at Birmingham, the corporation will ask the Board of Trade to sanction its use upon 30 new cars just being ordered.

The total liabilities of Bruce, Peebles & Co., the well-known Scotch firm of electrical engineers, who, as I announced last week, have been forced to go into voluntary liquidation, amount to $460,000. There are hopes that a scheme of reconstruction will be devised by the liquidators in view of the number of contracts on hand.

On the other hand, it is pleasant to record the fact that one British firm in the electrical industry, Mather & Platt of Salford, is doing well. In addition to a dividend of 15 per cent., and the transfer of $200,000 to the reserve fund, the firm has paid in $25,000 to the employes' benefit fund and has handed over $5,000 to the local hospital. It is also worthy of notice that during the last year Messrs. Henley's Cable Works have declared a dividend of 15 per cent., following equally substantial distributions by other cable companies. G.

Eastern Canada.

Ottawa, March 7.—The town of Stratford, Ont., will enter into a contract with the Ontario Hydro-electric Commission for the supply of Niagara power. Debentures will be issued by the town for $35,000 for the erection of a distribution plant.

The town of Galt, Ont., decided recently to take 600 horsepower from the Hydro-electric Commission, but a canvass of the town showed a possible sale of double that amount. Accordingly a vote of $66,000 for a distributing plant has been passed, and now power to the extent of 1,200 horsepower will be applied for.

The newly constructed transmission line of the Cape Breton Electric Company of Sydney, Nova Scotia, to the town of North Sydney, was used recently for the first time, and from now on this town will be supplied with electrical energy generated in the city of Sydney, across the harbor.

The management of the Montreal Street Railway Company is considering the question of large extensions to its system, not only within the city limits, but on the Island of Montreal. It is understood that the company has in view the expenditure of a large amount of money during the coming season. This expenditure will include the construction of several new lines of road, to be built in the suburbs and along the lake shore. A new circuit will connect the Back River and the Cartiersville systems. W.

New York.

New York City, March 7.—By an order of the Public Service Commission the New York and Long Island Traction Company must limit its rate to 10 cents for a continuous ride in either direction over its entire line and five cents for a single ride not exceeding five miles in either direction along its road. The company has been charging [illegible] Hempstead and Freeport, where the distance is less than five miles.

The report of the Interborough Rapid Transit Company for the year ended December 31st shows, after the payment of charges, a balance available [illegible] per cent on the company's $35,000,000 of capital stock. The [illegible] amounted to [illegible] per [illegible] that the directors have in contemplation an increase in the [illegible] per cent a year. This would be considerably below the amount [illegible] for the year [illegible]

[illegible]

charming residential towns and districts of that state within easy and convenient touch of the business sections of New York. Moreover, the obvious advantages of having direct communication with New York without change of car will prove a stimulus to the railroads to electrify their suburban lines and equip them with electric trains that can pass through the tunnels to the New York terminus.

The order requiring the Interborough Rapid Transit Company to show cause why all the Subway cars should not have side doors came up for hearing before Public Service Commissioner Eustis on Wednesday, but was postponed until April 8th, owing to the inability of Bion J. Arnold, the commission's expert, to be present. The first installment of the recent purchase of new steel cars for the Subway has been received and put in operation on the Subway expresses. The cars have doors nearly twice as wide as the doors of the older type of car, and the platforms are correspondingly larger. It is said that the new cars cost about $5,000 less each than did the first steel Subway cars. The ceiling instead of being aluminum is steel. The cars rattle a good deal and some of the train guards have dubbed them "tin cans." W.

Ohio.

Toledo, March 7.—The City Council of Lima has voted to issue bonds for $80,000 for the building of an electric-light plant. E. R. Young of Toledo has agreed to construct the plant at the price named, ready for operation, and with sufficient capacity for resident and private consumption. His proposition will be accepted by the city.

An ordinance is being prepared for the Village Council of Delphos, Ohio, which if passed will compel the electric-light company of that town to furnish meters to all of its patrons free of charge. The ordinance also provides for the appointment of an inspector to examine the meters.

The Fremont Home Telephone Company has increased the price of telephones to business men 50 cents a month, and a storm of protest has gone up. The local medical society has agreed to take out the telephones, and other business men are contemplating doing the same. The City Council has directed the solicitor to look up the franchise to determine the rights of patrons.

Electric street-car traffic was shut off in Toledo from the east side when the high water and ice wrecked the Cherry Street bridge, making it impassable. A temporary span will be erected within two weeks and traffic resumed. S.

Indiana.

Indianapolis, March 7.—The annual meeting of the Fort Wayne and Wabash Traction Company was held in Fort Wayne on the 5th instant. According to the annual report, the company enjoyed a large increase of business in all departments during the year. Colonel Jones, however, is by no means optimistic concerning the outlook for 1908.

The stockholders of the Indiana Union Traction Company held their annual meeting on March 3d in Anderson. The boycott placed upon the company's lines, both interurban and city, since January 1st, when the striking employes left their post, cut a large hole in the company's revenue. For the year 1907 the gross earnings were $2,089,232.50, and the operating expenses $1,111,198.48, leaving net earnings of $978,034.02.

A reorganization agreement for the Indianapolis and Cincinnati Traction Company (Charles R. Henry, president) is being sent to the stockholders and bondholders for their signatures.

The Grand Central Traction Company, which proposes to build an electric line from Indianapolis to Evansville, with a branch from Bloomington to Terre Haute, has filed a petition with the Board of Public Works of Terre Haute for a franchise to enter the city by a private right-of-way.

It is said that the head offices of the several allied utility companies operating in New Albany and Jeffersonville will be removed to Jeffersonville.

The Town Board of Paoli has voted to take over the electric-light plant of the Paoli Milling Company. The board will purchase new machinery, and when installed will increase the supply of electricity sufficient for commercial lighting, as well as for the lighting of the streets. S. S.

Mexico.

Mexico City, Mexico, March 5.—The use of American electrical machinery in Mexico is having a wonderful growth. The fact that many of the mines and industrial plants of the country are owned by Americans serves to turn the trade for electrical and other machinery of various kinds to the United States. There has been no period of dullness in the sale of electrical machinery and supplies in Mexico during the last few years.

The Lerma Mines Development and Power Company, [illegible] composed of Philadelphia (Pa.) men, is preparing to erect a large hydro-electric plant [illegible] state of Jalisco. The [illegible] initial power from the

Santiago River. According to the terms of the concession which the government has granted it for the purpose, the power will be transmitted to a number of mining camps in the state of Jalisco and used for the operation of mines and mills.

The Pinos Altos Mines Company, which is composed of Pittsburg (Pa.) men, has placed an order for machinery for an electric power plant and equipment for its mines and mill, situated at Temosachic, state of Chihuahua. The transmission line will be about six miles long to a sub-station, where a motor-generator will be installed to change the alternating current to a direct current for the operation of a 10-ton mining locomotive. Two 50-horsepower motors will be installed to operate the stamp mill, ore crushers, pumps and other machinery.

Manuel Sanchez Navarro is constructing a great dam across the Lerma River in the state of Michoacan for the purpose of forming a storage reservoir which will have a capacity of 100,000,000 cubic meters of water. The water will be used to operate a hydro-electric plant which he will install. Mines and other industrial concerns will be supplied with power from the plant.

There is a conflict of two concessions which were granted some time ago by the Federal government for the establishment of hydro-electric plants at the juncture of the streams known as La Joya and San Jose, in the state of Chihuahua. An American syndicate, headed by B. J. Burke, former United States consul at Chihuahua, obtained the first concession for the proposed plant and had arrangements made for beginning work on the installation of the plant, when the government granted a concession to the firm of Messrs. Schondube & Naugebauer of this city for the establishment of a hydro-electric plant at the same point. Both concerns have planned to build transmission lines to the cities of Chihuahua, Parral, Santa Rosalia and other places in the state. The conflict that has arisen has tied up both projects.

C. H. Brooks, vice-president of the Santo Domingo Mining Company of Hostotipaquillo, state of Jalisco, is at the head of a syndicate of American and British capitalists, which has taken steps to erect a hydro-electric plant on the San Diego River in the state of Jalisco. The proposed plant will cost about $500,000 gold, and the power thus generated will be used to supply the mines of that district as well as those of adjacent districts. It is stated that the work of constructing the plant will soon begin.

The waterfalls of two branches of the Ayoloco River, near Amecameca, are to be utilized to generate electricity for a hydro-electric plant which Juan Falera and associates are preparing to install there. The power will be used for industrial purposes. H.

Northwestern States.

Minneapolis, March 7.—The Wagner, Lake Shore and Armour Traction Company of Wagner, S. D., proposes the construction of a 125-mile electric interurban railroad, from Wagner to Sioux Falls.

Acker & Schiffeneder of Sheboygan, Wis., were awarded the contract for the installing of an electric power in the Ross-Sellinger plant at Sheboyan.

Plans have been prepared by Roy F. Smith of Lake City, Iowa, for the construction of the proposed interurban line between Lake City and Lanesboro. The estimated cost is $68,500. Mr. Smith is surveying a line from Lake City to Sac City and Storm Lake.

The Twin City Rapid Transit Company of Minneapolis will construct an underground conduit system on the east side for carrying feed wires to the north and northeast trolley lines.

F. M. Hubbell Sons Company of Des Moines, Iowa, purchased a block of the Creston, Winterset and Des Moines interurban railway stock recently, for building the proposed interurban line from Des Moines to Creston, Iowa, to cost about $1,800,000.

A lighting system for buildings and also street lighting may be installed at Maynard, Iowa, by Frank Talcott.

The city of Fergus Falls, Minn., may call for bids on the completing of the city electric-light dam shortly. The contract had been let to Contractor Ames, who recently filed a petition in bankruptcy.

The contract for the installing of arc lights in Eau Claire, Wis., was awarded to the Chippewa Valley Railway, Light and Power Company. R.

Western Canada.

Winnipeg, Man., March 7.—After several months of controversy the Winnipeg City Council has decided to drop the matter regarding the dismissal of Cecil B. Smith, civic power expert. It is probable that arrangements will be made soon for the construction of the $3,500,000 municipal power plant on the Winnipeg River.

The ratepayers of Edmonton, Alberta, voted a few days ago on a number of money by-laws and each one was carried, among them the following: $60,000 for extensions and improvements to the municipal lighting and power system; $40,000 by

the sale of debentures for additional expenses in connection with the municipal telephone system, and $20,000 for the installation of a fire-alarm system. Mayor Macdougall may be addressed.

The Lake Superior and Hudson Bay Development Company, seeking incorporation from Fort William, Ontario, is asking permission to build and operate telephone and telegraph lines along the route of its proposed canal to connect Lake Superior and Hudson Bay. Albert E. Honeywell, Ottawa, Ont., is interested.

The Saskatchewan Power Company is applying for incorporation with a capital of $1,000,000 for the purpose of developing electric power on the Saskatchewan River, near Saskatoon, Sask. An electrical expert stated that fully 400,000 horsepower could be developed. The incorporators include J. F. Cairns, Fred Engen and others of Saskatoon.

The ratepayers of Moosejaw, Sask., have voted favorably on a by-law calling for the expenditure of $90,000 for extensions to the electric-lighting system. J. D. Simpson is city clerk.

The plant of the Okotoks Electric Light Company at Okotoks, Alberta, which was closed down because it was not a financial success, has been purchased by C. O. Sanders and A. Alworth of that town and put in operation on March 2d.

Construction on The Eburne-New Westminster line of the British Columbia Electric Railroad Company has been resumed, and it is expected grading will be completed by April 1st. R.

Pacific Slope.

San Francisco, March 4.—The Clear Lake Power and Irrigation Company has been incorporated in San Francisco with a capital stock of $10,000,000 for the purpose of developing power and using for irrigation purposes the waters tributary to Clear Lake in Lake County, Cal. Attorney Charles S. Wheeler of San Francisco is nominally at the head of the company, although he admits that he is acting for others. He states that the company will erect a hydro-electric plant capable of developing 45,000 horsepower. The plans involve a transmission line to San Francisco and Oakland.

H. W. Esden, president of the Wadsworth Light and Water Company, operating at Wadsworth, Nev., and others have incorporated the Sierra Power Company. The new company will put in a power plant on the Truckee River, near Derby, Nev., to furnish light and power to the towns of Fallon, Fairview, Wonder and Rawhide. The company has an authorized capital stock of $100,000.

Ground has been broken for the new electric power house and gas plant of the Huntington Park Gas and Electric Company at Huntington Park, Cal. Contracts have been let for the construction work and for the electrical machinery.

The San Bernardino Valley Traction Company, operating at San Bernardino, Cal., has closed a contract with the Pacific Light and Power Company of Los Angeles for current to be taken from the Santa Ana Canyon plant of the Pacific Light and Power Company. Heretofore the San Bernardino company has secured its current from the Edison Electric Company of Los Angeles.

The city of Pasadena, Cal., has voted for a bond issue which will make $30,000 available for improvements in the electric-lighting system.

Merrill H. Fisher is preparing to build an electric power house at Alamogordo, N. M., which will cost, exclusive of equipment, $5,000.

James Sword of Salt Lake, Utah, announces that he will build an electric railroad from the town of Schurz to the new mining camp of Rawhide, in Nevada. The necessary power will be developed on Walker River.

E. W. Peterson has applied for a franchise for an electric railway in South San Diego. The proposed franchise will connect with one secured by Mr. Peterson about a month ago. A.

PERSONAL.

Mr. Henry W. Young of the Ohio Brass Company, Mansfield, Ohio, was a Chicago visitor this week.

Mr. George A. Campbell has resigned as manager of the Reno Power, Light and Water Company, at Reno, Nev., to become superintendent of the Truckee River General Electric Company, operating plants at Carson, Virginia, Yerington, Gardnerville, Reno and other points in Nevada.

Mr. E. B. Kirk of Dixon, Ill., has resigned as manager of the lighting and railway properties of the Dixon, Sterling and Eastern Electric Railway Company. He has been appointed general manager of the Atlantic Shore Line, which operates in Maine and New Hampshire.

Mr. A. M. Barron, general manager and treasurer of the Consolidated Light, Power and Ice Company of Joplin, Mo., for a number of years, has been appointed general manager of the Citizens' Electric Company of Eureka Springs, Ark. The Citizens' Electric Company operates a number of utilities, including electric light and power, [illegible]

[illegible]

Mr. W. W. W[illegible] terially.

Mr. R. R. McCormick, president of the Sanitary District of Chicago, has recommended to the finance committee of that body that the salary of Mr. E. B. Ellicott, the electrical engineer of the district, be raised from $5,000 to $6,000 a year. Mr. Ellicott's ability and zeal are worthy of this substantial recognition.

Mr. Henry L. Doherty will address the members of the Rockford (Ill.) Manufacturers and Shippers' Association at their annual business meeting to be held on March 21st. Mr. Doherty is at the head of the large gas and electric corporation which has among its properties the Rockford Edison Company. He is a man of wide business experience.

Mr. H. W. Young, who has been special representative of the Detail and Supply Department of the Westinghouse Electric and Manufacturing Company at Pittsburg, has resigned that position to become sales manager of the Central Electric Company of Chicago. Mr. Young has been especially active in the design and sale of electric meters.

ELECTRIC LIGHTING.

A. Pace will establish an electric-light plant in Danville, Ark.

Dublin, Ga., has voted $65,000 in bonds for the enlargement of its electric-light plant.

A 50-year electric-light franchise has been granted to Ira L. Hewitt at Long Pine, Neb.

The city of Galena, Kan., will vote on the subject of issuing bonds for an electric-light plant.

Linneus, Mo., has voted bonds to rebuild the electric-light plant recently destroyed by fire.

The Yorktown (Tex.) Light and Ice Company has been incorporated with a capital stock of $7,500.

The R. A. Horlock Company has secured a franchise at Navasota, Tex., and will install an electric-light plant.

The city of Genoa, Neb., has voted bonds to the amount of $6,000 for the establishment of an electric-light plant.

The Bloomfield (Mo.) Electric Light, Heat, Power and Water Company has been incorporated with a capital stock of $10,000.

Albert Rives of Bellingham, Wash., has purchased a half interest in the Sumas Light Company of Sumas, Wash., and has taken charge of the plant.

The Hutchinson (Kan.) News says that in Hutchinson there are a number of street blocks where porch lights are used in front of every house, and when they are all lighted these are the brightest blocks in town.

The taxpayers of Battleford, Sask., Canada., have voted in favor of raising sufficient money, by the sale of debentures, for the installation of an electric-lighting plant. B. Prince, Battleford, Sask., may be addressed.

Committees of the Hamilton and City clubs of Chicago, acting jointly, are among the most active in investigating the provisions of the proposed ordinance of the Commonwealth Edison Company. The committees are hearing the company's side and also the arguments of objectors in order to arrive at a decision as to the merits of the ordinance.

By the 1st of December next the Citizens' Electric Company of Macon, Ga., must have broken ground for the installation of a $100,000 lighting plant in the city of Macon. This must be done to bind a contract that has just been entered into between the city and the company and to make good a franchise of 50 years' duration that has just been granted to the company by the City Council. Recently the Macon Railway and Light Company reduced its rate from 15 to 12½ cents per kilowatt-hour on electrical energy for lights and allowed its rate of discount to remain at 10 per cent.

ELECTRIC RAILWAYS.

An order has been issued by Judge Grosscup on the motion of receivers of the Chicago and Milwaukee Electric Railroad Company permitting the deposit of the corporation's bonds. When the bonds have been deposited the receivers will advocate [illegible]

[illegible] connect Kansas City, Topeka and Independence [illegible]

[illegible] scendant of the Kansas City, Stranger Valley and [illegible] was organized two years ago and which made a [illegible]

A conference was recently held at Pontiac, Ill., between officials of the Joliet and Southern Traction Company and those of the Bloomington, Pontiac and Joliet Electric Railway Company, which are under affiliated control. It was definitely decided to extend the line of the latter company south from Pontiac toward Bloomington this spring. The line will be pushed at least 10 miles to Chenoa this year. Extension of the Joliet and Southern from New Lenox to Frankfort, about seven miles, will also be started as soon as weather permits. The cost of these extensions is estimated to be about $250,000. This does not include additional power or rolling stock.

The ordinance for the Calumet and South Chicago Railway Company has been practically completed. All that remains is to insert the figures showing the present value of the property. Bion J. Arnold and George Weston are now working on the valuations and it is expected their figures will be accepted by the company. This company is to be a consolidation of the Calumet Electric and South Chicago City railway companies, and the purpose is to give the territory south of the Chicago City lines better street-car service. The ordinance binds the company to rehabilitate its entire system, as ordered by the board of supervising engineers, within three and a half years; to provide fifteen new cars within the first year and as many more afterward as the board may order; to rebuild at once 40 miles of its track and to make extensions.

POWER TRANSMISSION.

The Chattanooga-Tennessee River Power Company of Chattanooga, Tenn., has selected the site for its large plant and construction work will be begun at once. Quarries will be operated in connection with the concrete work. E. H. Ballie of the Wilson & Ballie Manufacturing Company, James Building, Chattanooga, will be in charge of the construction work.

The Twin City Power Company of Augusta, Ga., has been authorized by Congress to construct three large dams across Savannah River above Augusta for developing electricity to be transmitted for manufacturing and lighting. The company has taken options on lands and secured provisional contracts for furnishing electricity in Augusta and other cities. Hugh C. Middleton is one of the company's managers.

The state railroad commission at Madison, Wis., has granted the Ashland (Wis.) Power Company the right to issue stock for $100,000 and bonds to the extent of $300,000 for the purpose of developing the properties of the Ashland Light, Power and Street Railway Company and for the purchase and development of waterpower and extension of the present railway system. The moving spirit of the new power company is A. E. Appleyard, now of Boston.

PUBLICATIONS.

The Engineering Department of the National Electric Lamp Association has issued a handsome brochure, entitled "The Quality of Light, Then and Now." It briefly follows the developments in the mode of artificial illumination from the time of the aborigine, who was content with the glow of the campfire, to the greatest achievement in the electric-lighting industry, the tungsten lamp; and then it gives some data about this lamp.

The 1908 catalogue of the American Steam Gauge and Valve Manufacturing Company, 208-220 Camden Street, Boston, is a well-illustrated, substantially bound book of 246 pages. With threescore years of business experience, operating probably the largest plant of its kind in the world, this company has made its products well known. The company manufactures gauges, valves, indicators and kindred appliances for governing, indicating, measuring, recording and controlling steam, water, air, gas, oil, ammonia and all other pressures. All

these are described in the catalogue and there is much useful general information.

Building contractors' hoists, electrically driven, are the subject of a booklet published by the Patten Manufacturing Company of Chattanooga, Tenn. The company's hoists are said to be essentially different and greatly superior to machines used heretofore by building contractors. The principles of operation and construction are well described and illustrated.

In its new bulletin, No. 98, on direct-current motors and generators, the Electric Machinery Company of Minneapolis publishes useful information and data which it has never before given out. The illustrations show some of the features of the company's machinery and a number of interesting tables which go into the construction, operation and price of the machines.

The De Laval Steam Turbine Company of Trenton, N. J., has issued bulletin 501, in which are given illustrations and brief descriptions of the different types of high-grade turbine and motor-driven machinery manufactured by the De Laval company. This company's product consists of turbine engines, either separate or driving dynamos or blowers, and turbine or motor-driven centrifugal pumps.

Circular 139 of the Forest Service, "A Primer of Wood Preservation," tells in simple terms what decay is and how it can be retarded, describes briefly certain preservatives and processes, gives examples of the saving in dollars and cents, and tells what wood preservation can do in the future. The circular can be had free upon application to the forester, Forest Service, Washington, D. C.

"Defunct Municipal Lighting Plants" is the title of a pamphlet compiled by Arthur Hastings Grant and published by the M. O. Publishing Bureau of New York city. Its title explains the contents. The list is conveniently arranged, in alphabetical order, and is valuable for the use of central-station companies combatting municipal ownership. The book is bound in a red cover with a picture on it of a railroad signal set at "Danger."

The Haller Sign Works of Chicago has just issued a very complete catalogue of electric signs and displays. Electric signs of many varieties, letters and accessories are listed, described and illustrated. There is also much valuable general information about signs. This company has made some of the largest and most attractive signs in the country. The new catalogue will be found of value to anyone interested in the subject.

The Jeffrey Manufacturing Company of Columbus, Ohio, has issued a new catalogue of Century rubber-belt conveyors. The numerous illustrations show the application of rubber-belt conveyors for handling materials of various kinds. This company also makes chain elevating and conveying machinery; screening, crushing and mining machinery; pulverizers, tipples, coal and rock drills; electric locomotives for mines and industrial plants, etc.

Recognizing the advantages to be derived from the widespread use of standard wiring symbols, the Allis-Chalmers Company has prepared, with the permission of the National Electrical Contractors' Association, a reprint of the symbols adopted by that association for distribution among its friends and the electrical trade. The National Electrical Contractors' Association has long felt the need of standard wiring symbols to be used in all wiring specifications. After careful consideration, 51 symbols were produced as best suited to the purpose. A copy of Allis-Chalmers miniature bulletin No. 4010 will be sent to anyone interested upon receipt of a request.

In a handsome booklet known as Bulletin No. 4543 the General Electric Company illustrates typical examples of direct and alternating-current motors installed on a variety of lathes, drills, grinders, punchers, shears, boring mills and similar tools which are suggestive of their almost limitless adaptability to this character of service. Among the advantages gained, as pointed out in the bulletin, are general economy of power and increased production, ease of control and convenience of handling, better arrangement of tools, independence of environment and greater cleanliness and decreased cost of maintenance, with increased safety [illegible]

The 1908 fan-motor catalogue, Bulletin 5352, of the Western Electric Company, is attractive in design, and lists every fan that is standard to the [illegible] Universal fan embodies all [illegible] of the old desk and bracket fans and many new features. This fan is so designed that it can be converted with ease into a [illegible] without the use of an adapter [illegible] and in con[illegible] special care. Besides [illegible] for direct current there [illegible] for desk and [illegible] alternating current [illegible] and W. E. standard [illegible] types and designs [illegible] application of

electric motors to ventilating fans, and several outfits are shown. Accessories and parts are thoroughly covered, and there are code words and list numbers for the convenience of customers.

The F. Bissell Company, Toledo, Ohio, wholesale dealer in electrical supplies and machinery, has just issued the first of a series of calendar cards which will be sent out monthly to anyone who will write to the company and request them. The first one, for March, is of original and clever design.

Vol. I., No. 1, of the Recorder has just been issued from the Chicago office of the Bristol Company, 753 Monadnock Building. The first issue, a booklet of 16 pages and cover, is a creditable one, devoted largely to Bristol recording instruments, with a sprinkling of "fables, froth, figures and facts." The company expects to publish this house organ monthly as a means of keeping in close touch with its many customers so that they can become familiar with the new lines, types and ranges of instruments continually being produced, and can have the benefit of experiences of others which will be recorded. The booklet will be sent out very generally free of charge.

One of the artistic electric-fan catalogues of the season is bulletin No. 4560, just issued by the General Electric Company. The 1908 fan motors are plainer and handsomer, if possible, than those of previous design, possessing as well the qualities of efficiency, speed control and reliability that were found in last year's product. The direct-current fans are equipped with a universal joint by means of which a desk motor may be instantly transformed into one of a wall-bracket type without the aid of tools. The catalogue is conveniently arranged for reference, two or three fan motors being shown on each page with a brief description in tabulated form and data as to voltage, catalogue numbers and list prices. Descriptions are included of ceiling fans, exhaust fans and some miscellaneous small motors for blower drills, buffing and polishing machines, sewing machines and the like.

The Hazard Manufacturing Company of Wilkes-Barre, Pa., has just issued a very complete and attractive catalogue of wire rope and insulated wire. The catalogue is in two sections, the first covering wire rope and kindred products, and the second the various kinds of insulated copper wires and cables. Both sections are profusely illustrated, showing the different kinds and sizes of Hazard products, and there are many interesting pictures representing the wide variety of uses of wire rope and insulated wires. The electrical conductors manufactured by this company are for use on street-railway, electric-light and power circuits, telephone, telegraph and signal systems. The wire-rope line is for general hoisting purposes, riggings, for use on tramway and power-transmission lines, street-railway cables, etc. Appliances that go with the rope and wire line are also shown. The catalogue is conveniently compiled and contains much valuable information and data.

SOCIETIES AND SCHOOLS.

An electrical club has been formed at Brandon, Man., with P. McGregor president and R. Young, secretary.

The semi-annual meeting of the American Society of Mechanical Engineers will be held in Detroit on June 23d to 26th. A symposium on the conveying of materials will be a feature.

At a special meeting of the American Institute of Electrical Engineers in New York on March 5th Mr. Gifford Pinchot, chief forester of the United States, delivered an address on "The Conservation of Our Natural Resources." Dr. F. A. C. Perrine also spoke on the same subject and showed some lantern slides.

MISCELLANEOUS.

Copies of the programme, plans and application forms for exhibits in connection with the International Exposition of Electrical Appliances to be held at Marseilles, France, from April 19 to October 31, 1908, may be obtained from the Bureau of Manufactures, Washington, D. C., by intending exhibitors

At Gilroy, Cal., electric power is generated at a plant at Sixth Street and the railroad track. The equipment consists of a 75-kilowatt, three-phase, 2,300-volt generator, belt-connected to a steam engine. The switchboard is made of marble, and switches for 2,200-volt circuits are of the 20-ampere oil-break type. The entire plant is well installed. Most of the wiring along streets and in buildings is in good shape

TRADE NEWS.

Under date of February 28th the creditors' committee of the Westinghouse Machine Company gives notice that, in accordance with the provisions of the agreement, dated December 24, 1907, between the Westinghouse Machine Company and the creditors' committee, the agreement and the plan of extension of the debt of the Machine company therein set forth are declared to be operative.

The Swedish Electric Vibrator Company of Chicago has been incorporated with a capital of $10,000 to manufacture electric vibrators. The incorporators are Forée Bain, George T. May, Jr., and C. A. Criswell.

The Watson Electric Company of Chicago has been incorporated with a capital of $2,500 to manufacture electrical apparatus and supplies. The incorporators are Robert H. Watson, Frank G. Watson and Milton O. Naramore.

The Electric Cable Company of 17 Battery Place, New York, whose plant at Bridgeport, Conn., was partially destroyed by fire, announces that it has made arrangements which will permit of filling all orders received for its various products, including Voltax, the transparent protective compound; rubber-covered wires, weatherproof wires and cables, magnet wire, annunciator and office wire, etc. Pending adjustment of insurance details, the company will make no announcement of its plans for rebuilding.

In advance of the annual report of the General Electric Company, it is asserted that gross earnings of the company for the year ended January 31, 1908, will show a substantial increase compared with the previous year. It is stated that in spite of the business depression during the last months of 1907, sales during the fiscal period aggregated about $70,000,000, which is $10,000,000 more than for the preceding year. It is calculated that the amount available for dividends is about $9,800,000, compared with $8,427,842 in the previous year. It appears that the company is selling very close and that its profits are being reduced gradually as the business volume gains. In 1903, when the gross sales were $36,685,000, the profits were $10,232,839.

BUSINESS.

The new commutator tool recently introduced by the Lofgren Specialty Company of Chicago has become popular among electricians and repairmen in general, and the company is put on its mettle in supplying the demand. This tool, especially adapted for commutator troubles, does its work quickly and with precision.

The Gergory Electric Company's bargain sheet for March is out and is an interesting and valuable list of used electrical apparatus available at reduced prices. The company lists only apparatus actually in stock at its works and guarantees to refund purchase price if the customer is not satisfied. The list, although of convenient pocket size, well indicates the extent and diversity of the business, and it is provided with an index. The company is addressed at Sixteenth and Lincoln streets, Chicago.

Among the encouraging signs of the times, from an industrial viewpoint, have been repeated purchases of electric generators, motors, transformers, etc., particularly motors, by the leading coal companies. From the electrical works of Allis-Chalmers Company sales of apparatus have been made to 16 large coal companies, besides various subsidiary companies of the United States Steel Corporation and other iron and steel plants, and numerous smaller operators. Aside from the operation of electric haulage locomotives, which are now very generally used throughout the country, one of the principal uses to which motors have been put in collieries is for connection to ventilating fans. Electric hoists are rapidly coming into favor; motor-driven centrifugal pumps have proven both economical and convenient, and elevators, conveyors, dumps, etc., can be most effectually operated and controlled when subject to the simple turning of a rheostat handle or switch. Then there are the small self-discharging steel cars known as "larries," cranes, grab-buckets, crushing rolls, scrapers, carpullers, brakes and various auxiliary devices which have reduced coal and coke operations to an almost automatic basis.

DATES AHEAD.

Electrical Committee, Underwriters' National Electric Association (general meeting), 32 Nassau Street, New York city, March 25th and 26th.

Nebraska Electrical Association (annual meeting), Omaha, Neb., April 15th and 16th.

Iowa Electrical Association (annual meeting), Savery Hotel, Des Moines, April 22d and 23d.

Iowa Street and Interurban Railway Association (annual convention), Savery Hotel, Des Moines, Iowa, April 23d and 24th.

Missouri Electric Light, Gas and Street Railway Association, Marquette Hotel, St. Louis, April 23d, 24th and 25th.

Omaha Electrical Show, Auditorium, Omaha, Neb., May 4th to 9th.

Missouri Independent Telephone Association, Kansas City, May 6th and 7th.

Southwestern Electrical and Gas Association (annual meeting), El Paso, Tex., May 7th, 8th and 9th.

National Electric Light Association (annual convention) Auditorium Hotel, Chicago, May 19th to 22d.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued [illegible] United States Patent [illegible], March [illegible], 1908.

880,521. Fire Alarm. William Glen[illegible], [illegible], N. J. Application filed June 14, 1907.

A fire-alarm device comprises a rod [illegible] material with a celluloid cap [illegible] contact plate secured to this cap, [illegible] the rod and secured at one end to [illegible] draw it into engagement with the [illegible] cluding the rod and contact plate.

880,537. Telephone Dictating System or Apparatus. John W. Kelly, Jr., Camden, N. J., assignor to the General Acoustic Company. Application filed April 27, 1907.

A number of managers' stations, each having a [illegible], and a stenographer's station are provided with means for establishing talking circuits between them, and means for establishing a talking circuit between two managers' stations, the circuit including the [illegible] one such station only.

880,544. Ground Detector. Justus C. Lawler, Colorado Springs, Colo. Application filed February 17, 1906.

A ground detector for three-phase circuits has three flat plates in a single plane and a single flat parallel vane common to the three plates, which has two equal and opposite sectors free to rotate with the vane.

880,547. Transformer Furnace. Axel R. Lindblad and Otto Stalhane, Ludvika, Sweden. Application filed November 5, 1906.

This furnace is practically a transformer having a core formed of an endless annular member composed of superposed plates or laminæ, the plates being arranged around the axis of the annular member to intersect all lines of force radiating from the axis of the core.

880,565. Fault-locating Apparatus. Lloyd C. Nicholson, Buffalo, N. Y. Application filed March 7, 1907.

A means for locating faults comprises a source of electricity, a loop connected through an impedance to one terminal thereof and containing a faulty conductor, a current-operated circuit-opener shunting the impedance, and means acted upon by the currents in the loop for determining the relative impedances of the two branches to the fault.

880,579. Carbon Electrode for Electrical Bleaching Apparatus. Paul Schoop, Nuremberg, Germany. Application filed November 26, 1906.

In a contact for carbon electrodes of electrolytic apparatus there is in combination with the electrode having a threaded hole formed therein a perforated precious metal lead and a hard carbon screw passed through the perforation in the lead and screwed into the electrode.

880,592. Long-distance Recording Indicator for Reciprocating Devices. Richard H. Sterling, Watsonville, Cal. Application filed September 29, 1905.

The apparatus consists of means operated by the reciprocating device for generating an electric impulse in a circuit, positive or negative, depending upon the direction of movement of the device, means for continuously advancing a recording sheet, an instrument for marking the sheet, and means for moving the instrument actuated by the passage of the current, the direction of movement of the instrument depending upon the direction of the current.

880,617. Electric Circuit Controller. Christopher Bach, Jr., Milwaukee, Wis. Application filed December 13, 1906.

This automatic circuit controller has a vertical cylinder open at the bottom and provided with a series of upper apertures at suitable intervals apart in a vertical direction, removable stoppers closing all but a predetermined one of the apertures, a piston having retarded descent in the cylinder until such time as it uncovers the open aperture of the same, and circuit make-and-break mechanism controlled by the movement of the piston.

880,650. Sparking Igniter. Paul Gaeth, Cleveland, Ohio. Application filed April 9, 1907.

A number of sparkers having rocking electrodes are arranged in a row. A shaft at the middle of the row, having a crank, and push rods connected to the crank and extending at various angles toward the sparkers, is arranged to operate the electrodes. Guide rollers are provided, over which the push rods work, and means to hold the rods thereto.

880,655. Trolley-wire Finder. Ferdinand Gundorph, Portland, Ore. Application filed May 29, 1907.

A recessed trolley head has a guiding slot therein, an actuating lever pivotally mounted therein, and a finder arm pivoted to the lever and extending upward through the slot.

880,662. Automatic Electric Fire-alarm Signal. Edward E. Hayden, Washington, D. C. Application filed May 11, 1906. Renewed July 2, 1907.

The signal consists of a casing carrying a push button, a contact member consisting of strips of brass and steel fastened together and curved into the form of a spiral, and a resilient contact member adapted to be pushed in by the push button, or to be struck by the first-named contact member as it expands under the influence of heat.

880,668. Burglar Alarm. William E. Jones, Minneapolis, Minn., assignor to the Electric Protection Company, Minneapolis, Minn. Application filed June 8, 1907.

An electrically actuated bell is located outside of the protected apartment. A sectional housing encloses the bell, and one of a pair of normally separated controlling contacts is perforated and applied to one section of the housing and the other contact is applied to the other section so as to project with clearness through the perforation of the perforated contact.

880,6[illegible]. [illegible] 1907.

[illegible]

880,689. Primary Battery. [illegible] Demar[illegible], [illegible] Orange, N. J., and [illegible] Robinson, New York, N. Y. Application filed March [illegible], 1907.

[illegible] trolyte.

880,691. Electric Alarm. Theodor Norpoth, St. Louis, Mo. Application filed April 10, 1907.

A normally open electric circuit containing an annunciator or bell [illegible] bar having one end in frictional engagement with the disk, and actuated by the disk, and intermediate circuit-closing devices interposed between the bar and circuit for closing the latter upon rotation of the disk.

880,703. Battery. George M. Wheeler and Henry Wilhelm, Brooklyn, N. Y. Application filed July 11, 1907.

A pocket battery of a number of cells is provided with a totally removable wrapper of flexible material comprising a central portion having a pair of side extensions folded around the cells to enclose them and also having a top and bottom extension folded over the ends of the cells.

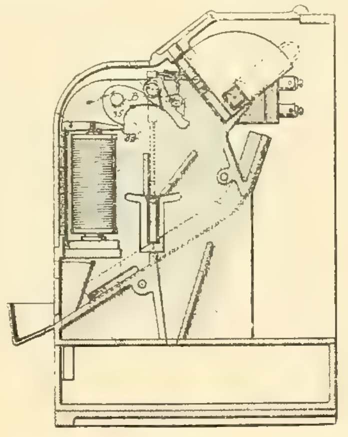
880,705. System of Electrical Distribution. Joseph L. Woodbridge, Philadelphia, Pa. Application filed August 30, 1905.

An apparatus is used in this system to rectify alternating current. It consists of a relatively fixed magnetic circuit with inductive windings, one of which is connected to a stationary commutator. Upon this two sets of brushes are revolved by a synchronous motor. One set is short-circuited and the other is connected to the direct-circuited mains.

880,706. Electrical Distribution. Joseph L. Woodbridge, Philadelphia, Pa. Application filed January 12, 1906.

The system comprises an alternating-current circuit, a storage battery and its direct-current circuit, transforming apparatus operatively connected between the two circuits and means responsive to fluctuations on the alternating-current circuit, for compelling the transfer of energy in either direction, the means including an armature connected in series between the terminals of the transforming apparatus and the alternating-current circuit.

880,708. Telephone Toll Apparatus. Edward P. Baird, Evanston, Ill., assignor to the Baird Manufacturing Company, Chicago, Ill. Application filed March 25, 1901.



NO 880,708.—TELEPHONE TOLL APPARATUS.

In this prepayment device there are coin-distributing means controlled by the exchange operator for either retaining or refunding a deposited coin. (See cut.)

880,716. Electrothermal Garment. Burton R. Charles, Portland, Ore. Application filed October 15, 1907.

This thermal garment has heating wires in the body portion. Wires for connection outside the body are fastened thereto inside a pocket. A contact plug and the wires connecting the same with the garment are adapted to be concealed in the pocket when the garment is used as an ordinary robe.

880,720. Recording Device. Edward S. Cole, Upper Montclair, N. J. Application filed February 17, 1904.

The apparatus comprises a conduit for a flowing stream, two tubes connected therewith, a U-tube containing a float, a series of electromagnetic devices provided with connections by which they are operated by the float, a series of pencils operated by the electromagnetic devices, a rotary drum associated with the pencils, and a pressure gauge connected with one of the tubes and having an arm provided with a pencil adapted for use in connection with the rotary drum.

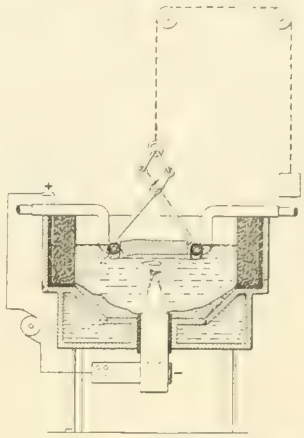
880,7[illegible]. [illegible]

[illegible]

880,7[illegible]. [illegible] Company, New York, N. Y. Application filed April [illegible].

[illegible]

880,760. Producing Metals by Electrolysis. George O. Seward and Franz von Kügelgen, Holcombs Rock, Va., assignors to the Virginia Laboratory Company, New York, N. Y. Application filed April 24, 1906.



NO. 880,760.—ELECTROLYTIC FURNACE.

In the electrolysis of fused electrolytes the metal is caused to separate in a molten state at a submerged cathode, to rise through the electrolyte, and collect and solidify under a movable protective cover in contact with the electrolyte. (See cut.)

880,761. Means for Draining Manholes of Electric Conduit Systems. Angus J. Smith, Boston, and Daniel Livingston, Cambridge, Mass. Application filed November 5, 1907.

A main suction pipe extends from a suction pump throughout the system. Branches from it lead to the bottom of each manhole. Float-controlled valves govern the inlets to the different branches.

880,762. Signaling System. Bernard Staub, New York, N. Y. Application filed November 5, 1906.

The sending station has a number of rotatable disks operated from distant points through cords and a corresponding number of make-and-break wheels. The receiving station has a circuit containing a recorder and any of the make-and-break wheels referred to. A contact device on each disk closes the circuit through one of the wheels and the receiver.

880,770. Signaling Circuit for Railways. Joseph A. Wilson, Westfield, N. J., assignor to the Hall Signal Company, New York, N. Y. Application filed February 10, 1902.

Two signals are provided, one controlled by a neutral relay and the other by the neutral relay and a special relay with two windings.

880,780. Means for Electrically Operating Fire Engines. Gustave A. Drake, Denver, Colo. Application filed June 17, 1907.

An electric motor is operatively connected with a pump. Means are adapted to simultaneously connect the motor with the terminals of the conductors in a broken electric circuit and a suction nozzle with a water conduit.

880,788. Means of Forming Electrically Bonded Rail Joints; also 880,789, Means of Forming Joints in Electrical Conductors. Horatio G. Gillmor, Bath, Me. Applications filed March 27, 1906, and February 4, 1907, respectively.

An electrically bonded rail joint includes, in combination with the rails, a chair having upwardly extending arms, a bonding plate overlapping the ends of the rails, and a wedge whereby pressure is exerted upon parts of the joint.

880,790. Implement for Removing Insulating Covering from Electric-circuit Wires. John H. Goehst, Chicago, Ill. Application filed February 25, 1907.

This cutting plier has a pair of swinging jaws, coacting blades at the side of jaws, one carried by each jaw, for transversely cutting the covering, and a blade between the jaws for longitudinally splitting the covering and arranged to split it past the center of the wire.

880,809. Advertising Device. Joseph T. Moncrief, Montgomery, Ala. Application filed September 30, 1907.

A number of electric lamps are arranged to form letters that are removably supported on wire netting [illegible]

as to form a unit. A supporting structure is built in the form of a tower frame divided into sections adapted each to receive one or more of the units.

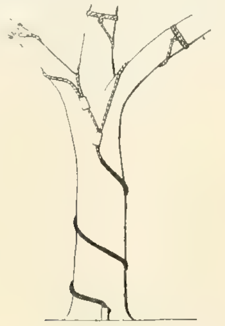
880,838. High-potential Transformer. Chester H. Thordarson, Chicago, Ill. Application filed April 17, 1905.

The magnetic circuit comprises a laminated core, base and end pieces. The transformer coils encircle said core and are respectively equally distant from the base and adjacent end portions.

880,851. Railway Signaling System. Joseph A. Wilson, Westfield, N. J., assignor to the Hall Signal Company, New York, N. Y. Application filed August 10, 1906.

A number of separate, independent electromagnets are provided with means whereby one of them actuates a circuit controller in one direction, means whereby another electromagnet actuates the controller in the reverse direction, and means for neutralizing the magnetic field of one magnet and increasing the magnetic field of the other.

880,854. Lightning-protector Attachment for Trees. John P. A. Anderson, Madrid, Iowa. Application filed February 23, 1907.



NO. 880,854. LIGHTNING PROTECTION FOR TREES.

A tree protector consists of a main metallic conductor spirally embracing the trunk of the tree and in electrical connection with the ground and coacting metallic conductors clamped to the main conductor and embracing the branches of the tree. (See cut.)

880,858. Electro-automatic Weighing Apparatus. Charles L. Bond, Los Angeles, Cal. Application filed January 28, 1907.

A conveyor-chute for conducting material to a weighing scale has a gate with an orifice, means for holding the gate open, electromagnetic means for releasing the gate, means for controlling the speed of its movement when released, a cut-off operable beneath the orifice of the gate, and means for controlling the cut-off.

880,876. Coin-controlled Brushing Machine. Everett Goldthwait, Elkhart, Ind. Application filed January 15, 1906.

The insertion of a proper coin closes the circuit for an electric motor that sets the brush in operation for a definite time.

880,888. Electromagnet. Winthrop K. Howe, Buffalo, N. Y., assignor to the General Railway Signal Company. Application filed April 26, 1906.

This traction magnet has a core with two legs wound with magnetizing coils and an auxiliary unwound leg, an armature co-operating with the magnetic core, and means for displacing the phase of the currents in the coils and for providing a shunt-circuit for one of the coils.

880,889. Automatic Sprinkling and Fire-alarm System. Charles A. Jacoby, Chicago, Ill., assignor of one-third to Michael Farrell and one-third to John L. Fruin, New York, N. Y. Application filed March 11, 1907.

Sprinkler heads carried by the water supply pipes have electrically operated valves adapted to control the flow of water through the pipes. There are a number of independent valve circuits and a number of thermostats and thermostat circuits having relays therein for closing the valve circuits, also an independent test circuit for each of the valve circuits, and an indicating device in the test circuit.

880,891. Electrical Purification of Flour, Grain, Etc. John L. Lawson, Leith, Edinburgh, Scotland. Application filed June 22, 1906.

[illegible] flour, grain, rice and like cereals consists in feeding the same in comminuted condition in a series of shallow streams, slightly separated from one another, below a superposed conductor charged with high-tension electricity whereby the impurities in the cereals are lifted from the streams, brought into contact with the conductor and repelled so as to fall between [illegible]

880,900. Process for Producing Chlorides of Carbon. James MacKaye, Cambridge, Mass., assignor to Stone & Webster, Boston, Mass. Application filed April 13, 1905.

[illegible] and chlorine in [illegible] subjecting the mixture to [illegible] electrical means [illegible]

880,940. Electric Bell. Charles J. Wagner, Chicago, Ill. Application filed August 15, 1907.

[illegible]

880,963. Trolley Pole. Henry Bouchard, Austin, Tex. Application filed April 16, 1907.

The trolley pole comprises a number of telescoping sections, means for retaining the pole in alinement with the bracket, means whereby the extending of the sections will release the retaining means, a spring acting normally to extend the sections, and a rest on the bracket for supporting the pole when out of alignment with the bracket.

880,971. Insulator. George W. Carter, Canyonville, Ore. Application filed May 8, 1907.

The insulator body is grooved in its upper end to form a seat for a tie wire. A peg receiving the body has below the same a transverse opening for the tie wire which engages with the groove in the upper end of the insulator body and passes through the opening in the peg.

880,974. Operating Mechanism for Magnetos. Albert N. Classon, Rutland Township, LaSalle County, Ill. Original application filed April 20, 1906. Divided and this application filed October 7, 1907.

Means for driving the magneto from the engine comprise a friction pulley normally operated by engagement with the flywheel of the engine, and a spacing roller adapted for insertion between the pulley and the rotating part for transmitting motion when the engine is rotated in the opposite direction.

880,976. Trolley Mechanism. William J. Craig, Pine Bluff, Ark. Application filed September 6, 1907.

A plate with a C-shaped slot in it fits over a hole in the roof of the car. The pole is pivoted to a rotating plate with a corresponding slot. A rod with a spring about it passes through the slot and is pivoted at its top to the pole.

880,978. Electrode Element for Storage Batteries, and 880,979, Method of Making Storage-battery Electrodes. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Applications filed November 2, 1905.

This storage-battery plate is made by introducing within a non-deformable enclosing pocket in successive small increments a mixture of particles of nickel hydrate and flakelike conducting material, and in applying to each increment after its introduction sufficient pressure to deform or crush the active particles and cause them to substantially follow the contour of the conducting flakes.

881,005. Signaling System. Edward E. Kleinschmidt, New York, N. Y., assignor to George M. Seeley, New York, N. Y. Application filed December 29, 1905.

A signaling station consists of a track instrument wherein an induced current is set up by the passage of a car or train over the instrument, a call box, and means controlled by the induced current from the track instrument to set in operation the call box to thereby actuate a signal.

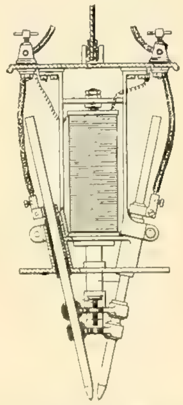
881,009. Make-and-break Igniter for Explosive Engines. Robert H. Koenig, Camden, N. J., assignor to Nicholas A. Petry, Philadelphia, Pa. Application filed January 29, 1907.

The cylinder of the engine carries one of the electrodes of the igniter. A sliding plunger carries the other electrode and is acted upon in one direction by a spring and in the other direction by the pressure in the cylinder. A pressure-actuated circuit opener and closer is likewise carried by the plunger.

881,010. Process for Producing Electric Resistance Bodies. Johann Krannichfeldt, Cologne, Germany. Application filed November 1, 1907.

The process consists in mixing good and bad electric conductors, subjecting the mixture to an electric influence, while in a condition of mobility of particles to establish a definite position of the conducting particles, and then causing the mixture to solidify.

881,015. Electric Arc Lamp. Louis C. H. Mensing, Rugby, England. Application filed February 9, 1905.



NO. 881,015.—ARC LAMP.

A pair of inclined carbon tubes is arranged to contain the carbon points which are engaged by clutches mounted on a bridge that is connected with the core of a central solenoid. (See cut.)

881,017. Heating Device. W. E. H. Morse, Algona, Iowa. Application filed April 25, 1907.

A hemispherical shell contains an incandescent lamp with its axis projecting inward and parallel with the open face of the shell.

881,020. Weighing Scale. Clarence W. McKee, Phoenix, Ariz. Application filed February 28, 1906. Renewed October 5, 1907.

One of the scale arms carries a contact which closes [illegible] when a balance is obtained.

881,031. Safe and Vault, and 881,032, Safe and Vault Construction. William F. Schultz, Cincinnati, Ohio, assignor to the Herring-Hall-Marvin Safe Company, New York, N. Y. Applications filed November 23, 1906.

The vault walls have a backing of insulating material and two independent layers of electrically insulated disks mounted therein, each layer being composed of separated vertical columns, the columns of one layer being staggered with relation to those of the other and the axes of the disks being at substantially right angles to the face of the wall.

881,049. Art of Liberating Aluminum and Other Metals. Henry S. Blackmore, Mount Vernon, N. Y. Application filed October 29, 1904.

The process consists in inducing a reaction between an aluminum methide (Al_4C_3) electrode and aluminum oxide and fluoride, by passing a current through the electrode in communication with the oxide and fluoride, whereby the metal content of the latter is reduced by the concurrent combination of their electro-negative constituents with the anode.

881,055. Electrical Appliance for Protection Against Insects. Alphonse L. M. Chaulin, Paris, France. Application filed June 26, 1906.

A collapsible electrocutor for insects consists of two electrical conducting rings, conducting chains uniting them, a link of insulating material in each of the chains, in combination with means for connecting the rings to the positive and negative poles respectively of a source of electricity.

881,058. Gas-engine Igniter. Albert N. Classon, Rutland Township, LaSalle County, Ill. Application filed April 20, 1906.

An ignition apparatus for internal combustion engines comprises a magneto, a vibrator electrically connected to the magneto and mechanically operated by the rotation of the armature thereof, binding posts oppositely disposed in the path of the vibrator, and a condenser in parallel with the vibrator and binding posts, whereby the vibrator may be positively operated and an alternating current generated.

881,064. Slotting Machine. Walter Favreau, New York, N. Y. Application filed December 27, 1906.

This machine is driven by an electric motor under the table. The motor is connected with the cutters so as to allow it to be moved vertically and thus to permit adjusting the cutters horizontally.

881,087. Electric Insole. Robert A. Stevenson and John T. Story, New York, N. Y., assignors of one-half to the John T. Story & Co., New York, N. Y. Application filed December 14, 1905.

A shoe is provided with an insole carrying two galvanic piles, each of which is composed of a number of positive and negative elements, and means connecting the elements in circuit one with the other.

REISSUES.

12,756. Telephone System. Edward J. Burke, Brooklyn, N. Y. Application filed October 25, 1907. Original No. 853,002, dated May 7, 1907.

Each subscriber's line has a signal lamp arranged to give lights of different character when a connection is wanted and when the conversation is completed.

12,757. Incandescent-lamp Socket. Frank F. Seeley, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed January 22, 1908. Original No. 839,655, dated December 25, 1906.

The socket has a cap provided with oppositely faced angled projections on the inner face of the rim and a tongue provided on its inner face with a beveled catch. The shell is provided with holes suitably placed to receive the angled projections and the beveled catch when the cap and shell are fitted together.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 9, 1908:

447,767. Electric Arc Lamp. H. C. Forganson, Oakland, Cal.
447,768. Combined Annunciator and Telephone System. J. C. Francis, New York, N. Y.
447,788. Electric Switch. J. M. Orford, Bridgeport, and J. C. English, New Haven, Conn.
447,827. Electric Starting Switch. W. Hochhausen, Brooklyn, N. Y.
447,832. Electric-light Fixture. J. Kintz, Ballard Vale, Mass.
447,843. Coupling for Electric Wires. C. M. Knight and T. Hawken, Salem, Mass.
447,858. Induction-preventive for Telephones. T. F. Wright and E. G. Wilson, Chicago, Ill.
447,861. Conduit for Electric Wiring in Buildings. S. Bergmann, New York, N. Y.
447,867. Electric Switch. H. T. Clark, Bridgeport, Conn.
447,894. Electric-light Signal. W. R. McCann and S. S. Creider, Sterling, Ill.
447,896. Insulation of Electric Conductors. F. J. Nash, Brooklyn, N. Y.
447,897. Electric Conductor. F. J. Nash, Brooklyn, N. Y.
447,906. Electric-railway Signal. W. W. Rosenfield, New York, N. Y.
447,918. Automatic Telephone Exchange. A. B. Strowger, Kansas City, Mo.
447,921. Alternating Electric-current Generator. N. Tesla, New York, N. Y.
447,939. Electric Motor. W. H. Chapman, Portland, Me.
447,943. Railway-car Telegraphy. W. S. Cook and M. C. Cook, Omaha, Neb.
447,998. Electric Alarm. G. W. Adams, Boston, Mass.
448,024. Telephone-toll Apparatus. W. Gray, Hartford, Conn.
448,031. Electric-railway Signaling Apparatus. F. L. Hanson, Crookston, Minn.
448,054. Electrode for Arc Lamps. A. C. Seibold, Mount Vernon, N. Y.
448,107. Electric Arc Lamp. LaMotte C. Atwood, St. Louis, Mo.
448,110. Electric Door Opener. L. Bates, Jersey City, N. J.
448,111. Apparatus for Intensifying Electrical Undulations. J. C. Ludwig, San Francisco, Cal.
448,116. Automatic Switchboard and Safety Cut-out for Electric Circuits. L. A. Sweet, Milford, Mass.
448,125. Trolley for Electric Railways. M. J. Wightman, Scranton, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Electrically Operated Labor-saving Appliances in the Federal Building in Chicago.

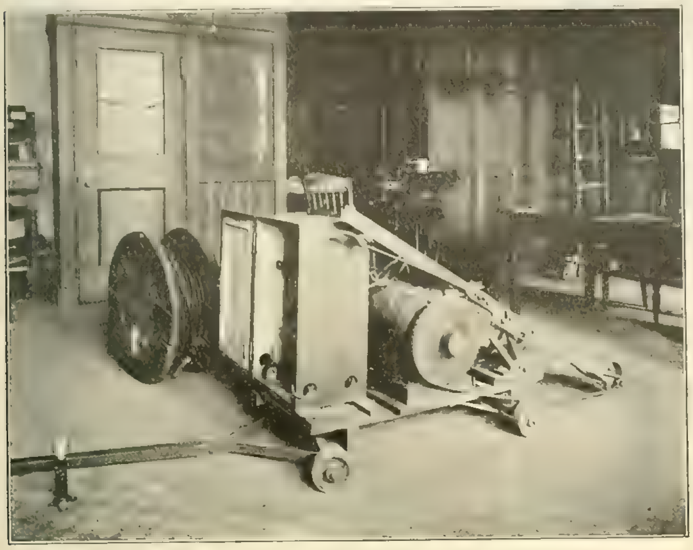
The casual visitor to the Federal Building in Chicago who has seen only the rotunda and corridors of its interior is apt to carry away the impression that the building as a whole is only a luxurious housing for the various government offices in the city. A more complete inspection of the interior reveals, however, that nearly one-half of the floor space of the building is not office room at all, but is taken up with large workrooms, in which so much machinery is used that a person believes he has strayed into the factory of a large commercial concern. This machinery is almost all electrically driven, there being about 180 electric motors ranging from 1-16 horsepower to 35 horsepower in daily use throughout the building.

No department of the national government represented in Chicago comes into such frequent and important contact with the citizens and commercial interests of Chicago and the central West as that of the postoffice. The principal work of this department is done in the workrooms of the Chicago postoffice, taking up almost all the first floor and basement and all of the second floor in the new Federal Building. On an average day about 270 tons of mail are received at the building; on the heaviest day during the year 2,640,000 letters alone were received. The most work in connection with the handling of these vast amounts of mail through a single postoffice [illegible] that of properly sorting and distributing it into [illegible] for the various railroad postoffice and city delivery routes which carry it to its destination. The work necessarily requires a force of hundreds of clerks, as the day when a machine will be able to decipher and classify a multitude of addresses is not yet at hand.

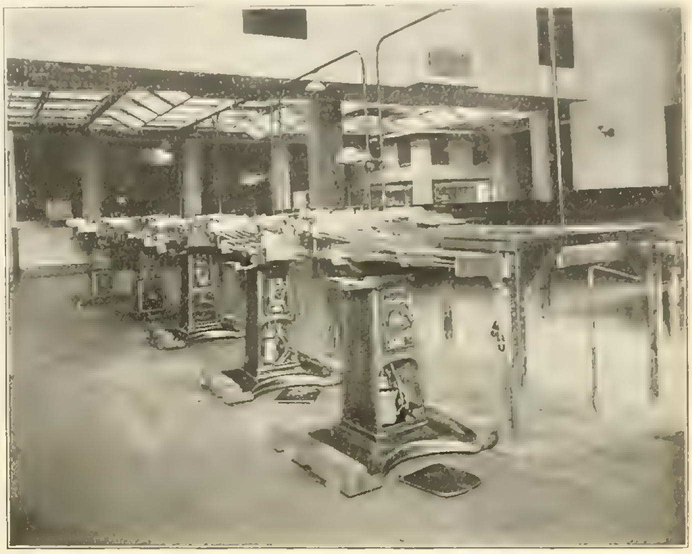
Almost all the other work in connection with the handling of the mail in the postoffice is done by machinery. This includes its carriage from its entry to the building to various groups of clerks and from them to, and in some cases subsequent to, its removal from the building; this alone represents a great saving of labor in trucking and hauling sacks, pouches and bundles of mail. All the counting, stamp canceling and dating of ordinary sizes of mail matter is done by machines in one operation. Throughout, the aim is to avoid the handling of individual pieces by any but the distributing clerks, and thus much time and labor are saved and a greater reliability of service attained.

About 75 per cent. of the mail collected each working day in the downtown district comes in between the hours of 4 to 9 p. m. Collecting wagons traveling on the east and west streets deposit their pouches at the receiving chutes along Dearborn Street, down which they drop to weighing platforms, and are then transferred to motor-driven rubber belt conveyors running under the sidewalk that carry the pouches to vertical bucket conveyors. [illegible] The sacks are automatically thrown from the rubber belt conveyors into the buckets and lifted to the second floor, which is devoted entirely to the mailing division that handles the mail going out of the city. Aside from the mail collected by wagons in the downtown district, much is teamed to the postoffice by the large mail-order houses, which is already partly classified by them. Mail from the railroad depots and from outlying stations of the postoffice is received by pneumatic tubes, electric tunnel cars and street-railway mail cars. The tube and tunnel methods were described in articles in the Western Electrician of July 1, 1905, and March 3, 1906.

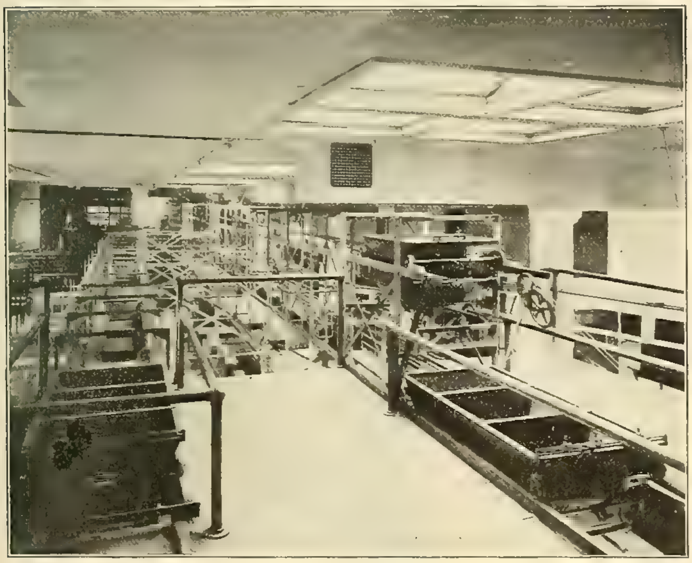
The first-class mail, composed of such letters collected by wagon that have not yet been faced and canceled, is handled by the vertical conveyor in the southeast corner, from which the sacks are dumped to an overhead platform. From this platform a light trestlework is carried over two long parallel rows of sorting and facing tables. Below the trestlework and directly above the tables are long bins, or hoppers, that are used for storing letters until the tables below are cleared. Carried by the trestlework are rails, upon which small steel hopper cars run. Into such a car the contents of



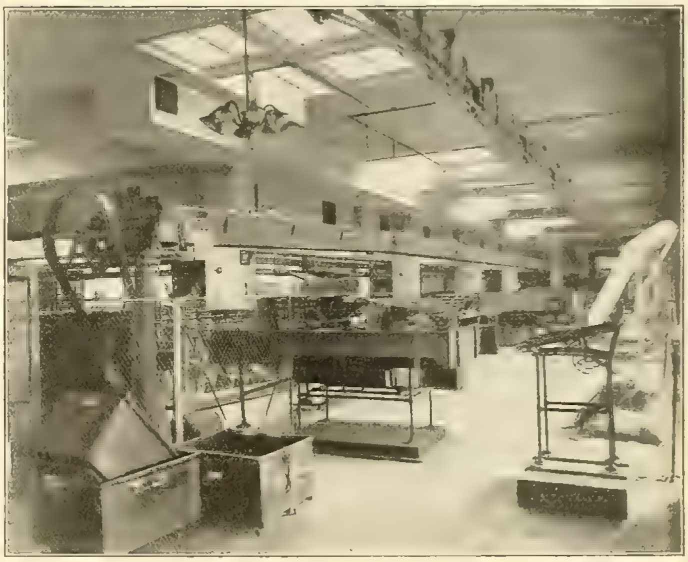
Floor-grooving Machine for Installing Conduit or Cable.



A Group of Electric Canceling Machines in Postoffice.



Conveyors for Delivering First-class Mail.



Belt Conveyor for Tied-up Mail.

ELECTRICALLY OPERATED LABOR-SAVING APPLIANCES IN FEDERAL BUILDING, CHICAGO.

the sacks are emptied and the car run over the bins, into any of which it automatically drops its contents. These cars, as shown in one of the illustrations, have either a single or three compartments, each having a capacity of three sacks of letter mail. They are run by a cable which is motor-driven. The three-section car can discharge its compartments into the same or separate bins as desired. When the load is dropped the car automatically returns and closes its bottom.

In this main facing and stamping section there are seven steel tables, each 17 by 5 feet. In the front of each table are spaces for eight men side by side. In front of each man is a pocket into which he faces the letters, i. e., turns the face of the letters toward him with the stamps in the lower left-hand corners. This is necessary to pass the letters through the canceling machines properly and also saves subsequent turning of each letter in classifying. These men also separate the larger sizes of letters into a separate pocket and pick out special-delivery letters, bulky letters and such as would damage either their contents or the machine in being cancelled in the regular way; all these receive special treatment. The pockets into which the letters are faced connect into two channels which run along the front edge of the table. The bottom of the pockets and channels is formed of a continuous rubber belt four inches wide, running along the edge of the table and carrying the letters on edge toward the table end, where they are forced through a stacking device consisting of a series of rubber-faced rollers and separators. This belt is electrically driven.

From the stacking device the letters are passed through the cancelling machine adjoining. Each of these machines can handle 400 to 500 letters per hour. Nineteen of them are in use in the Chicago postoffice, 17 on the second floor and two on the main floor. A group of five machines is shown at a table used for handling circular mail. Each machine has a small electric motor mounted in its base. The machines are mounted on casters so they can be moved to any place desired. The machines cancel the stamp, affix the date and time and count the letters as they pass through. Some were built by the International Postal Supply Company of New York and others by the B. F. Cummins Company of Chicago. A description of their details would itself make an interesting article.

A basket pick-up conveyor is used extensively in the postoffice, especially in the city delivery division on the first floor. A cable is stretched wherever desired, over and near tables, desks, sorting cases, wherever it may be necessary to send certain letters or small parcels. To this cable is fastened by gripping devices a series of wire baskets, each having an overhanging brush attached to its side. Small station shelves are placed wherever desired directly under the cable, and on these the letters or par- [illegible] traveling under the cable passes under each shelf, brushing whatever may be thereon into the basket. When the basket reaches its desired destination the bottom opens automatically, dropping its load into a receptacle, after which it closes again and continues on its course. In this way special delivery letters receive immediate attention.

The faced and canceled letters in the mailing division are handled by a series of tray conveyors consisting of three endless belts traversing three sides of a square, or nearly 1,000 feet in distance. These belts run over a 10-inch pulley at each end and are supported on wooden idler pulleys at intervals of 30 inches, thus giving a very even surface for the belt. These pulleys are suspended by a framework from the ceiling. A four-inch wood curb is placed on each side of the belts, and in this curbing are cut openings for the loading and discharge stations, of which there are nine. The belts run at right angles to each other, which makes it necessary to provide means for transferring the trays from one belt to another; this is done by a series of rollers placed at the angle formed by two belts, each tray being deflected from the belt to the rollers, which discharge the tray to the next belt. The trays are pan-shaped, 30 by 7½ inches and 5 inches deep at the head end, tapering to three inches at the tail; they are of tin and hold from 500 to 700 ordinary letters. To the front of each tray is attached an adjustable finger extending about 1½ inches above the top of the tray. This finger is placed in one of a series of notches. At each station is a deflecting rod placed over the belt so that loaded trays can pass beneath. These rods are mounted at various distances from the side of the belt to correspond with the numbered notches on the front of the trays. Thus a tray destined for station No. 4 will pass No. 3 because deflecting rod No. 4 projects one-half inch farther over the belt than that of No. 3. The loaded trays are carried on the lower belt and empties are returned on the upper one. These conveyors, as shown in one of the illustrations of a corner, are motor-driven. They carry the letters to the distributing tables.

DRIVING MECHANISM FOR OVERHEAD TRACK CONVEYOR FOR SECOND-CLASS MAIL, CHICAGO POSTOFFICE.

Another conveyor that is of interest is the sack or bag conveyor which is used for carrying sacks of mail from the point where they arrive on the second floor to any desired section thereof, where their classification, already completed by states, may be carried further. A steel framework suspended from the ceiling surrounds the edge of the entire floor, a distance of nearly 1,300 feet. On this runs a steel cable to which are attached 125 bag carriers about 10 feet apart. Each carrier is a small cast-iron trolley running on four wheels in a double channel connected with the steel framework referred to above. From the center of each of these little cars is suspended a collapsible hook held in place by a vertical sliding rod. Each sack is placed in a rope sling with a looped end which is thrown over the hook. The carrier is then automatically set on any desired number and is released only when its finger comes in contact with the release finger at the corresponding station. This release is somewhat similar to the deflecting system described for the tray conveyor.

The driving mechanism for this conveyor is in duplicate, as shown in one of the illustrations. A 7½-horsepower motor drives a sprocket, over which runs a link belt carrying about 150 steel grips which are so constructed that they grasp the cable at a certain point, and after dragging it along about 25 feet they release the cable and return over two idler sprocket wheels. No bags are carried along the south side of the room; at the southwest corner there is placed an automatic device which would cut off power from the driving motor should any bag be carried beyond this point.

A conveyor of novel type has been installed recently to lift boxes of first-class mail from the letter drops in the rotunda to the second floor. This is a vertical lift device called a finger-tray conveyor. The boxes are much larger than those in the tray conveyor already described. An endless link belt has fingers normally extending at right angles upon which the boxes are placed. They are removed by coming in contact with a set of inclined stationary fingers spaced between the moving ones. The driving motor is mounted on a pedestal adjacent the top of the conveyor. This conveyor was installed by the Weir & Craig Manufacturing Company of Chicago. Almost all the other conveyors were made specially for this service in accordance with the ideas of the postoffice officials by the Lamson Consolidated Store Service Company.

Among the special tools devised by men in the government service in Chicago is a portable motor-driven blowing machine used for blowing dust out of the cancelling machines and a portable automatic starter used in connection with 7½ or 10-horsepower motor pumping outfits. A special machine is being built for cleaning the large number of Holophane lamp shades, globes and reflectors used in the building. Some 12,000 of these are installed, the cleaning of which required the labor of one man for seven months to make the rounds. By means of the new machine, which is built on the principle of dishwashing machines, it is expected to make the rounds once a month.

A machine of special interest to wiremen is a

DELIVERY STATION FOR SECOND-CLASS MAIL IN CHICAGO POSTOFFICE.

floor-grooving machine perfected by William A. Richardson, chief electrician of the building. It is used to run floor connections to desks and tables in the various offices. These have had to be shifted occasionally; to avoid considerable overhead conduit work in making these changes this machine was devised to cut the necessary channels in the floor. A two-horsepower, 220-volt motor running at 310 revolutions per minute drives a milling cutter at 2,400 revolutions per minute. This cutter makes a smooth uniform groove through any kind of wood and cuts through nails and screws as well. Lead-covered cable is laid in the groove connecting the floor boxes with the condulet outlets under the desks. The groove is then covered with an oak strip which is glued and toenailed into place. The surface is dressed with a planing cutter, replacing the one used in grooving. Linoleum carpet is then laid over the whole floor. One of the illustrations on page 225 shows the machine and one of the new outlets.

Neutralizing Inductive Disturbances in Telegraph Lines.

The introduction of single-phase electric railways has caused trouble in the operation of many adjoining telegraph lines, due to inductive disturbances set up in the latter interfering with the normal operation of the relays or other receiving instruments. To overcome these effects an interesting system has been invented by Edward Blakeney of Ossining, N. Y., and Robert E. Chetwood, Jr., of Elizabeth, N. J., and the patent on this method has been assigned to the American Telephone and Telegraph Company.

To understand the conditions it is necessary to consider that the ordinary telegraph system is one in which the relays are operated by the presence or absence of direct current. In other words, it is organized for operation by the normal slowly recurring current impulses of standard Morse signals manually transmitted. If the line has near it a conductor through which passes an alternating current, a similar current will be induced in the telegraph line which will be superposed upon the operating current. A class of alternating current which is at the present time often encountered is that of single-phase and of comparatively low frequency, yet high relatively to Morse transmission, say 25 cycles per second, which is employed for power transmission and some railway work. The electromotive forces producing such currents are usually extremely high, and of course change abruptly from their maximum value to zero, giving powerful inductive effects, yet the frequency is not so great but that the armatures of the relays can follow the alternations induced in the line. As a result the operating current assumes such an undulatory character that the signals are distorted and confused by the vibration of the armatures. To exclude the alternating current from the telegraphic receiving elements and thus prevent this disturbance and to provide a system by which signals may be effectively transmitted and received without interference or confusion are the principal objects of the invention.

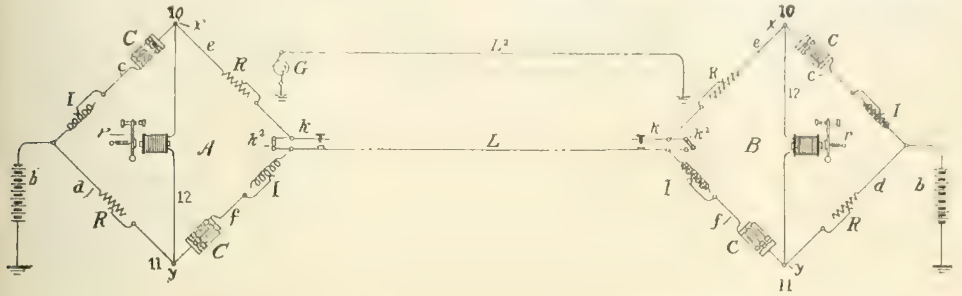
It consists in a means for furnishing separate paths for and confining thereto currents of diverse characteristics. The system herein described is in the form of a Wheatstone bridge circuit, with which the receiving element is associated and which excludes alternating current from the receiving element by virtue of the establishment of a condition of equipotential at the extremities of a bridge or cross conductor in which it is placed, while the bridge is thrown out of equilibrium for operating currents and made a portion of their exclusive path by the presence of inductive devices in a portion of the branches of the balance circuit to which telegraph currents are relatively impassable.

Referring to the accompanying diagram, telegraph stations (A) and (B) are provided with sending and receiving elements (k) and (r), respectively, and between which extends the line conductor (L). This conductor is shown as grounded at its extremities to complete the main circuit, though obviously a complete metallic circuit could be substituted if desired. The circuit contains batteries (b) or other suitable sources of operating current.

Situated in such proximity to the line as to act inductively upon it is shown a conductor (L^2), constituting, for example, a portion of a railway circuit that carries an alternating current flowing from a generator (G), which is of such periodicity that a disturbance will be produced in the telegraph line prejudicial to its operation.

To nullify the effect of these parasitic or disturbing currents and to prevent the receiving instruments (r), which are shown in the drawing as relays, from being affected thereby, the line (L) is divided at each station, there being two conductors (10) and (11) connected in parallel to form a section or extension of the main circuit. These parallel branches of the line are separated into portions (c), (d), (e) and (f) by a bridge conductor (12) connecting the points (x) and (y) in the branch conductors, and in this bridge conductor of each station is connected its relay (r).

It will be seen that each of the station circuits is arranged in the manner of a Wheatstone bridge, the portions (c), (d), (e), (f) of the conductors (10) and (11) forming the four sides, while the conductor (12) provides the cross-wire or bridge. As is well known, when the fall of potential in, say, the side (c) of the balance is to that in the side (e) as the fall in the side (d) is to that in the side (f), the points (x) and (y) will be at equal potential and therefore no current will flow through the bridge path. Therefore, to nullify the disturbing effect of the energy existing in the conductor (L^2), while still permitting telegraphic operation, it is only necessary to secure equality of potential for alternating currents, while for direct currents the bridge is unbalanced. This result may be attained by so adjusting the



NEUTRALIZING INDUCTIVE DISTURBANCES IN TELEGRAPH LINES.

impedance of each side that with reference thereto the equation $\frac{c}{d} = \frac{e}{f}$ will be satisfied, and by employing in the conductors (10) and (11) at opposite sides of the bridge reactive devices such as condensers which are impassible to direct currents while permissive to alternating currents, and including in the companion sides impedance devices allowing currents of both characteristics to pass. In each of the sides (c) and (f) of the balance circuit are shown coils (I) possessing both resistance and inductance, this being preferably adjustable, and in series with the coils (I) in diagonally opposite portions of the parallel branches are condensers (C) which are shown as being of variable capacity. In each of the arms (d) and (e) is a suitable resistance (R), also preferably adjustable.

When the impedance in the various sides is balanced in the manner previously stated, the bridge (12) will be neutral to the induced alternating currents, which will flow through both the parallel branch conductors, passing inductively through the condensers, and to ground through the battery, thus leaving the relays unaffected. But upon making and breaking the main circuit by means of one of the keys the impulses will pass through the line, and since the condensers are conductively discontinuous for, or are impassable to, direct, slow-changing currents, the circuit is unbalanced as far as these are concerned, and they flow exclusively through the sides (d) and (e) and the bridge connection, these constituting the sole conducting path through the bridge circuit, and operate the relays in the usual manner.

In balancing the circuit the frequency of the disturbing current should be considered, and, as this is liable to vary, such values of resistance, inductance and capacity should be chosen as will not greatly disturb its equilibrium if slight changes in frequency occur. This may be determined experimentally, or mathematically, until such values are found that the impedance will vary but little for the expected fluctuation in the frequency. In any event, the resistance in the sides (d) and (e) should be kept as low as possible to avoid cutting down the operating currents they carry. Also, if such devices for any specific case are not unduly large, air-core coils preferably should be used in the sides (c) and (f), as is illustrated at station (A), since their inductance is reasonably constant within a wide range of practical conditions, and with non-inductive resistance in the arms (d) and (e) the circuit would remain substantially balanced for any particular frequency, regardless of the magnitude of the induced current. It may be found, however, that to secure the necessary inductance air-core coils are too cumbersome, and in such case those having iron cores may be employed, as is shown at station (B).

There are four portions of the circuit in which each of the keys (k) may be placed to effect the transmission of signals—in the bridge (12), in the line outside the balance circuit, or in either one of the sides (d) or (e) which the operating currents traverse. If located in the first-named position, the key is shunted by two circuits of large capacity furnished by the arms (c d) and (e f), respectively, so that, although the relay of the sending operator may respond properly, that of the distant station will be sluggish. With the key in the line, if the [illegible] by the line batteries, and upon closure is discharged, giving a strong current impulse, which [illegible] the line current. In connection with each of the keys is shown the usual circuit closer or switch (k^2), by which the continuity of the circuit may be preserved when the operators are not transmitting. The switch at the station (B) appears as open, or in the position for transmission.

Modern Tilting Tower for Railroad Cars.

By [illegible]

It is a useful endeavor of modern times to lessen human labor, among other directions in the loading and unloading of vehicles, particularly railroad cars. Apparatus for this service has been built in the shape of cranes, conveyors, etc., and recently huge structures have been invented to tilt whole railroad cars.

The picture accompanying this article shows such a tilter which presents several novel features. The tower was erected recently at Cosel, a German inland port, and executed by a large firm in Germany. The main feature is that the platform with the cars to be unloaded can be moved up and down to adapt itself to the water level. The latter varies considerably—5.45 meters—and the buyer made the condition that brittle material, such as coal, should be unloaded without being crushed.

The movement is effected by lowering that part of the platform which is above the water, or by elevating the opposite part, or by doing both. This is all done electrically in an ingenious way. If, for

ELECTRIC RAILROAD-CAR TILTER.

instance, at low level coal is to be emptied into the ship, an electric mechanism is started which lowers the waterside portion of the platform to bring it near the boat, while at high level an electric hoist elevates the landside portion. At any intermediate level both motors are at work, so that the distance from the ships to the chute is always the same. At the same time the platform is in an inclined position of 45 degrees. The dead loads of the latter and the guides are counterbalanced by weights, as shown in the picture.

Another interesting feature is that the tiresome, slow method of pushing the cars to and from the platform is avoided. This is here done also electrically. When a car arrives loaded it is first drawn by an electric motor upon a turntable, then turned 90 degrees and pulled upon the platform. The car is then locked by clamps automatically fastening the front axle. Next the platform is tilted and the coal falls into a big funnel-shaped tank. This is closed by a door which is also operated electrically from the engineer's seat. The

perator may let pass a greater or smaller quantity of coal by changing the width of the opening. When the car is emptied the platform is tilted back and the car pushed upon the turntable and then upon a side track.

Several of the details are patented in various countries. The apparatus has only been in use a few weeks and has worked very satisfactorily. It is particularly useful, owing to the extensive use of electricity. Thus it can be started at any moment and by its use much time and labor are saved.

Alternators in Parallel.[1]

By Morgan Brooks.

The successful operation of alternators in parallel depends upon a combination of favoring circumstances more or less under control. A consideration of the influence and relative importance of some of these circumstances is the object of this paper. Synchronous motors or converters operated by generators from a distance are, in fact, in parallel with these generators, and conditions of such motor operation will be included.

When two similar shunt-wound direct-current machines are running in parallel, and the driving power of one machine fails, that machine tends to slow down, as would be expected. As soon, however, as its induced electromotive force is thereby decreased enough to permit current to flow back through it from the other generator it becomes a

synchroscope. Indeed, if we represent the vectors in opposition, as shown in some text-books, how can three or four machines in parallel be represented? If now we assume that a paralleling switch is closed when the vectors are nearly in phase as represented in Fig. 4, the vector-difference voltage AB, properly E, the electromotive force of the local circuit, acts to drive current through the impedance of the local circuit. Whether this vector-difference E should be indicated with its direction toward (B) or toward (A) depends on the point of view. With regard to (A), its positive direction is BA; while with reference to (B), its positive direction is AB. Fig. 4 shows arrows at both ends to indicate this. Now BA drives a current, shown at (I_A) lagging by a definite angle Θ dependent on the impedance of the local circuit. Cosine Θ is the proper power factor of the local circuit of the two machines. This current is nearly in phase with OA, the electromotive force of machine (A). This indicates generator action, and there is a load upon machine (A), due to this circulating current. Viewed from the machine (B), the active electromotive force AB furnishes the same current, represented this time as (I_B) lagging Θ degrees behind AB, which current is nearly in opposition to vector OB, showing that machine (B) is momentarily a motor whose speed will be accelerated. That is, the generator action on (A) and the motor action on (B) both conspire to bring the machines together in vector position. In passing through identical phase position at equal excitation the action passes through zero, meaning that no synchronizing action holds the machines together,

current to vectors OA and OB), the chart, Fig. 8, has been drawn by a method explained in detail in a paper, "Interaction of Synchronous Machines," proceedings A. I. E. E., June 25, 1907. The heavy circle (OAV) is the locus of (B) of vector OB when there is no transfer of power to machine (B). For any position of (B) in this circle a current lagging Θ degrees behind AB will necessarily be at 90 degrees from OB, and hence cosine b will equal zero. The current sent out by the generator (A) is all consumed in I^2R losses. For positions of (B) within the circle, such as (B), power is received by machine (B) in proportion to its distances from the circumference, the maximum power occurring when the vector falls at (C), the center, at an efficiency of 50 per cent. Positions within the upper part of the circle above diameter (OCV) are stable running positions, below that diameter unstable, since here the slightest increase in load tending to make the machine (B) fall behind drives it into a position of less power intake.

Positions of vector OB without the reference circle show a reversed function of (B), which then becomes a generator with respect to (A) as motor, although there is the restricted space lying between the reference circle and its tangent at (A), where both machines are generators, machine (A) not changing from generator to motor until (B) takes a position to the left of the tangent through point (A). Where it is desired to consider two or more machines as motors, points within the circle are required for vectors, vector OA representing the single generator or the combined result of all generators. Where it is desired to consider two or more generators in parallel, points without

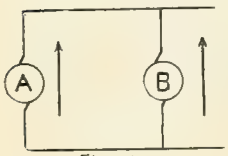


Fig 1

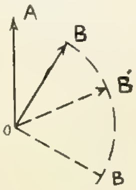


Fig 2

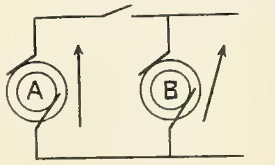


Fig. 3

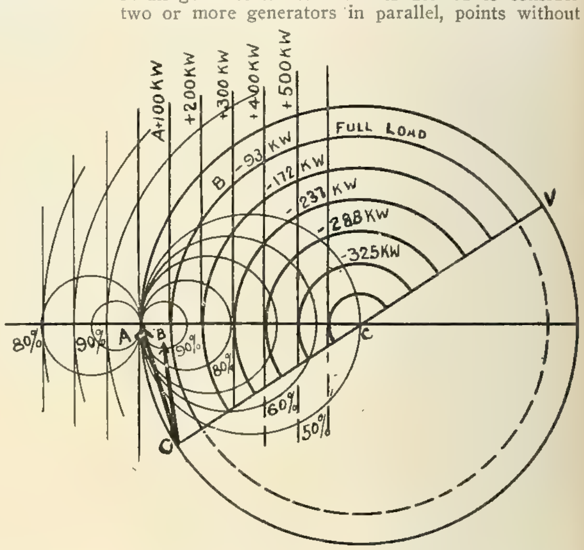


Fig. 8.

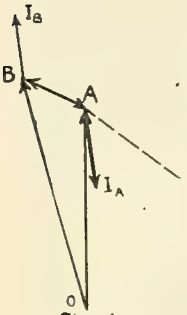


Fig. 4

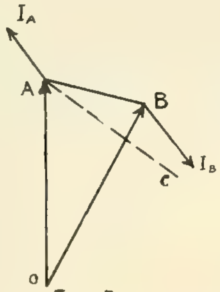


Fig. 5

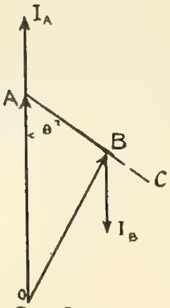


Fig. 6

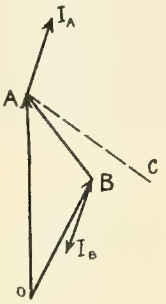


Fig 7

ALTERNATORS IN PARALLEL.

motor, and continues to run without much apparent change. In a somewhat similar way in the case of two alternators in parallel, if the driving power of one machine fails, it tends to slow down, but as soon as its vector position with reference to the generator falls behind a mere fraction of a cycle, current can flow backward, making it a motor, even without any reduction whatever of its induced electromotive force. It then continues to run as a motor and at synchronous speed. The tendency to slow down in this case results immediately in a lagging position, but the machine is held in step, dragged along by the current it receives. The actual change in vector position is often very slight, a matter, say, of two degrees electrical, that is, only one-half degree actual in an eight-pole machine. The change is so slight it is hard to realize that such change marks the difference between generator and motor action of the same machine.

For the interpretation of these facts, as well as the presentation of other interesting features, the chart shown in Fig. 8 has been prepared. This chart is derived as follows: Fig. 1 represents two direct-current machines (A) and (B). the vectors representing induced electromotive forces. If (A) is generator and (B) is motor, current will flow with vector A and against vector B in the closed [illegible] two alternating-current machines (A) and (B) not connected in circuit. The vectors may have any possible relation, as [illegible] Fig. 2, which represents the relative positions of any two alternators (A) and [illegible]

[illegible] clockwise at approximately synchronous speed, vec- [illegible] we can only catch a glimpse of the vectors at the moment when A is in the vertical position shown, [illegible]

[1] [illegible] Illinois.

but that such action operates as soon as the machines separate to prevent their falling apart. It is a sort of elastic coupling whose force increases with angular separation. The force action becomes enormous at small vector angles, and synchronous machines cannot be pulled out of step without very great strain.

It will be noticed that since the current vector always lags by angle Θ degrees behind the resultant electromotive force E, the terminal (B) of machine vector OB must lie along a line (AC), Fig. 6, making angle Θ with AO to produce a circulating current in phase with OA. In synchronous motor operation, proper excitation to produce this result is known as "normal" excitation, and gives what is known as unity power factor. Any greater excitation will produce a current which leads vector OA, Fig. 5, any less excitation a current which lags behind OA, Fig. 7. When the current leads or lags, the power factor is properly denoted as cosine a, and should not be confused with cosine Θ, the legitimate power factor of the local circuit, which tells the current relation to resultant E, the vector-difference between OA and OB. The difficulty in recognizing this cosine Θ power factor lies in the fact that AB has no visible existence immediately the switch is closed between the machines in parallel operation, and as between generator and its motor in a distant station the electromotive force is difficult to measure. Nevertheless, a vector difference may exist, even if not accompanied by a voltage difference that can be measured. That this vector difference is a fact is evident from a consideration of the oscillating vector positions, due to hunting, causing surges of current to flow forward and back between the machines, rapidly changing their function from generator to motor and back again. The diagram, Fig. 4, is the representation of the relation between voltages as would exist at the moment of switch closing or of switch opening if that were [illegible]

From the vector equations of the machines (A) and (B), [illegible] and OB [illegible] indicate the relation of

the reference circle show such generators, where OA represents the entire load.

The circle within and without the reference circle marked "full load" is estimated and is to be taken as illustrative rather than as absolute. The angle Θ taken at 74 degrees in Fig. 8 is intended to illustrate normal condition of parallel operation proper. This angle is often given as 90 degrees in popular texts, but cannot greatly exceed 75 degrees in actual practice, and comes down to 60 degrees probably on ordinary transmission lines.

The chart is calculated for assumed values of resistance and reactance as follows:

R, resistance of alternator or motor, $= 0.7$ ohm.
X, reactance of alternator or motor, $= 2.4$ ohms.
Z, impedance of alternator or motor, $= 2.5$ ohms.

When power transmission is considered, the constants r and x of the circuit are included. R and x are not precise constants, but are assumed at such values as give reasonably simple calculations. Since the lag angle of the current I, behind the resultant electromotive force E, is determined by these constants, we find that tangent Θ $X \div R = 3.43$, showing $\Theta = 74$ degrees.

Similar charts could be readily made for any given conditions, either measured or assumed. The results do not include all the conditions of the problem, which is exceedingly complex, and yet they will serve to indicate what may be expected under operating conditions with some certainty.

Vector A is taken as fixed, meaning that the terminal voltage of this machine is constant at 1,000 volts. Vector B is viewed, however, as the induced voltage of that machine. Any variation of voltage is considered as existing entirely in the B vectors. Positions of (B) within the reference circle are motor positions, and loci for definite loads are circles concentric with the reference circle, whose circumference is the locus for zero power delivered. The locus marked full load is based on 100 amperes of current at maximum efficiency; with over or under-excitation of the motor, full load will require more than 100 amperes. With transmission line included, full load again means 100 amperes of current at maximum efficiency for

this case, which is nece[illegible]arily l[illegible] than under [illegible] circuit conditions.

[illegible]

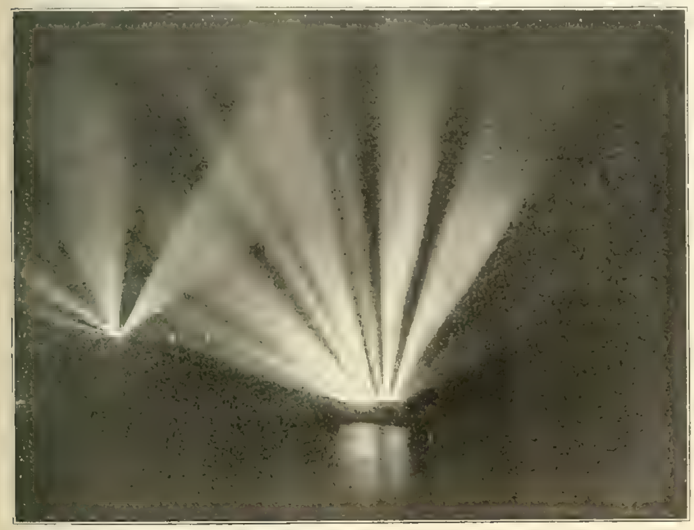
The circles, Fig. 8, marked 60 per cent., 70 per cent., 80 per cent., 90 per cent. efficiency are interesting loci of (B), showing that in general a motor [illegible] ciency but at different excitations. When, however, the excitation for a given load is "normal," as previously defined, the efficiency is a maximum for that load. It is observed that the use of a converter "over excited" to balance other inductive loads is necessarily at a lower efficiency, and since the power and efficiency loci separate at a rapidly increasing rate with departure from the line (AC) of normal excitation, great departure from that line is at considerable loss of efficiency. Taking all conditions into consideration it is probably best not to attempt to raise the power factor to complete unity where induction motors are used on the same transmission line. The highest combined efficiency will generally be obtained by raising the power factor to perhaps 95 per cent., retaining a fairly good efficiency for the synchronous motor not too much over-excited.

[*Continued on page 232.*]

Searchlight Illumination at Niagara Falls.

During the month of September, 1907, the cataracts and surroundings at Niagara Falls were most impressively illuminated by searchlights. Reference to the spectacle was made in the Western Electrician at the time. Later a series of excellent photographs of the illumination and of the apparatus used was made, and when these pictures were exhibited at the Chicago Electrical Show of last January they attracted much attention. Four of these photographs are reproduced herewith.

Copyright, 1907, by B. H. Norris.
THE "AURORA" (DIVERGED) FROM THE MAID OF THE MIST LANDING.



Copyright, 1907, by B. H. Norris.
THE "AURORA" FROM PROSPECT POINT, NIAGARA FALLS.

Copyright, 1907, by B. H. Norris.
THE AMERICAN AND BRIDAL VEIL FALLS ILLUMINATED.

The projectors were installed on the Canadian side, and located in three batteries.

Battery No. 1 comprised 11 30-inch and 10 18-inch projectors installed on a platform 250 feet long, located in the Gorge at a point midway between the American and Horseshoe Falls, 20 feet above the water's edge, and approximately 1,200 feet from the center of Goat Island.

Battery No. 2 consisted of four 30-inch projectors placed on what is known as the "spillway" of the Ontario Power Company, approximately 3,500 feet from the American Falls. These two batteries received current from a 300-kilowatt motor-generator set installed on a steel car stationed near battery No. 1. The generator delivered 110 volts, and was driven by a 500-volt motor, taking current from the trolley circuit.

Battery No. 3 was made up of 11 18-inch projectors located in Victoria Park, about 1,500 feet from the center of the American Falls. The projectors at this point were arranged for series operation, and obtained current directly from the trolley circuit.

The lighting effects were controlled from Battery No. 1, which was connected by telephone to the generator car and smaller batteries. The subdivision into three batteries was for the purpose of securing a wide sweep over both the cataracts, with a rising and a plunging light.

Very good results were obtained, particularly on the American Falls. It was not possible, however, properly to illuminate both Falls simultaneously. Under normal conditions, approximately 50 per cent. of the light was scattered or absorbed by the mist, and it was rarely that any discomfort was experienced in looking directly into a 30-inch projector from Prospect Point, which was not over 2,500 feet distant. On one occasion, for a period of 15 minutes, the light was completely shut out by the mist and rain, so that neither the Falls nor the light beams were visible. With this element to contend with, in conjunction with the large area over which it is necessary to distribute the light, one can readily appreciate why a battery of searchlights giving approximately 2,000,000 candlepower, [illegible] the experiment, will be necessary properly to illumi[illegible]

Mr. W. D'A. Ryan, illuminating engineer for [illegible] use of white light. On this point, however, there appeared to be considerable difference of opinion. There appears to be no question that the introduction of soft clear colors through suitable screens did not detract from the beauty of the Falls, but lent a pleasing variety of effects which appeared to be greatly admired and appreciated by the thousands of people who thronged the parks on both sides of the river every evening. An additional variation was introduced by noiselessly exploding loose giant powder in front of the main battery. This formed a blanket of pure white smoke, appearing as a cloud into which the colors were introduced. The sunset effects thereby produced in the water were beautiful beyond description.

Copyright, 1907, by B. H. Norris.
THE GORGE BATTERY OF SEARCHLIGHTS AT NIAGARA FALLS.

So pleasing were the results, as well as successful from a purely commercial point of view, that arrangements are being made to complete a permanent and larger installation, which is expected to be in operation early next summer.

A writer in the New York Evening Post gives this description of the spectacle:

"Perhaps the most complimentary thing that can be said of the spectacle is that it was witnessed in dead silence. From all those thousands there was no acclaim, no suggestion of a cheer. They simply gazed and wondered and admired, speechless. The roar of the Falls was the only accompaniment for the show.

"In the beginning all the power of the 36 searchlights was concentrated upon the American Falls and the Bridal Veil. No color showed at first, and nothing could be a purer white than that huge wall of foam plunging 157 feet down the face of rock. Between the Big Falls and the smaller cascade to the right, known as the Bridal Veil, the naked rock stood out gray and grim, with every crevice revealed by the fearful glare to the watchers across the river.

"Then a broad band of the white foam suddenly turned to red, with a rose-tinted cloud of mist above it, mingling with the white vapor. Gradually the red rays suffused the whirlpool below, and then their light made its way up the river, against the rush of water, and climbed into the smo.her of the Horseshoe.

"Somebody said 'a river of blood,' but the remark wasn't as obvious as it might seem to have been. The effect was too beautiful to suggest anything horrible.

"Green, orange, blue and violet tints followed, and then all were blended. A score of rainbows spanned the river at the same time, shifting their arcs and changing their combinations of color as the rays were turned from one cloud of mist to another.

"And, finally, when the batteres were turned from the American to the Canadian Falls, huge vertical prisms of light stalked along the heights, illuminating a dense growth of woodland, and appearing as so many ghosts among the trees."

WESTERN ELECTRICIAN

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[illegible] Mr. [illegible] made an interesting statement in relation to continuity [illegible] result of practical experience, but which will not be surprising to those familiar with the phenomena of Hertzian waves. He said that there are certain periods, fortunately of short duration, when transmission across the Atlantic is somewhat difficult, and at times ineffective, unless an amount of energy greater than that used at normal times is employed. These periods come in the morning and the evening, when, owing to differences of longitude, daylight or darkness extends only part way across the Atlantic. Just why darkness should make a difference in the efficiency of radio-telegraphy is not known, but it is a fact that meteorological conditions have much to do with the successful transmission of wireless messages.

Mr. Marconi asserted that, despite all difficulties and delays, wireless communication across the Atlantic has never been interrupted for more than a few hours at a time since the beginning of commercial work on October 17th last. In a few months, he added, much greater speed and efficiency are likely to be attained.

THE WIDELY ADVERTISED "cold motor" of the Bidwells made a sorry showing in court when subjected to the criticism of competent electrical engineers. It was shown that even if practicable, which is doubtful, such a motor would not be economical. The defendants were found guilty of working a "confidence game," and the elder Bidwell made a vigorous and dramatic statement of his case to a reporter which is quoted elsewhere. The money secured from the misguided investors in the "cold motor" was obtained as a result of sensational advertisements in the daily newspapers. Reputable newspapers should not accept "get-rich-quick" advertisements of this character, and some of them do not. Where electrical principles are involved in these schemes prospective investors may save themselves money by consulting an electrical engineer of recognized standing before responding to alluring prospects held out by daily-newspaper "ads."

TOO DRASTIC regulations required in the installation of electrical apparatus defeat their own ends. Everyone desires to see all reasonable safeguards thrown about the employment of electric power, but there is a common-sense limit appealing to fair-minded men beyond which owners and contractors should not be expected to go. The use of electricity should not be penalized, but simply made safe. In the case of the new regulations of the Factory Acts in England the limit of good judgment seems to have been passed, and the whole subject is now under inquiry by Mr. James Swinburne, acting for the Home Office. In an account printed this week our London correspondent shows that a storm of protest from electrical men in England has arisen over rather extreme requirements relating to switchboards and motors. The remonstrants seem to have justice on their side, and we trust that their representations will have the effect of modifying the law.

ONE OF THE SUBJECTS which will undoubtedly be brought up at the annual meeting of the Electrical Committee of the Underwriters' National Electric Association in New York next week will be the recodification of the National Electrical Code. The subject was referred to a committee at the meeting in March, 1907, and the recommendation of the committee, now made public, is that it be continued with authority to revise the Code in certain respects as to arrangement, but not to change the present Code requirements, and that it report at the meeting of March, 1909, so that if its detailed plan is acceptable, the new arrangement may go into effect with the 1909 edition of the Code. The plan is to simplify the Code by printing separately the "Class D" rules, relating to specifications for fittings, materials and details of construction; the elimination of cross-references where feasible by repeating the requirement to which reference is made; eliminating both bold-face and fine-print rules as far as possible, and printing all mandatory rules in the body type, using the fine type only for suggestions.

These recommendations are based on good sense, and the electrical committee may well adopt them. The National Electrical Code is the result of growth, revisions and accretions. In its present [illegible] 1907) it consists of over 140 pages of rules, some in body type, some in fine type and some in bold-face type, with a somewhat complicated typographical arrangement. The whole presents a rather complex and forbidding appearance, well calculated to dismay the uninitiated person who for the first time goes to the Code as his guide and mentor. Any movement to simplify the presentation of this indispensable collection of rules and regulations is to be welcomed.

A RAILWAY RIDE of twenty miles for five cents is certainly cheap enough for the most exacting. That is at the rate of one-quarter of a cent a mile, and if applied to the railroad fare between Chicago and New York would make a ticket cost $2.50. Such a ride is now possible in Chicago by reason of the through routing of cars, which is a phase of the street-railway rehabilitation. A passenger may take a Wentworth Avenue car at the Seventy-ninth Street terminus on the South Side, and ride north without change through the downtown business district to Howard Avenue at the northern limits of the city for a single nickel fare. The distance is about twenty miles, and nearly two hours is consumed in making the trip. Of course, few persons will have need to make the whole length of the journey, which must be a trifle tedious, but the through cars will be a convenience in many respects, besides doing away with the time-consuming loops in the central downtown area, and they illustrate the cheapness of urban transportation made possible by the use of electric power.

MR. FERGUSON'S nomination for the presidency of the American Institute of Electrical Engineers by the board of directors of that organization will be especially pleasing to western electrical men in general, to those interested in the central-station industry and to the candidate's personal friends, of whom there are a large number, East and West. Including the man who goes into office this year, the Institute will have had 21 presidents in its history of 24 years. Rather curiously, if elected, Mr. Ferguson will be the second western man and the second central-station man to be so honored. His predecessor in the first distinction was Mr. Bion J. Arnold of Chicago and in the second Mr. John W. Lieb, Jr., of New York. It is apparent that neither the West nor the electric-lighting and power industry has been unduly favored in the distribution of the highest office in the gift of the Institute. This fact, coupled with Mr. Ferguson's high standing in the profession and his personal popularity, should make the choice of the directors, which is based on the nominations of members, one in which all interested in the Institute will concur with pleasure and satisfaction.

DR. COLEMAN SELLERS, whose death was recently noticed, is the subject of a tribute in the March Proceedings of the American Institute of Electrical Engineers which does credit both to him and to the writer of the memoir, Mr. L. B. Stillwell, who was associated with him in the Niagara Falls work for a number of years. Dr. Sellers was a distinguished engineer, and did not, perhaps, receive the general credit for his work to which he was entitled. Mr. Stillwell goes so far as to say that his death is a loss to American engineering and invention in the field of mechanic arts fairly comparable to that which science has sustained in the death of Lord Kelvin. This is perhaps saying too much; nevertheless Dr. Sellers was entitled to great praise for his very important work in connection with the utilization of the waterpower at Niagara Falls. He was chief engineer of the Niagara Falls Power Company during the crucial period from 1889 to 1893. As Mr. Stillwell says truly, "the extent to which the judgment and painstaking investigation of Dr. Sellers in connection with the Niagara work influenced electric development in America along lines now well established has not been generally recognized." And again: "His patience, unfailing ingenuity, broad view and courage in assuming great responsibilities were in every way admirable."

It is a pleasure to witness and applaud this disinterested testimony to the value of the work of an eminent engineer from one who was a worthy associate.

Regulations Relating to the Use of Electric Power in English Factories.

(From the London correspondent of the Western Electrician.)

London, March 7.—The proposal by the Home Office to bring into force a set of regulations applicable to all places coming within the Factory Acts in which electrical energy is used has led to such a storm of protest that, as I have already pointed out, it was deemed advisable to conduct a public inquiry. The inquiry was begun this week. Representations are being made on behalf of all municipalities owning electric supply works, by all electric supply and power companies, by many factory owners and by a large number of railway companies and others whose premises come within the jurisdiction of those administering the Factory Acts. It is obvious that Mr. James Swinburne, F. R. S., who is conducting the inquiry as a special commissioner on behalf of the Home Office, has no light task before him.

The preliminary discussion has taken place upon two rules which relate to switchboards and the placing of no-load releases upon all motors, as these are considered to be the most important, opposition to the remaining 31 regulations being mainly questions of detail and drafting. With regard to switchboards, it is stipulated that for low-pressure and medium-pressure boards there shall be a clear height of seven feet and a clear width of three feet, while for high-pressure and extra-pressure boards the figures are eight feet and four feet, respectively. While no very serious objection is taken to these figures as regards future work, the proposal to make the regulation retrospective is opposed, for the reason that hardly one of the switchboards erected in the earlier days of the electrical industry comply with the strict letter of this regulation. The obvious inference is that they will have to be reconstructed in order to do so, and if this were insisted upon undoubtedly it would in the majority of cases be physically impossible, on account of the environment, to say nothing of the expense. The only conclusion, therefore, that the owners of such stations have come to is that they will be forced to give up the business. While no reasonable man could think even the Home Office would be capable of prescribing such a drastic means, there is nothing in the regulations to set one's mind at rest beyond an exemption which is said to be applicable to all stations which are shown to be not less adequately protected than if the regulation in question were complied with. This exemption lays it down that the factory inspector, admittedly not an electrical engineer, is to give a decision on this point. This might not be so alarming, for there would always be the electrical inspector himself to appeal to, but, unfortunately, under the Factory Acts themselves a way would be opened whereby, say, the representatives of a workmen's trade union could institute a prosecution for failure to comply with the strict letter of the regulation, a very unsatisfactory position to put an owner in. Consequently, there is a general demand for complete exemption of all existing work from this regulation.

The second regulation referred to stipulates that on every motor, whether alternating or continuous-current, there shall be fitted a no-voltage release to come into operation when the current is broken for any cause. The justification put forward by the Home Office for wishing to enforce such a rule as this is that there is a great possibility of current being cut off, either through the fuse going or due to failure at the generating station, and that the operator, not having turned off his switch, would be injured when the current came on again suddenly and he was not warned of it or prepared for it. A specific case was mentioned of a printing machine on which the operator began to work when the fuses were being replaced, and the current coming on without his knowledge, he was caught at work in the machine and killed.

There is a strenuous conflict of opinion on the need for such devices between the opponents and the Home Office technical advisers, both on the question of principle and upon the point of whether such no-voltage releasing devices for alternating-current motors are to be purchased as a commercial article today. It is argued by the opposition that the introduction of such devices would add to the danger, and would certainly not diminish it, in that another man might replace the device without the operator being aware of it, just as he might replace fuses. Cranes, capstans and the such like are quoted as instances in which there is no need for adding these apparatus, as the man must always be at the motor and would always be cognizant of what was going on. The opposition case also rests largely on the question of the expense of fitting no-voltage releases to all motors.

Some time must elapse before the inquiry, which is now adjourned for a week, is completed. As I have already pointed out, there are unmistakable signs that the general consensus of opinion in the industry is that the regulations, at any rate in their present form, will hinder progress and that the existing regulations of the Board of Trade are quite sufficient both for the protection of the public and of the workpeople. The answer to this argument [illegible]

G.

Louis A. Ferguson Nominated for President of the Institute.

[illegible] the American Institute of Electrical Engineers has made the following nominations for the coming annual election:

For president—Louis A. Ferguson, Chicago.

For vice-presidents—[illegible], Pittsfield, Mass.; Calvert Townley, New Haven, Conn.; Bancroft Gherardi, New York.

For managers—D. B. Rushmore, Schenectady; H. E. Clifford, Boston; W. G. Carlton, New York; C. A. Stone, Schenectady.

For treasurer—G. A. Hamilton, New York.

For secretary—Ralph W. Pope, New York.

These nominations were announced at the Institute meeting of March 13th. If the usual procedure is followed, the directors' nominations will be followed by election in due course.

Mr. Ferguson, who is second vice-president of the Commonwealth Edison Company, will have the distinction of being the second western man to serve as the president of the American Institute of Electrical Engineers in its history of 24 years, during which time, including the incoming president of this year, it will have had 21 presidents. The first western president was Mr. Bion J. Arnold of Chicago, who served in 1903 and 1904.

LOUIS A. FERGUSON

Mr Ferguson is preeminently a central-station man, and his whole professional and business career has been connected with the Commonwealth Edison Company of Chicago and its predecessor, the Chicago Edison Company. He was born in Dorchester, Mass., in 1867, and graduated from the Massachusetts Institute of Technology of Boston in 1888 with the degree of bachelor of science in electrical engineering. It is interesting to recall that his graduating thesis was on the practical subject, "The Law of Relation Between Candlepower and Current, Voltage and Energy Consumed in Incandescent Lamps." At that time the plans of the Chicago Edison Company were in the formative stage, and Mr. Ferguson, whose work at "Tech" had attracted attention, was offered and accepted a position with the new company. Shortly afterward the young man became electrician of the underground department, and thereafter his advancement was steady and rapid. He became, in succession, electrical engineer, electrical engineer and contract agent, general superintendent and second vice-president.

The nominee for the presidency of the Institute possesses ability, originality, enthusiasm and cordiality in a happy combination. Among electrical men he is widely known and heartily liked. This statement is attested by the fact that he has already served as president of the Association of Edison Illuminating Companies and of the National Electric Light Association. He was vice-president of the Institute when nominated for the higher office. Mr. Ferguson has made valuable contributions to electrical literature, many of which have been published in the Western Electrician. He is a member of many technical and social organizations and his home is in Evanston.

A Pit's Mouth Generating Plant for Indiana.

The plan for a large electric generating plant to be built in the coal fields of Vigo County, Ind., transmitting electric power to Indianapolis, seems to be taking more tangible shape. The Indianapolis Power Plant Company has been organized, and it proposes to erect a generating plant of about 3,000 horsepower. The present plan seems to be to make gas from the coal in producers, and to drive the generators by gas engines. In order to have a ready market for the product of the new plant as soon as completed the company is reported to have taken over the People's Light and Heat Company in Indianapolis. This company has a 25-year fran- [illegible]

The Bidwells Found Guilty.

[illegible] under false pretenses.

Differing from the average confidence game, the Bidwells [illegible] business. Their plant represented an investment of probably more than $100,000, and they had a large corps of workmen [illegible] Money was coming in plentifully and many considered the Bidwell Electric Company a great manufacturing concern.

The company was capitalized at $2,000,000, represented by 2,000,000 shares of the par value of $1 each. Although none of the witnesses at the trial knew of any of the motors being sold, the company in its advertisements in the daily papers made extravagant claims for the "cold motor." It was represented that the motors were being manufactured in large quantities and the future orders would mean millions in dividends. Then, it seems, disputes arose as to the dividing of the money received as investments, and Miss Ida Palmer, confidential secretary, who said that she had been tricked out of $2,000, instituted the proceedings resulting in the indictments and conviction.

During the trial electrical and mechanical experts testified as to the merits of the "cold motor," which was generally declared to be impracticable. Prof. P. B. Woodworth, of Lewis Institute, and Mr. James Lyman, electrical engineer, with the General Electric Company, were among the witnesses. Mr. Lyman was called to dispute the testimony that the General Electric Company had considered the purchasing of a "cold motor."

Benson Bidwell, the inventor, came to Chicago in 1905. He lays claim to the invention of the trolley car, the electric fan, the railway telephone, a water generator, and finally the "cold motor," which is the basis of the present suit.

Following the reading of the verdict Benson Bidwell is quoted with the following interesting remarks in an interview with a reporter:

"You ask me if I have anything to say to the public. Yes, I have. Tell them for me that Benson Bidwell will be building and selling cold motors in a mighty short time. If anyone thinks that I can be knocked out by a little thing like this he is mighty mistaken. The devil and all his fiends can't stop me until I have demonstrated to the world that I am what I claim to be or am planted under six feet of earth. I am 12 years older than Thomas Edison. I began the study of electricity in 1847, and there is no man on earth who has done more or knows more in that field than I. I have been fighting, fighting, fighting, an uphill battle all my life; and by now I know how to fight. I am only 72 years old and I will have those cold motors running every car and train in the United States in spite of all the courts between here and hell.

"Personally I don't care what they do with my old body. I have come to a stage where most things that are precious to men mean nothing to me. There is one thing, and one thing only, that I care about. That is my fame as an inventor. My reputation is much more dear to me than life or liberty, and I mean to vindicate it and beat them all yet."

Aside from technical features the case attracted much interest. Following the verdict charges were made by the defense of flirtation between certain jurymen and Miss Palmer. The accused, however, have made affidavits of denial. The jury on its first appearance returned four separate verdicts, two against each of the defendants. One document found guilt on the charge of operating a confidence game and the other on the obtaining of money under false pretense. The judge, however, ordered the jury to correct its verdict, with the result stated above.

Alternators in Parallel.

[*Continued from page 229.*]

In order to operate alternators in parallel it is first necessary to synchronize the machines. This process, once difficult, has been rendered quite simple by the use of the synchroscope with its clear indication of vector relations, showing the attendant the proper moment for switch closing.

As in direct-current parallel operation, approximately equal terminal voltage must be secured, but now the problem includes the much more critical conditions of approximate speed equality, of same phase rotation and of sensibly identical vector position before the paralleling switch can be safely thrown. It is even possible by a device now on the market to have the switches closed automatically when vector relations are correct, relieving the attendant of the strain of his work. This might be likened to the actual dropping of a time ball at high noon automatically, although the preliminary arrangements are manually made in advance. The condition of vector or phase equality must be closely realized, but this can be done after experience even with a relatively large speed difference by causing the switch to close as the indicator passes across the zero mark, just as a bullseye can best be secured with the gunsight passing across the target. Also, as in shooting, the time lag of the switch or gun mechanism requires experienced allowance. There is no great difficulty in making a good record under normal operating conditions, but in an emergency when quickness of action is most necessary, undue haste may cause an imperfect switch closing, or possibly as in railway substations an irregular load may make the conditions as indicated by the synchroscope so erratic as to confuse the operator.

A method of self-synchronizing has been devised in which the reactions commonly the result of imperfect switching are so reduced as to permit the switch to be closed at any time regardless of phase relation of the incoming machine. Purposely bad synchronizing produces a mere flicker of the lighting load, and ordinary synchronizing is absolutely devoid of disturbance of any kind. The scheme is merely the temporary insertion between machines (using but one phase in two or three-phase machines) of an inductive coil without an iron core. The action of this coil limits greatly the possible current rush on imperfect switch closing without limiting to the same degree the synchronizing power of the machines to pull into step, necessary to complete the process.

It is known that in transformers the initial primary current on switch closing may be abnormal, especially in case of unfavorable residual magnetism. When two alternators are connected together while differing in phase the magnetism of the two machines cannot be precisely in the relation required for least cross-current, and an abnormal rush of current may result. In case of opposition of phase (180 degrees) the case is equal to a sudden short-circuit, resulting in a current rush of perhaps 20 times full-load current, although a gradual but complete short-circuit may not develop more than three times full-load current. This current rush or surge is sufficiently reduced by a rather small coil of wire, whose reactance does not depend upon iron, and which, like resistance, seems instantly ready for duty. A coil costing about one per cent. as much as the machine served is often found sufficient for the purpose. The small size of the coil required for self-synchronizing has been a surprise. With such coil it has been found possible to close the switch connecting the bus-bars and a machine to be synchronized before it is even started, when it will easily fall into step upon attaining proper speed. This is not to be recommended, as it will cause an undesirable reaction upon the existing load unless an unduly large coil be provided.

Experiments have shown that best results are obtained in synchronizing an incoming generator when it is running a trifle "fast," as switching in puts a load upon it, slowing it down. Similarly an incoming converter should be running "slow," as the current flowing into the motor will normally produce motor action, tending momentarily to increase speed. Attention to this difference will [illegible] an oscillation of machines.

By introducing a large condenser between two machines to be synchronized it has been found pos- [illegible] at opposition of phase, proving that inductance is necessary in the impedance used for self-synchronizing. Resistance alone is neutral, merely tending to limit the current rush. Too much inductance limits the necessary circulating current too much. The required coil is small, but 50 pounds of copper in a coil without core serving to permit a 75-kilowatt, two-phase, 60-cycle alter- [illegible] position.

[illegible] ized that two engines driving alternators in paral- [illegible] one mechanical degree in position from uniform rotation, due to cyclic variation, and must change speed simultaneously and equally in case of a change of load, it is seen how difficult the problem is. A certain speed difference is required to operate even an isochronous governor. Too sensitive governing may easily lead to hunting; too sluggish to unequal load division, preventing the use of many units in parallel, or of units differing greatly in size. A considerable fall of speed from no load to full load in the engines usually increase the ease of operating a generating station, since there is less relative variation among the several engines. Since all engines must run at synchronous speed precisely, they will carry the loads determined by their governors at that speed, and no change of excitation avails to vary the load, as may be done in direct-current operation, where a slight speed difference is of no consequence. As may be seen from the chart at a given load capacity, the vector position of generator is fixed by its excitation, and any change in excitation will alter its vector position and power factor.

A recent circuit arrangement by which two alternators are connected through the outside connections of a balancing autotransformer whose neutral connection goes to line serves to maintain equal or proportional current outputs from the two machines and permits a considerable excitation difference while maintaining unity power factor, provided the engine powers are arranged to carry the load difference. This method has its special advantage in regulating the outputs of two direct-connected units by means of voltage instead of by currents as heretofore. This permits a considerable load adjustment with equal currents, something hitherto impossible. An interesting feature of the balancing transformer connection for alternators is found in the separation of circulating current from load current, so that any tendency for machines to hunt, even slightly, is noticed, and any exchange of current between machines, no matter how small, may be detected. When the driving power or the voltage is adjusted to give good operating conditions, little or no circulating current is found. It is even possible to have an automatic alarm arranged to notify the attendant of any circulating current above a predetermined minimum, the alarm to be entirely independent of amount of load current delivered. Operating is made more certain, the machines will run at unity power factor and armatures and circuits are not encumbered with an unknown wattless current. It becomes safe to operate the plant at higher load factor and a small unit is protected from overloads, due to hunting.

Cyclic variation of speed, especially in gas engines, and variations due to the engine response often falling many electric cycles behind the command of the governor are frequent causes of serious hunting. The recent attempts to improve gas-engine regulation by so radical a step as "bleeding" shows how important the question has become. It would seem that a flexible mechanical or electrical coupling is demanded to make gas engines successful in parallel operation. The steam turbine has such unrivaled advantages in respect to constant-speed rotation as to have largely superseded reciprocating engines. The proposed use of asynchronous generators with gas engines will perhaps become the solution of the gas-engine problem of regulation.

The use of heavy flywheels helps materially in uniformity of rotation, but in the case of parallel operation it is a question if the instant dropping of load from a generator which gets so little as one degree in space behind its prescribed position, if it has 30 poles, has not fully as much to do with regulation of speed. If so small a position change removes the load from a generator, the load must be carried by another, and the shifting of load due to hunting or to variations of speed not properly termed hunting must overheat the generator rapidly, even when its average load is normal. The slight hunting that will cause at one instant no load and at the next thrice full load, due not only to carrying its own and its neighbor's load, but also to driving its mate momentarily as a motor, will cause a heat loss somewhat more than twice normal. Moderate hunting will cause surprisingly large momentary loads and will reduce the apparent rating of the alternator.

All the preceding discussion assumes a pure sine curve of alternating current. The presence of the higher harmonics can add no power for transmission, yet may increase the heat losses in line and in machines. The fact that the triple harmonic is not recorded, even on an oscillograph when connected to the terminals of a three-phase generator, has been the cause of its presence remaining often undiscovered. A vector difference of 30 degrees in the fundamental is 90 degrees in the third harmonic, hence synchronizing at a very moderate phase difference as to the fundamental may give unexpected prominence to the harmonic. In case of different wave forms, even having the same equivalent value, dangerous circulating currents may [illegible]. The balancing transformer, previously mentioned, will largely reduce any circulating harmonics.

The sensitiveness of alternators in parallel to slight vector or excitation differences shows that even a seemingly slight unbalanced condition of phases may cause serious overloading of one phase or of the machine. A five per cent. inequality of voltage as received by a rotary converter might easily cause one phase to produce two-thirds the motor output, while the second phase produced but one-third. The synchronous motor, which produces lagging or leading currents at will with a relatively slight change in excitation, might produce a lagging current in one phase and at the same moment a leading current in another, accentuating a potential difference of an unbalanced line by altering the standard phase angle of current. The action of the induction motor, on the other hand, serves to greatly reduce any unbalanced condition. Synchronous generators and motors require almost ideal conditions for satisfactory operation, and the success of so many transmission lines using rotary converters is proof of the high ability of the engineers installing and operating these plants.

Demonstration.

To aid in the presentation of the foregoing paper, Professor Brooks used a number of wall charts that were enlargements and particular applications of Fig. 8. These were provided with conveniently adjustable strips representing the vectors OA and OB in various relative positions. A still more effective demonstration was made by means of two independent bicycle wheels that were mounted back of each other in parallel planes with concentric axles. The wheels were enameled black and one carried a white radial arrow, representing, say, the vector OA, while the other carried a similar red arrow, representing the vector OB. On placing a rubber band between two pins on the neighboring rims and then starting the wheels with an angular distance between the revolving vectors a very clear ocular demonstration of hunting was produced. A number of other conditions in synchronizing were also shown by the same device.

A practical demonstration of the value of Professor Brooks' self-synchronizing coils was made by the Commonwealth Edison Company. Private telephone connection was established between the meeting room in the Monadnock Block and the Harrison Street station of the company. A 200-kilowatt, 25-cycle rotary converter at that station was set apart for the experiments and connected through special circuits to a panel board on which were mounted three synchroscopes and two ammeters. Two independent parts of the system were first synchronized to illustrate the method. The 200-kilowatt machine was then started up by driving it as an alternator by means of its companion machine running as a direct-current motor. It was put in parallel with the bus-bars in the ordinary way, a large instantaneous current resulting at the moment of switching it in. It was then synchronized with the self-synchronizing coil in at a vector-difference of about 30 degrees with a comparatively small instantaneous current of about 50 amperes. When repeated with the switch closed a trifle after the proper time the current was nearly 100 amperes. Synchronizing at 180 degrees vector-difference produced an instantaneous current of about 250 amperes. The synchronizing coil, which had consisted of 470 feet of No. 0 wire wound on a reel merely removed from the storeroom, was then shortened by 100 feet and the last test repeated; in this case the current rose to some 350 amperes, but settled down a little more quickly. Still another test was made while the machine was quite markedly out of synchronous speed and the switch was thrown in indiscriminately; in this case the current was about 500 amperes. The first trial of synchronizing without the coil was repeated and found to result in an instantaneous current of approximately 1,200 amperes.

Discussion.

Chairman D. W. Roper opened the discussion by showing a lantern slide picture of the 200-kilowatt machine used in the tests. It was one of a number of pairs of machines installed as double-current generators direct-connected to vertical cross-compound engines. For some time the engines at the Harrison Street station have been idle. The engine connecting rods have been disconnected and the two generators in each unit have been operated as rotary converters. In speaking of parallel operation, Mr. Roper said that the subject had received much attention, but was deserving of the closest study. He traced the changes in synchronizing methods which had been made in recent years. Referring to the synchronizing of 1,500-kilowatt rotaries in New York, he said that as a measure of precaution, since such large machines had not been run in parallel before, the machines were brought up on the direct-current side to practical synchronism and the direct-current switches opened for an instant while the alternating-current switches were being closed. Later the induction-motor method of bringing the machines up to step was developed. In practice the conditions are much worse than those prevailing during the tests made that evening, since here there were used steam-turbine and motor-driven units which run very much more uniformly than the ordinary reciprocating engine.

James Lyman said that the diagrams developed by

Professor Brooks were strikingly clear in showing up the conditions of parallel operation. The effects of leading and lagging currents were particularly well shown. He recalled some of his early experiments in the laboratory to see the effects of resistance, inductance and capacity on the synchronizing power in parallel operation. He wished to know whether the synchronizing power was reduced by the inductive coil after having the machines in parallel.

Professor Brooks stated that it was not, since the synchronizing coil is used only in bringing the machines into step and is then cut out. In fact, it is used like a starting resistance for motors and could be arranged in a similar way.

Peter Junkersfeld dwelt on the rapid advance that the art has experienced during recent years. The very machine used that evening was the first 25-cycle double-current generator used in Chicago. He recalled its installation and synchronizing with a similar later unit 10 years ago. Subsequently it was synchronized with an inverted rotary converter. It was certainly a great step from those early attempts, when there was frequently no telling what would happen on closing the switch to the cool and quiet demonstration of synchronizing at a distance of about three-quarters of a mile from the machine. This was the first demonstration of the use of a self-synchronizing coil with a machine as large as 200 kilowatts. Nearly all devices got up as an aid in this line have been automatic synchronizers that attempt to close the switch at the proper instant. The trouble that would result from the derangement of these devices has limited the confidence imposed in them. He had kept in close touch with Professor Brooks' work on parallel operation at the University of Illinois during the last two years and felt that the profession in general was much indebted to him.

W. L. Abbott called attention to the fact that the last tests were made with only about 125 pounds of copper in the synchronizing coil, making a little over half a pound per kilowatt of machine capacity. He believed this could be cut down to one-quarter of a pound per kilowatt and put in the form of a compact coil conveniently disposed.

E. F. Smith declared that all large systems have skillful operators nowadays and comparatively little trouble in synchronizing results. For instance, in the extensive system of the Commonwealth Edison Company, of whose sub-stations he has charge, synchronizing is done regularly about 3,000 times per month, and there have been over 100,000 such operations since the last trouble from this cause, which was a trifling one. He suggested that the Brooks coil would be serviceable on each side of frequency changers that are sometimes troublesome to synchronize properly. It may also be used on rotary converters, in which case Professor Brooks has found it desirable also to put an impedance coil on the direct-current side of compound rotaries, as without this the machines have a tendency to speed up on coming into step. Practically all the rotaries used in his stations are started from the direct-current side except for railway work. He gave a number of figures showing the rapidity with which machines are brought up to speed and synchronized.

G. H. Lukes said the use of these synchronizing coils presented very many attractive possibilities. For one thing, they are simple and cheap. He thought they would be serviceable not only in special cases where poor engine regulation had to be contended with, but even in large, well-ordered plants as an insurance against trouble. He believed there was only one thing Professor Brooks deserved severe censure for in this connection, and that was that he did not bring out his synchronizing methods years ago.

Preparations for the Chicago Convention.

Final plans for the exhibition in connection with the Chicago convention of the National Electric Light Association have been adopted. The display will be shown in the large hall on the top floor of the Auditorium Hotel, and the well-known architects, D. H. Burnham & Co., have been engaged to plan the booths and decorations. Through the courtesy of the Electrical Trades Exposition Company the railings, posts, cables and other material used at the recent Chicago Electrical Show will be utilized, but the general effect will be entirely original.

The plans provide for 63 booths, ranging in size from 44 square feet to 123 square feet, and as heretofore two or more sections may be combined into larger ones. Upon the whole the area of exhibition space is about the same as that of last year at Washington.

Perhaps the most interesting feature in the decorations will be the color scheme, to which much attention has been given. Appropriate to the times the tungsten lamp will play an important part in the illumination of the hall. The object sought will be a uniform distribution of soft white light rather than extreme brilliancy.

The convenience of members and their guests has not been overlooked. Convenient to the elevators, a large coatroom will be provided, at which garments and packages may be checked. At the other end of the hall, near the passageway leading to the convention hall, will be located a counter at which convention papers may be left.

Judging from inquiries already received, the demand for space will be even greater than in former years. Mr. Walter Neumuller, [illegible] Duane Street, New York, is secretary of the exhibition committee.

The convention committee of the National Electric Light Association is made up as follows: L. A. Ferguson, 139 Adams Street, Chicago, chairman; Alex Dow, Detroit; Charles L. Edgar, Boston; W. C. L. Eglin, Philadelphia; W. W. Freeman, Brooklyn; Frank H. Gale, Schenectady; John F. Gilchrist, Chicago; George H. Harries, Washington, D. C.; Charles R. Huntley, Buffalo; Frank M. Tait, Dayton, Ohio; Arthur Williams, New York.

The hotel committee for the convention is H. E. Niesz, 139 Adams Street, Chicago. Accommodations may be engaged at any time by addressing Mr. Niesz.

Special features of entertainment for the ladies attending the meeting are now being arranged and will be announced later.

The date of the convention, which will be held at the Auditorium, is May 19th to 22d.

QUESTIONS AND ANSWERS.

Wiring Lamps in Series with Motors.

C. F. C. H., San Jose, Cal.: We have a 550-volt direct-current system here to which we had to wire some small motors. We found the best results from the following combinations: (1) A 220-volt fan motor, amperes unknown, required five 16-candlepower incandescent lamps in series. (2) A 110-volt motor for driving a small air compressor took 2.34 amperes and required in series with it a group of 12 32-candlepower lamps arranged in three parallel rows each having four lamps in series. Are these results consistent? Is there a general rule for wiring lamps in this manner?

Answer.

The assumption is here made that all the lamps used were common 110-volt carbon-filament lamps. In case (1) the motor probably took less than one-fourth ampere; of the 330 volts across the five lamps in series each one received 66 volts, at which point its resistance is about 280 ohms, and it takes a little less than one-fourth ampere. In case (2) of the 440 volts across each row of lamps, each lamp received about its normal 110 volts and took something less than an ampere. These results are fairly consistent with actual practice. A general rule for wiring lamps in series with small motors to take up excess voltage of the circuit may be expressed as follows: Connect in series such a number of lamps that the voltage across each lamp is not above normal and the current each lamp takes at this voltage is equal to, or a simple fraction of, the total current required; after the number of lamps in series is determined and the current is found insufficient, connect a number of parallel rows together to give the current-carrying capacity desired. No more specific rule can be given, because of the large variety of lamps differing in voltage and candlepower that can be used.

Spread of Fixtures.

E. L. J., Fort Baker, Cal.: How and where is the spread of electric light and gas fixtures measured? Also the extension of brackets?

Answer.

There seems to be no standard practice in this matter, as each fixture house establishes its own rules. Of six prominent fixture designers consulted, four measure the diametrical distance across chandeliers between the centers of opposite sockets or gas burners and call it the spread; one measures the distance between the tips of opposite lamps, and one measures the extreme distance over the outside globes or other glassware. Where the lamps are not opposite, as in three-light or five-light fixtures, the general rule is to measure one arm, or the radius, and call it half the spread of the fixture.

In the same way in brackets, four measure the extension as the perpendicular distance from wall to center of socket or burner, one to tip of lamp and one the extreme distance that the bracket extends from wall. What partly accounts for these discrepancies is the custom, still quite common, although in many cases poor practice, of placing the lamps at an angle of 45 degrees instead of straight down.

In view of this lack of uniformity, it is prob- [illegible] or extension undefined.

Chicago Illuminating Engineers' Meeting.

The March meeting of the [illegible] the Illuminating Engineering [illegible] 19th, was devoted to [illegible] [illegible] of the discussion. The members had dinner in the breakfast room of the Grand Pacific Hotel at six o'clock, and Mr. J. P. [illegible] chairman of the Chicago Section, called the meeting to order at about half-past seven.

Those who took part in the discussion agreed that the paper of Mr. Hunter brought out some excellent points for thought and development as to the proper blending of colors and the selection and arrangement of lights from a decorative viewpoint.

Mr. F. J. Pearson, of Marshall Field & Co., who opened the discussion, said that the paper covered a field heretofore neglected by illuminating engineers. He welcomed a tendency to revert to nature for color and light in decoration. The beautiful and harmonious colors in nature effected by the rising and setting sun are largely lost by the more direct rays at noontime. This has its lesson in the study of indirect lighting and teaches the illuminating engineer that by observation in the morning and evening he can learn from nature much about artistic decorative and lighting effect. Mr. Pearson cited the case of a leading milliner who attributed her success to the ability to absorb and reflect natural color effects in her work. Complementary colors and the location of light in decoration should follow natural suggestions. In nature blue, probably, predominates.

It was shown that some of the suggestions in Mr. Hunter's paper would bear modification. Mr. Cravath called attention to the necessity of a clear understanding of the wasting of light. Ceilings and walls need not be robbed of illumination, but frequently they are given too much light at the expense of interior points where light is needed. An example of improved practice in this direction is the new system of lighting at the Marshall Field retail store; here 65 to 75 per cent. of the light is directed to the counters instead of to the ceiling, as under the old arrangement. Still the walls and ceilings are as well, if not more pleasingly, illuminated than formerly when the light was wasted on the walls and ceilings and the sales places and display counters suffered. The object is not to light the floor but the plane between the source and the floor. Artificial lighting tends too much toward the walls and ceilings, while natural light is more in the plane. Indirect lighting, that is, light properly diffused from the walls and ceilings, is an aid to the direct source, but indirect lighting, to an extent, is a sacrifice of efficiency to the comfort of the eye. The problem is to get the right proportion. Dark floors, suggested by the Hunter paper as lending an air of solidity, can be carried to extreme, because, added to low efficiency of lighting in some places on account of economy, there would be created a feeling of insecurity and uncertainty.

Mr. H. Von Holst, from the architect's viewpoint, spoke of harmony of colors, and said that contrast in colors in decoration as well as in lighting should be avoided. Even daylight entering a room with numerous and large windows is more pleasing in its effect on the decorations if subdued by lace curtains or the like. Messrs. G. H. Jones, John J. Sorber and others spoke briefly.

Australia Asks Bids for New Cables.

The postmaster-general of Australia is inviting bids for the construction and laying of two new cables between the Island of Tasmania and the mainland. The bids close at noon on April 14, 1908. The bid forms provide for the manufacture and laying of 350 nautical miles of main cable, 20 miles of intermediate cable, and 20 miles of shore-end cable. The conductor of the cable is to be composed of a strand of seven copper wires of equal diameter, weighing 107 pounds per nautical mile. It is to be insulated by three coatings of purest guttapercha, weighing 150 pounds per nautical mile. The coil is to be taped with an approved tape, overlaid with brass tape about three-fourths inch wide. The brass-taped coil must be served with yarn or Russian long-dressed hemp, and sheathed with galvanized-iron wire of prescribed diameters. All the work of laying and completing is to be done by the contractors, so that the cables may be handed over ready for use, the first not later than March 1, 1909; the second not later than 31 days thereafter. Mr. John P. Bray is United States consul-general at Melbourne.

National Conference on Standard Electrical Rules.

The annual meeting of the National Conference on Standard Electrical Rules will be held at the Edison Auditorium, 44 West Twenty-seventh Street, New York city, on March 27th at 1 p. m., to act upon any business which may be brought before the meeting. This meeting will follow that of the electrical committee of the Underwriters' National Electric Association, representing the National Board of Fire Underwriters. All persons interested are invited to be present. Mr. C. J. H. Woodbury, 501, 45 Milk Street, Boston, is secretary. Mr. W. H. Blood, Jr., is president.

The meeting of the Underwriters' National Electric Association is on March 25th and 26th, at 32 Nassau Street, New York. Reports of committees and suggested changes in rules will be considered. Mr. Blood, as insurance expert of the National Electric Light Association, says that for the last year or two he has had very little support at these meetings from members of the National Electric Light Association, and he asks for an attendance of members which will fairly represent the association. The Underwriters' inspectors, municipal inspectors and contractors are always out in full force, and to meet them it is essential that the electric-lighting men appear in great numbers. The passage of burdensome rules that tend to restrict the use of electricity is felt more seriously by the electric-lighting companies than by any other interests; it is therefore advisable that members of the fraternity assist in the passage of rules that shall make electric lighting safe but which will not retard the growth of the industry. Where it is impossible for members to send representatives to the annual meeting, it is hoped that suggestions with reference to the proposed changes will be sent to Mr. Blood, 147 Milk Street, Boston, in order that he may bring them up at the conference.

Pole Supply in Western Canada.

Mr. E. A. Lindsley, secretary and treasurer of the Lindsley Bros. Company of Spokane, Wash., writes to the Western Electrician to say that the article in the Western Electrician of March 7th, headed "Poles Scarce in Canada," from the Winnipeg correspondent, is erroneous in several respects. He says that there are more poles in British Columbia than ever before, and that the dealers would be glad to sell them if there was any demand. His company is interested in the pole business in British Columbia, having on hand about 40,000 poles, but there is no immediate prospect of sales. The pole market in that section is overproduced, it seems, as other companies than Mr. Lindsley's report the same condition.

Mr. Lindsley is undoubtedly well advised of the situation in Western Canada, and the Western Electrician is glad to make the necessary correction which he points out.

Institute Convention to be in Atlantic City.

At the meeting of the board of directors of the American Institute of Electrical Engineers on February 14th, a committee of four was appointed and empowered to select a location for the next annual convention. Among the places considered were Detroit, Montreal, Boston, Washington and Atlantic City. President Stott and Secretary Pope visited Atlantic City on March 9th, and after thorough examination of all available halls and hotels reported to the committee in favor of holding the convention at Atlantic City, with headquarters at the Hotel Traymore. The convention will be begun on June 29th and is expected to close on July 2d. The action of the committee, in selecting Atlantic City, was reported at the meeting of the board of directors on March 13th and approved.

Institute Meeting in New York.

A regular meeting of the American Institute of Electrical Engineers was held in New York on March 13th. President Stott was in the chair, and among other business Secretary Pope announced that earlier in the day the directors had elected 95 associates to membership. The paper of the evening [illegible] L. B. Stillwell and written by [illegible] and H. S. [illegible] Putnam, was entitled "Notes on Electric Haulage of Canal [illegible] of the Lehigh Canal near Mauch Chunk, Pa. Those tak- [illegible]

St. Louis Electrical Show Postponed.

[illegible]

Electric Club Discusses Central-station Heating.

The regular weekly meeting of the Electric Club of Chicago at the Grand Pacific Hotel on March 11th was an interesting one. The speaker was F. N. Jewett, Chicago manager of the Wagner Electric Manufacturing Company, and the subject was "Central-station Heating." Mr. Jewett gave a historical sketch of the development of the art, starting with the heating and refrigerating company that came to such a disastrous ending in Boston a number of years ago.

The conclusion was reached that technically the central-station method of heating was perfectly sound, but from a financial viewpoint it was not in every case feasible. The subject was discussed by Homer E. Niesz of the Commonwealth Edison Company, H. Otis and E. Switzer.

At the next meeting it is expected E. O. Sessions will address the club. Other speakers on the programme for future meetings are Arthur Frantzen, George Cutter, F. P. Vose and J. G. Pomeroy.

On April 3d the club will give its first smoker. At the present rate of growth it may not be long before permanent and larger quarters will have to be secured.

Through Routes in Operation in Chicago.

The first result of the through routing of street cars provided for in the traction settlement ordinances of Chicago was apparent on March 17th, when the first connecting link in street-car service between the North and South sides was put in operation. The route is No. 22 in the list provided by the Board of Supervising Engineers. At 4:20 in the morning cars were started by both the Chicago City Railway Company and Chicago Railways Company. The route is 20 miles long. Sixteen cars were started, eight minutes apart, by each company, all the cars running through to the opposite terminals. Thus passengers can now board a car at Howard Avenue and Clark Street, at the north limits of the city, and ride downtown through the central business district and on to Seventy-ninth and Halsted streets on the south, or vice versa, without changing cars and for a five-cent fare. Transfers will be issued to cross lines outside the district between Twelfth Street and the river. The North and South Side cars as they passed through opposite ends of the city attracted much attention, and many people for the first time realized that there is a movement on for improved transportation facilities. Plans are now being worked out for other through routes, the next one to be opened being a North and West Side line.

Western Union Quarterly Report.

Net revenue of the Western Union Telegraph Company for the quarter ended December 31, 1907, was $803,942.97, which, added to the previous surplus, amounted to $15,727,143.38. Deducting dividends of $1\frac{1}{4}$ per cent. amounting to $1,217,000, and interest on bonded debt, $433,062.50, left a surplus at the end of the quarter of $14,077,080.88. It is estimated that the earnings for the present quarter will be $1,100,000.

President Clowry says that commercial depression continues and the revenues of the company show a large decrease over the corresponding periods last year. The executive committee therefore recommended the payment of the $1\frac{1}{4}$ per cent. dividend for last quarter in stock. It is also recommended that in lieu of the usual cash dividend for the present quarter stockholders be issued out of $1,413,000 unused stock an amount equal to $1\frac{1}{4}$ per cent. of the stock held by each.

Westinghouse Business Improving.

For the first time since the Westinghouse Electric and Manufacturing Company went into the hands of receivers announcement is made that the low-water mark in business has been passed, and that the month of February showed marked improvement, with the first two weeks of March business showing every indication that February's business would be exceeded. E. L. Herr, one of the receivers, and general manager for the receivers, formerly vice-president of the company, states that no more men will be laid off, and the indications point to more men being employed. He says: "At this time we have about 8,500 men working [illegible], which is 75 per cent. of the number employed under normal conditions. The small work has not been affected. Our repair department has been rushed. We have done more repair work in [illegible] than for [illegible]. Our foreign [illegible] splendid."

New Rate Ordinance for Commonwealth Edison Company.

A new rate ordinance has been drawn for the Commonwealth Edison Company and it may be presented to the Chicago Council next Monday night. As a result of the discussions and agitation of various organizations and individuals so many amendments were attached to the original measure recommended by the committee on gas, oil and electric light that an entirely new draft was made. The rates are not changed, but numerous changes intended to protect the city and consumers are made.

There is said to be little objection to the ordinance as it now stands, although some persons are still of the opinion that a more thorough investigation into the subject of rates should be made before the ordinance is adopted. Alderman Young, chairman of the committee on gas, oil and electric light, has a letter from Bion J. Arnold, in answer to an inquiry as to his opinion of the ordinance. Mr. Arnold, while he does not say that the rates are the lowest that could be given, thinks the city is being dealt with justly, as the rates in the new measure are lower than those estimated in the Arnold-Carroll report of two years ago. The rates are also lower than those in New York and Boston, or probably any other large city. The average rate for the last three years of the five-year term will be eight cents a kilowatt-hour.

More Evidence in the Peoria Electrolysis Case.

Judge I. C. Pinkney of Peoria has been in Chicago acting for the Peoria Railway Company before Special Master in Chancery Frank L. Ween, who is hearing the additional evidence in the famous electrolysis case. The railway company has had an expert electrical engineer working in Peoria for several months past, making notes and calculations, and he will give the data he has collected to the court in the form of evidence.

This suit was started about 10 years ago and has been referred from judge to judge in the United States court until it reached Judge Sanborn. He then referred it to Frank L. Ween, who, as master in chancery, heard the first trial. During the month of January permission was obtained to introduce evidence, as the conditions governing street railways have changed much since the case was first started.

The suit was brought originally by the Peoria Water Works Company, which claimed that the method of running street cars in Peoria hurt its system of piping, and that the electrical current grounded from passing street cars caused the pipes to chip, and this chipping would ultimately result in their bursting.

Cheap Power in Omaha.

In the course of an interesting letter in the Omaha Bee, dated March 5th, Waldemar Michaelsen, the city electrician of Omaha, says that the large Omaha and Council Bluffs elevators are being furnished power at a less rate than corresponding elevators are being charged by the waterpower plant at Buffalo. "I have often thought," says Mr. Michaelsen, "that the Real Estate Exchange and the Commercial Club are overlooking a splendid opportunity by not advertising this fact. Instead of this, the general cry is that manufacturers are kept away from Omaha from the lack of cheap power. As to securing cheaper power from the projected waterpower plant at Columbus, such will never materialize; it could not under the most favorable conditions compete with a local coal plant, owing to the extensive line construction and consequent 'abnormal' investment on which the plant must pay interest."

A Large Catalogue.

The new general catalogue of supplies issued by the Western Electric Company of Chicago is one of the most complete of its kind ever published. In it are included all such electrical apparatus and supplies as are constantly in demand. The book has over 800 pages, $7\frac{1}{4}$ by 10 inches, with hundreds of illustrations, and weighs nearly five pounds. Nearly everything listed is illustrated, and good descriptions, with sizes and prices, are given. There are also many useful tables and much general information. Three indexes make reference easy.

Atomic Weight of Radium.

At a recent meeting of the Royal Society in London Dr. Thorpe, director of the Government Laboratory, announced the result of investigations regarding the atomic weight of radium, a subject of special interest in connection with the true position of radium in the system of chemical elements. Dr. Thorpe's researches showed that the atomic weight of radium was about 227 times greater than hydrogen, which is the unit of weight commonly adopted by chemists. This value is in good agreement with that suggested by Mme. Curie.

Testing Electric Locomotives.

In order to determine the actual performance of Baldwin Westinghouse mine and industrial locomotives under service conditions before they leave the works, the Baldwin Locomotive Works has erected a testing plant similar to the locomotive testing plant that was used at the St. Louis Exposition.

This plant, as shown in the accompanying illustration, consists of a [illegible] rolls upon which are placed wheels that may be moved to accommodate locomotives built for any gauge. Provision for varying wheel base is made by movement of the rolls toward or away from each other.

The locomotive to be tested is anchored in position by chains attached to the ends. Suitable prony brakes are used to measure the power developed by the motors, and a switchboard provided with the necessary electrical instruments enables a complete record to be made of the performance of every locomotive.

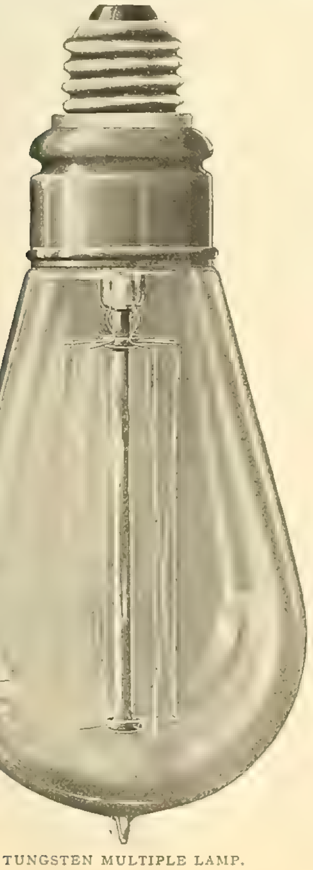
Although a thorough test of the electrical equipment is always made before it leaves the Westinghouse works at East Pittsburg, this test of the assembled locomotive is found to be of great advantage in that it insures the ability of the locomotive to operate continuously under service conditions.

TESTING ELECTRIC LOCOMOTIVES.

Tungsten Multiple Lamp.

From a recent bulletin of the Engineering Department of the National Electric Lamp Association the following information is taken:

Tungsten is a metal found in combination with various elements in several ores. Metallic tungsten is exceedingly hard and brittle. Therefore, it cannot be cold-drawn into wire, as is the case with tantalum. Its melting point is high, being about 3,000° C. The specific resistance of tungsten is [illegible]



TUNGSTEN MULTIPLE LAMP.

[illegible] fits the ordinary socket. The skirt is so insulated from the base, that, when the lamp is in place, no metal carrying current is exposed. The filament is composed of five simple loop or hairpin filaments arranged in series. The filaments are supported in such a way by small wires, sealed into a central glass supporting member, that the lamp can be satisfactorily operated in any position without the filaments sagging, so as to short-circuit one another. Unlike tantalum lamps, the tungsten lamp operates with equal satisfaction on direct current and alternating current of any periodicity.

It is advisable to handle tungsten lamps with care, since when cold the filaments are somewhat brittle.

Tungsten lamps for multiple service are made in two sizes and are rated by total wattage, as 40 and 60 watts. The 40-watt lamp includes lamps ranging from 35 to 45 watts. The 60-watt lamp includes lamps ranging from 50 to 70 watts.

The high melting point makes it possible to operate tungsten filaments at a temperature at which most other filaments vaporize; i. e., at a higher efficiency. The efficiency attained by the tungsten lamp is about 1.25 watts per mean horizontal candle, which is remarkable when it is considered that carbon lamps operate, at best, at 3.1 watts per candle.

The resistance of the tungsten lamp increases with a rise of temperature. Therefore, the candlepower, current and life are less affected by a fluctuation of voltage than is the case with the carbon lamp, whose resistance decreases as the temperature increases.

The life of a tungsten multiple lamp is about 800 hours when operated at an efficiency of 1.25 watts per candle. Burnouts generally occur before the initial candlepower has dropped 20 per cent., thus practically eliminating the possibility of a lamp outlasting its useful life. As is the case with the tantalum lamp, the filaments often come in contact with one another after rupture, establish a circuit and weld together. This renewal is usually accompanied by an increase in candlepower.

The tungsten lamp, owing to its high operating temperature, emits a light of pure white color, much resembling clear daylight. This fact alone has brought the tungsten lamp to the attention of people who are desirous of matching and distinguishing colors or shades of colors.

The list price of a 40-watt tungsten lamp with clear bulb and Edison base is $1.50. Of the operating cost of the lamp the Engineering Department has this to say:

"At costs of power greater than two cents per kilowatt-hour the tungsten lamp is the cheapest, considering both the first cost of the lamp and the cost of power, excepting only the higher candlepower tantalum lamp. The latter is cheaper than the tungsten at costs of power below 2½ cents per kilowatt-hour on 60-cycle alternating and four cents per kilowatt-hour on direct current. This warrants us in saying that for all practical purposes the tungsten lamp may be regarded as the cheapest source of light, considering all forms and types of incandescent electric lamps, so that the question of the cost of lighting with the tungsten lamp drops entirely out of consideration, and we may devote our full attention to the wonderful quality of the new light it gives."

The Pacific States Telephone and Telegraph Company has leased its local and rural business at Calistoga, Cal., to the Northwestern Electric Company, which recently leased from the same company the local lines in several other small towns in that vicinity. The Pacific States company has ordered a new $30,000 switchboard for its system at Napa, Cal.

BOOK TABLE.

[illegible] complete volume for that year there are mentioned [illegible] American patents, together with title and technical journal review, or mention of the same, are also given. In addition to the usual subject index of some 60 pages, there is given, according to the usual German custom, a name index. This includes authors, inventors, engineers and firms contributing to electrical literature during the year.

The subject matter is arranged under different headings and subdivisions, which, in combination with the wide range and completeness of the work, render each volume of the greatest utility for reference purposes. These three parts are in keeping with the usual high grade of German thoroughness which has been adhered to in the former issues of this valuable and commendable publication.

The Electric Furnace in Iron and Steel Production. By John B. C. Kershaw. London: Electrician Printing and Publishing Company; New York: D. Van Nostrand Company. 1907. Pp. (8½ by 5⅜ inches), vi., 68, with 24 illustrations. Price, $1.50.

This book is the compilation of a series of papers written by the author for an iron-trade journal, and deals entirely with the problem of the electric furnace as used in the production of iron and steel. A brief description of the early devices for obtaining high temperature by means of electricity is followed by discussions concerning the advantages of the electric furnace over those of the combustion type. Twelve commercial types of electric furnaces are described and illustrated by drawings, and the process of reducing and refining is carefully explained for each furnace. A chapter on the comparative yields and costs of the different furnaces furnishes valuable data concerning the power required and the relative cost for reducing and refining by the different processes. The subject is exhaustively treated in a clear, concise manner, and the book should be valuable to anybody interested in this line of work.

Engine-room Chemistry. By Augustus H. Gill, associate professor of technical analysis, Massachusetts Institute of Technology. New York: Hill Publishing Company. 1907. Pp. (4½ by 7 inches), x., 198, with 47 illustrations. Price, $1.

This book, the substance of which has appeared serially in Power, deals with the everyday chemistry of the engine room. It presupposes only an elementary knowledge of chemistry. It begins by explaining the meaning and use of chemical symbols, and describes the more common forms of apparatus used, also the reagents required. The analysis of fuels to determine their heating value is covered in a very thorough manner. The standard forms of calorimeters and other apparatus are described. The analysis of flue gases is similarly covered. The formation of boiler scale, together with pitting and corrosion, is taken up, with methods of testing and remedies. Under oils, the author takes up the various kinds of mineral, animal, and vegetable oils, their preparation, relative advantages and the various tests by which they are identified and their purity tested. The practical engineer will find this book of much service in becoming better acquainted with many features of his work.

A Text-book of Electrical Engineering. By Dr. Adolf Thomälen; translated from the German by G. W. O. Howe. New York: Longmans, Green & Co. 1907. Pp. (9½ by 6 inches), viii., 456, with 454 illustrations. Price, $4.20.

This book aims to provide a suitable text on electrical engineering for technical schools and colleges. Both for the student following a prescribed course of study and the one desirous of obtaining a clearly written reference work, the present volume has much to recommend it. Of the 20 chapters which comprise the book, the first five are devoted to the exposition of elementary principles and notions, and this is given with a clearness that will be immediately appreciated by the ordinary reader. The succeeding four chapters deal with direct-current machines, the various types of both generators and motors. The remaining chapters are allotted to the detailed consideration of alternating-current principles and machines.

Throughout the volume there is a continuity of subject-matter, a gradual and well-planned advance from fundamental ideas to dependent and complex relations, and an evidence of the writer's painstaking effort that is unusual even in text-books, and which speaks well for the present work and its author. The book is devoted exclusively to the principles of electrical engineering, and as such it must be considered one of the most acceptable contributions to the literature of the subject.

Relation of Illuminating Engineering to Architecture.[1]

By E. L. Elliott.

The business of the illuminating engineer is to produce a given or required result of illumination at the minimum outlay for the original installation and subsequent maintenance cost. But who shall determine what the required illumination shall be? Evidently this question must be decided jointly or separately by the three parties to the contract; namely, the owner or client, the architect and the illuminating engineer. It may be stated without fear of serious contradiction that the owner has fully met his responsibility in the premises when he has clearly set forth the exact uses for which the various parts of the structure are to be put. It then lies between the architect and the illuminating engineer to determine what the best illumination for each and every particular case may be. As between these two parties, the greater economy of thought and labor will be secured by placing the responsibility upon the illuminating engineer. To determine just what manner of illumination is best for all the numerous and widely varying conditions of modern life requires an extent of technical knowledge and a breadth of experience which the architect may very appropriately and wisely avoid, providing the results can be obtained from other sources.

The advent of the illuminating engineer as a specialist should be hailed with greater delight and relief by the architect than by any other member of the community. Having satisfied himself of the competency of the illuminating engineer, just as he would satisfy himself of the competency of the electrical or construction engineer, the architect can turn over the plans of the building, with the specifications of the use or uses to which it is to be put, and probably also a statement of the illuminant to be used, and leave the entire technical problem to the illuminating engineer. On the other hand, the illuminating engineer must have authority commensurate with his responsibility. The architect would not think of arbitrarily changing the specifications of a structural engineer without his full consent, and for the same reason the plans of the illuminating engineer should be equally respected.

There is one difference, however, between these two branches of engineering as connected with building; the skeleton of a building, which is the work of the structural engineer, is hidden when the work is completed; but the apparatus especially connected with the illumination is not only in plain view, but so conspicuously in sight as to form one of the necessary elements in the artistic whole. This phase of the problem of illumination therefore falls within the legitimate province of the architect. There is clearly but one solution of this apparent clash of authority, and that is co-operation between the architect and the engineer. The engineer demands a certain physical result; the architect demands certain structural features or conditions in order to produce the general harmony of result which it is his business to secure. How shall these two demands be reconciled? Evidently there will be a large number of cases in which no reconciliation will be necessary; all that is required will be such a versatility on the part of the engineer that he can design the physical part of the installation so that it will produce both the physical and artistic results demanded. It is conceivable, however, that cases may arise in which the artistic conditions required by the architect can be secured only at a greater or less sacrifice in economy; the decision then very clearly rests with the client. The possibility also still remains of the architect specifying certain conditions which he considers essential from the artistic standpoint, but which the engineer deems not only uneconomical, but positively detrimental in point of the resulting illumination. Who then shall decide? In this, as in all other cases, the client is the court of last resort, on the generally accepted theory that he who buys an article has a right to dictate as to its character. If a man chooses to work by light which is dangerous to his eyes, or is ill-suited to the purpose for which the illumination is required, for the sake of the supposed artistic effect, he can hardly be denied his right to such a course, however foolish [illegible]. Such cases, however, are hardly likely to occur under proper conditions. [illegible] willingly subject [illegible] or handicap the [illegible] by bad light after having been duly warned.

Since the larger proportion of buildings at the present time are predominantly utilitarian, there is extremely little opportunity for any disagreement between the illuminating engineer and the architect. [illegible] artistic talent of the illuminating engineer should [illegible] includes factories of every description, office build- [illegible] number of residences the illuminating engineer should also be competent to lay out, or pass upon every feature of the installation. There remain then only the more pretentious class of dwelling houses, churches, theaters, and, to a partial extent, libraries and public buildings, in which co-operation of engineer and architect is essential. In these cases the artistic features of the lighting installation are of such importance as properly and justly to demand the attention of the architect. However, while the architect is properly the arbiter in such cases as to the artistic side of the problem, the services of the illuminating engineer are no less valuable than in the other cases. Let it be clearly understood that art as applied to architecture does not exist for its own sake, but is only directed to the embellishment of the necessary and essential physical features of the building. Good decorative art is not only compatible with an efficient physical result, but can be considered of the highest order only when it conforms to good mechanics—in fact, decorative arts rests upon a purely scientific basis.

A careful analysis of the respective provinces of the illuminating engineer and the architect, therefore, discloses no more ground for mutual disagreement and distrust than between the architect and any other engineering specialist. The passive or active antipathy which has thus far existed to a greater or less extent on the part of the architect toward illuminating engineering appears to be wholly unjustifiable.

In most cases the sins of the architect have been rather of omission than commission. With the increasing demands upon his attention from the growing complexity of building, he has given less and less attention to details, and seemingly the least attention of all to the extremely important matter of artificial illumination. Lighting systems have been put in either without the slightest regard to the scientific principles involved, or at best with the aid of a few rule-of-thumb formulas, which were as apt to produce faults as anything else. Only the greater ignorance of the client has prevented an earlier upheaval. Were proportionately serious mistakes made in other points of construction, there is scarcely one building out of ten that would be accepted by the owner when completed. What would one say, for example, on learning that the heating apparatus in his building was wasting 25 per cent. or even 50 per cent. of the fuel? And yet such losses in light are by no means uncommon.

The sins of omission committed by the architect were even surpassed by the sins of commission committed by the fixture maker. Where the architect specified a number of light sources, figuring in a vague way on the illumination which they would produce if unobstructed, the fixture manufacturer has perhaps reduced the illumination to one-half by the accessories and construction used. It is quite to be expected, therefore, that the fixture manufacturer should not welcome the illuminating engineer with open arms. It is bad enough to have one's faults baldly pointed out; but when such faults have been an important source of revenue, the sting is so much the keener. There is no denying the fact that a very considerable part of the faults of lighting fixtures is directly traceable to a desire for profit.

Look at any fixture you please, and judge for yourself how much of the metal work is essential, and how much is a mere excrescence hanging on in the name of art, but having its true motive in the pocketbook. It is the existence of this condition of affairs that has made it necessary for the illuminating engineer to give a greater consideration of the artistic side of his subject than ideal conditions would require or justify, and so long as the condition prevails his efforts must continue.

The architect has had the reins from the beginning of history to the present time, and must be held wholly responsible for the results. If these are faulty, there need be no hedging on nice distinctions as to exactly whose duty it may be to institute the reform. The reformer is justified by his works.

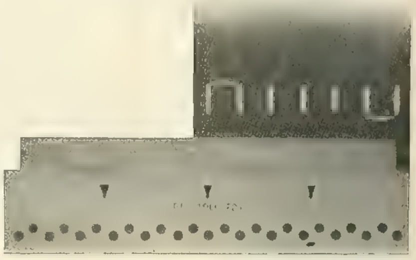
The principal point in dispute thus far between the illuminating engineer and the architect seems to be a question of jurisdiction. The architect has been comparatively ready to admit the authority of the illuminating engineer in regard to the purely physical and economical aspects of the question, but has denied his authority in matters pertaining to the esthetic or decorative features involved. The engineer, on the other hand, has contended that under this ruling the architect can practically overthrow the results of his labor by setting up the claim of esthetic requirements.

Since illuminating engineering involves questions of decorative art, there is no reason why the illuminating engineer should not make a sufficient study of this side of his profession to become an adept. The principles of art as applied to architecture are within the grasp of any intelligent person having [illegible] appreciation, and there is no more reason why the illuminating engineer should not master these principles, at least [illegible] they affect his profession, than there is for the architect not acquiring the general principles of structural engineering.

Whatever his incompetency may be in regard to the purely artistic side of the question, there is one invaluable result that is sure to follow the agitation that has been set up, and that is a greater amount of attention on the part of both professional and layman to the subject of illumination. The results in this regard are already apparent. The very first essential to reform is to discover the need of it, and until this discovery is made and accepted by a sufficient number of the people it is useless to look for improvement. The fact that the former prevailing practice in lighting had numerous and grievous faults is becoming pretty generally known, and as a direct result of this knowledge a demand for better methods is making itself felt.

Pullen Wire Lacing Gauge.

The Pullen wire lacing gauge, herewith illustrated, prevents the pulling out of lacing in belts due to uneven strain on the lace caused by inaccurate punching or spacing of the holes. This device will insure perfect spacing of the belt holes, resulting in strong joints and smooth running belts.



PULLEN WIRE LACING GAUGE.

The gauge can be instantly adjusted to any size belt, on either side or edge, and the holes punched through rapidly, insuring a good joint in much less time than it is possible to do without the gauge. The Pullen wire lacing gauge may be obtained from the Leather Preserver Manufacturing Company, 31 West Monroe Street, Chicago.

Power-house Improvements in Athens, Ga.

Among the progressive railway, power and lighting companies in the South is the Athens Electric Railway Company of Athens, Ga., which began operations in 1894, and whose progressive methods have resulted in the rapid growth of the business. Care has been taken to secure operating current at the lowest possible cost of production. For earlier requirements two hydro-electric developments, one about 6½ miles and the other 2½ miles from the city of Athens, furnished as much power as the system required, but with the extension of the street-railway lines and the rapidly increasing power and lighting load, it was found necessary to build a new power house in the town itself, where for some time past a steam turbine of the horizontal type has been in operation. Recently the requirements of the service have increased to such an extent as to call for the installation of a second steam turbine of 1,000 kilowatts capacity, and this, with the generator designed for direct connection to it, is now being built by Allis-Chalmers Company. The unit will deliver three-phase, 60-cycle current at a terminal pressure of 2,300 volts, and excitation is to be obtained from a 40-kilowatt induction motor-generator set. Mr. C. D. Flanigan is manager of the system.

New Tantalum Incandescent Lamps.

Some new types of tantalum lamps have been put on the market by the General Electric Company. The lamps are rated for 40, 50 and 80 watts. The 40 and 50-watt types replace the former 44-watt lamp. The 50-watt lamp, it is stated, will enable stations to maintain their output per lamp the same as with the present 16-candlepower lamp, and give the customer 50 per cent. increase in the candlepower. In Bulletin No. 4566 an interesting table is given showing the saving secured for 750 hours of service at various loads per kilowatt-hour, which indicates that with the average cost of current to the consumer now in force the tantalum lamp saves more than twice its cost. Under the heading, "Solution of Illuminating Problems," an interesting outline is given of the best methods of selecting proper units for various conditions. An illumination table in foot-candles for various types of reflectors and distances is given, as well as many illustrations of the different lamps fitted with Holophanes and accompanied by candlepower-distribution curves. The front page of the bulletin has an illustration of the Meridian type tantalum lamp which is made in 40 and 80 watt sizes, and provides an ornamental and attractive form of the new lamp.

Lighting Statistics of Chicago.

The total cost to the city of lighting the street of Chicago for the year 1907 was $1,031,3[illegible], the estimated total candlepower being 18,233,000. The lighting was done by gas, gasoline and electric lights, the cost and candlepower of each being as follows:

	Cost	Candlepower Estimated
Gas	[illegible]	[illegible]
Gasoline	[illegible]	[illegible]
Rented electric lights	[illegible]	[illegible]
Municipal electric light	[illegible]	[illegible]
Gas office	[illegible]	[illegible]
Total, 1907	[illegible]	[illegible]
Total, 1906	[illegible]	16,181,080

The cost of operating each street arc light in the municipal system is given by the Department of Electricity as $52.03 for the year, distributed as follows: Operation, $49.93; replacement and betterment, $2.01; per cent. of office expense, 30 cents. The rented electric lights cost $90 each.

The total number of electric-lighting stations in the city under the jurisdiction of the Department of Electricity at the close of the year 1907 was 1,422, 30 more than in 1906. From the combined plants a total of 44,656 arc lights were operated, being the equivalent of 2,851,401 16-candlepower lamps.

The 1,422 lighting stations are classified as follows:

	No. of Stations.		No. Arc Lamps Operated.	
	1907	1906	1907	1906
Commercial companies, central stations	25	28	[illegible]	19,781
Isolated plants	1,380	1,348	16,265	15,757
City plants, street lighting	4	4	7,047	6,602
City plants, isolated	[illegible]	12	100	[illegible]

The department made 47,070 inspections, issued 18,544 permits for installations, and issued more than 20,000 certificates for wiring and incandescent lamps. The motors inspected aggregated 60,501 horsepower.

GENERAL TELEPHONE NEWS

The Jefferson Township Telephone Company of Jefferson, Iowa, has been incorporated.

G. M. Simmons and others have organized a company to install a telephone system in Winfred, S. D.

The Fayette County Mutual Telephone Company of Randalia, Iowa, has been incorporated with a capital stock of $10,000.

The Mutual Telephone Company of Silver Lake, Ind., is in the market to purchase material for making extensive improvements and extending its lines throughout Kosciusko County.

The Albert Lea and Northwestern Telephone Company at Albert Lea, Minn., was burned out, with a loss of $10,000. The exchange was well insured. Temporary quarters have been secured.

It is reported that the Indianapolis Independent Telephone Company has contracted with the United Automatic Telephone Company of Urbana, Ohio, for the purchase and installation of a new automatic switchboard to cost $150,000.

The Central Iowa Telephone Company has reorganized under the name of the Central Telephone Company of Iowa Falls. W. V. Shipley is president and H. G. Conger secretary and treasurer. Nearly $10,000 will be expended on improvements.

The Minneapolis, St. Paul and Sault Ste. Marie Railway Company, known as the Soo Line, will install telephone service over its line, as extensively as possible, in order to comply with the nine-hour law.

The Manitoba government has divided the province into two sections for the purpose of better looking after the telephone system recently acquired from the Bell Telephone Company. J. F. McInnis, formerly district manager at Winnipeg, has been given charge of the northern half, while J. Galliford, formerly manager for the Bell company at Lethbridge, Alb., has been given control of the southern portion of the province.

The following-named telephone companies are among those recently incorporated: Farmers and Merchants' Telephone Company, Ragan, Neb.; Sisseton Telephone Company, Sisseton, S. D.; LeSauk Telephone Company, St. Cloud, Minn.; Lunde Telephone Company, Vienna, S. D.; Warren Telephone Company, Woonsocket, S. D.; Clara City Telephone Company, Clara City, Minn.; Alonzo Telephone Company, Alonzo, Ark.; Gracemont-Binger Rural Telephone Company, Gracemont, Okla.; Alden Telephone Company, Alden, Okla.

The town of Ava, Mo., has made up a bonus of $35,000 to promote the building of an electric railway between Ava and Cedar Gap. It is reported that the same company is to build a line between Gainsville and West Plains. J. B. Quigley, who constructed the St. Louis waterworks, is the promoter of the enterprises.

CORRESPONDENCE.

Continental Europe.

Paris, March [illegible].—[illegible] hydraulic plant of considerable [illegible] Alsace. There will probably be two different turbine stations located at different levels in order to take up the head of water. The plant will supply the region of Mulhouse. A commission has already been formed to examine the project and to find out what industries in the region are likely to use current from the plant. As to the estimated cost of the whole project, this is somewhere near $8,000,000, of which one-half will be in shares and the other half in bonds. The government is favorable to the execution of the project. It is thought that it will take about five years to carry out the whole of the work. A large amount of power can be disposed of in this region, and it is proposed to build the first of the turbine plants for a capacity of 22,000 horsepower.

A number of rolling mills in Germany are now using motor-driven rolling machinery, and the new type of reversible roll is preferred in the newer plants. At present there are 12 sets of reversible motor-driven rolls installed, and this number will no doubt be increased. Seven of these are constructed by the Allgemeine Company of Berlin and the remaining five by the Siemens-Schuckert firm. Some of the motors use three-phase current and the others direct current.

One of the most important of the mountain-climbing roads in Switzerland, the Zermatt Gornergrat line, is soon to be extended so as to reach the summit of the Gornergrat Mountain, as formerly it stopped short somewhat below this point. Excepting the Jungfrau line, this is the highest mountain railway in Europe, for the summit of the mountain lies at 10,290 feet above Gornergrat. It is expected to have the new part of the line ready to start by next summer. From the summit of the mountain, which lies opposite the Cervin, is to be had a view of no less than 50 glaciers.

Munich receives an additional supply of current from the new Moosburg hydraulic plant, and it is now in successful operation. The plant is located upon the Isar River and upon the middle part of an offtake canal which is 2½ miles in length. The head of water which is utilized in this case is 8.5 meters, and the plant has a capacity of 5,000 kilowatts at a maximum. In the turbine house are mounted three groups of four turbines each, using three-phase alternators which operate at 5,000 volts.

One of the new sections of the Paris Metropolitan is nearing completion. The present line joins with the No. 2 section, which has been in operation for some time at the Place d'Italie. At this point it lies in a subway tunnel of the standard type, but after 600 feet or more it runs upon an overhead structure which it follows until reaching the Seine. A special bridge has not been built for this line, but it crosses upon a stone-arched viaduct which is laid upon the already existing stone bridge at this point. On reaching the other side it passes at once into the tunnel portion, and thus continues as far as the terminus in the eastern part of town at the Place de la Nation. Passengers can thus pass from the extreme western part of town, making a semicircle through the southern district and finally reach the eastern part. From there they are able to make a similar circuit over the northern district by means of a transfer from this line to the northern semicircular section. This will afford a convenient means of transit. The present line is a comparatively short one, having about 3.3 miles length. The overhead portion is a metallic structure which has about the same general lines as the overhead parts on the other sections, using iron pillars or masonry columns to hold the superstructure, and the latter is made up of a certain number of metallic trusses, the longest of which is 38 meters and the average length 22.5 meters. There are 10 underground or overhead stations on the line. A. DE C.

New York.

New York City, March 14.—Bion J. Arnold, investigating for the Public Service Commission into possible improvements which would increase the capacity of the subway, has submitted a report recommending double-decking the express stations. He proposes that the second deck shall be used for local trains, thereby leaving the present platforms for the sole use of express trains.

The steamer Providence, carrying 350 passengers, took fire a few nights ago when all the passengers were asleep. The steamer is equipped with wireless telegraphy, which fact averted a panic and probable loss of life. The captain sent a wireless call to the steamer Richard Peck and did not awake the passengers until the steamers were side by side ready to transfer the passengers.

A series of bills pending before the Legislature with a view to regulating and cheapening telephone rates in New York city, are still in the Assembly committee on gas, electricity and water supply. The most important of these bills is the one introduced by Assemblyman Hammond of Onondaga, [illegible]

[illegible] Manhattan [illegible]

Corporation Counsel [illegible] interests. Mr. Pendleton refers to bills to be introduced in the Legislature authorizing the Board of Estimate and the Public Service Commission together to purchase such tunnels. The Public Service Commission [illegible] it thinks the Blackwell's Island Bridge will relieve any congestion in Queens.

Prof. Alexander Graham Bell's new aerodrome, the "Red Wing," had its test flight over Lake Keuka on March 12th. The aerodrome rose gently to the height of about 10 feet, and then sailed at that elevation for a short distance, at the rate of from 25 to 30 miles an hour. After having covered about 400 feet, a portion of the "tail" gave way, and the aerodrome was brought down for repairs. This is declared to be the first successful public flight of a heavier-than-air flying machine in America. The aerodrome proper weighed 195 pounds, the engine and apparatus about 200 pounds, and the operator 175 pounds, thus giving the entire machine and operator a weight of 570 pounds. The total supporting surface, including tail and rudder, was 453 square feet.

What will constitute one of the most important changes in the street-car service in this city, from an operating point of view, will be made within the next few weeks, when the receivers for the New York City Railway Company will place on the Madison and Fourth Avenue surface line 155 of the new pay-as-you-enter cars, similar to the ones in use in Chicago. At the same time they will establish a set of destination signal lights to be carried on the cars at night. The cars are larger and heavier than those to which New Yorkers have been accustomed. They are 11 feet longer and considerably wider. The main feature, however, is the very wide platform, which is seven feet six inches long and six feet wide. They are built to accommodate 20 persons. The conductor stands behind a railing, between the two compartments, and collects the fares as the passengers enter. W.

New England.

Boston, March 14.—In view of the opposition encountered by the Boston Elevated Railway Company to its bill to permit the acquisition of connecting lines, President William A. Bancroft has issued a statement withdrawing the bill from the Legislature.

The Berkshire Street Railway Company desires to purchase the Bennington and North Adams company. The former company is controlled by the New Haven road, and the much-discussed merger question relative to the ownership of trolley roads by steam roads comes up for consideration once more. There is opposition to the project in consequence.

One of the biggest automobile shows ever held in Boston is in progress this week at the Mechanics Building. Most of the leading manufacturers of electric vehicles are represented in the great exhibit, which is attracting visitors from all parts of New England and more remote points.

Nearly 200 members of the New England Railroad Club, which embraces both steam and electric-road officials in its membership, were present at the annual banquet of the organization held at Hotel Brunswick on March 10th.

The Exeter, Hampton and Amesbury Street Railway Company was sold at auction on March 10th for $250,000 to Charles H. Penney of Hartford, Conn., representing a committee of bondholders.

A merger bill has been introduced this week in the Rhode Island Legislature for a charter of the Blackstone Valley Gas and Electric Company, granting it permission to acquire light and power companies in Providence County, R. I. The capital is to be $3,000,000.

Power projects on the Connecticut River of a large nature are under consideration and one is in process of construction. The latter is at Brattleboro, Vt., where a dam costing $1,000,000 is now under way, with 450 men working day and night. The electric power developed will be upward of 16,000 horsepower. The French-King Rapids Company asks authority of the Massachusetts Legislature to build a dam near Turner's Falls in this state, and residents of Springfield, Mass., contemplate erecting a dam at Windsor Locks, Conn.

The total registration at the Massachusetts Institute of Technology this year is 1,410 students.

The Harvard University Engineering Society will have its tenth annual dinner on March 21st. Among the speakers will be Frederick P. Fish, ex-presi-

dent of the American Telephone and Telegraph Company; George A. Kimball, chief engineer of the Boston Elevated, and E. A. Clarke of the Lackawanna Steel Company. Professor Hollis, head of the department of civil, electrical and mechanical engineering at Harvard, will preside. An organization of graduate engineers, to be allied with the Engineering society, will be formed, to be called the Association of Harvard Engineers.

The amount of new construction by the American Telephone and Telegraph Company in the past year was approximately $50,000,000, against upward of $79,000,000 in the record year of 1906. In 1905 and 1906 the company had a big expansion, expending about $130,000,000 in the two years. The high cost of material last year was conducive to a halt in the size of expenditures of this nature.

The Massachusetts Electric Companies, through the subsidiary companies known as the Boston and Northern and the Old Colony, will put out $2,000,000 additional preferred stock, $750,000 for the Old Colony and $1,250,000 for the Boston & Northern.

B.

Michigan.

Detroit, March 14.—A consolidation of the H. M. Loud's Sons Company and the Commonwealth Power Company will be effected and will result in the development of the Au Sable River and the building of a transmission line to Bay City. About 10,000 horsepower will be available with an ultimate development of twice that.

The village of Armada has contracted with the St. Clair Edison Company for street lighting and pumping.

The Michigan Power Company of Lansing has begun work on its new 2,500-horsepower steam and power plant.

L. W. Green, of the Harvard City electric-light plant, has asked the council for a 10-year contract for street lighting.

The Houghton County Street Railway Company will erect a new sub-station at Larium and build an addition to its car barns. This is necessitated by the Mohawk extension.

The Manistique Light and Power Company has been granted a 30-year franchise at the present rate of 10 cents per kilowatt-hour and a 10-year pumping contract at $1,200 per annum. The rate for arc lamps for street lighting will be $70 per annum.

A committee of Mt. Clemens aldermen met a Business Men's committee and recommended to the Council that no action be taken on the franchise for the Home Telephone Company now before the Council. The Michigan State Telephone Company's representative stated that no concessions in the way of cheaper rates could be allowed, as the exchange was paying only five per cent. on the investment, but that they would turn the exchange over to the city if the city would guarantee a return on the investment of six per cent.

The Council of Greenville has granted a 30-year lighting franchise to R. J. Towar and has contracted for street lights at $50 per lamp per year, moonlight schedule, and $5 extra for light from 5 a. m. The service will be given from the water-power plant at North Greenville.

The Michigan State Telephone Company will extend its Bay City system and increase the capacity of the plant about 300 per cent. A large force is already at work and will be increased. Several hundred new poles and 25 miles of cable will be erected and the switchboard enlarged.

D.

Illinois.

Peoria, March 14.—A new time-card is in course of preparation for the limited cars of the Illinois Traction Company, running between the city of Springfield and Danville, whereby the time will be shortened 45 minutes, making it four hours even. The schedule will go into effect on the first of April or the first of May.

The City Council of Taylorville has granted the St. Louis, Terre Haute and Quincy Railway Company a franchise through the city of Taylorville. The ordinance gives the company the right to carry passengers, mail, express and freight of any kind at all hours. Work on the line from Quincy to Taylorville will be commenced within 60 days. Six million dollars will be required to carry the road through to completion, and backers of the [illegible] ready to place the money, it is said, as [illegible] 60 per cent of the right of way has been secured.

[illegible] the City Council of this [illegible] ordinance requiring the Peoria Rail[illegible] feed wires underground in the central portion of the city. The ordinance [illegible] completed by March 1, [illegible] at $20,000. Following this came the ordinance requiring the company to [illegible] work. This was [illegible] cement pole might [illegible]

[illegible] changing [illegible] on the line between the cities of Springfield and Decatur. [illegible]

tem, where the instrument was carried on the car and plugged into the jack box at the sidings. This was the cause of much trouble, for the boxes were distributed so that there was a box on every twenty-fourth pole. The new way contemplates the erection of booths that will contain the telephone. The telephone is not connected to the line till the door of the booth is opened. This is the invention of the company's men, and if the scheme works as well as expected the remainder of the lines will be equipped with the same apparatus.

The Perry Time Stamp Company of Chicago has certified to a change of name to the Stromberg Electric Manufacturing Company.

General Traffic Manager Stephens of the Illinois Traction Company was in the city this week to see about the awarding of the contracts for the overhead crossing of the Chicago and Alton tracks at Lincoln.

According to the report of the state board of railroad and warehouse commissioners, which was issued this week for the year ended June 30, 1907, there were in the state 1,456 miles of surface and elevated roads operated with electricity, an increase of 269 miles. The total income of the electric roads was $13,956,210 for the year, an increase of $1,676,018. The net-income increase over the former year is given as $385,299. The number of employes is 6,607 and they received $4,479,742 in wages during the year, which is an increase of $513,980. The commission recommends that a law be passed giving it the authority to separate the grade crossings now existing, to prescribe the manner in which telephone and telegraph wires should be protected at crossings and tracks, and providing for the approval of the commission of all proposed issues of stocks and bonds before being issued

V. N.

Northwestern States.

Minneapolis, Minn., March 14.—The Jefferson Interurban Railway Company of Jefferson, Iowa, has been incorporated with a capital stock of $3,000,000 by Albert Head and associates. They contemplate securing a right-of-way for an interurban road to Perry, Iowa. Other propositions are being considered.

Alfred F. Pratt has been named receiver for the Anoka Electric Light and Waterworks Company of Anoka, Minn. The holders of bonds propose to improve the present plant.

The new interurban cars for the Plymouth line of the Sheboygan Light, Power and Street Railway Company of Sheboygan, Wis., will be in operation shortly.

Citizens of Lake City, Iowa, are endeavoring to secure a right-of-way for the proposed interurban line.

United States mail will be carried between Fort Dodge and Des Moines, Iowa, over the Fort Dodge, Des Moines and Southern interurban road hereafter.

The Twin City Rapid Transit Company of Minneapolis has purchased a site for a North Side transforming station at Third Street and Thirty-second Avenue, N., to be similar to the one on Lake Street.

An electric-light, water and power-house commission has been established at Winnebago City, Minn., to have control of the power house.

The Mitchell Illuminating and Power Company, a recently established organization of Mitchell, S. D., has taken possession of the electric-light plant formerly owned by the Mitchell Gas Company. D. B. Miller is president.

The Winnebago Traction Company of Oshkosh, Wis., has ordered six new open cars for the White City line.

R.

Pacific Slope.

San Francisco, March 11.—Another move looking toward extensive electric-railway construction by the interests controlling the Key Route system on the east side of San Francisco Bay was made this week. The San Francisco, Oakland and San Jose Railway Company was incorporated with a capital stock of $7,750,000 to take over the San Francisco, Oakland and San Jose Railway and the recently incorporated San Francisco and Bay Counties Railway. The incorporators of the consolidated company are the same as those of the two companies previously incorporated. The company will operate a total of 81.66 miles by the overhead-trolley system already in use on the Key Route.

The municipality of San Diego will erect ornamental electric-lighting posts along Sixth Street in that city at a cost of $5,490.

The city authorities of Placerville, Cal., have ordered plans drawn for the putting in of an electric-lighting plant.

The Coquille Valley Power Company of Coquille, Ore., has announced plans for its power plant at the head of Brewster Valley. Water will be piped 5,000 feet to the power house, where a fall of 300 feet will be secured. A three-acre site has been secured for the power house and about 120 acres for a reservoir site. Duplicate waterwheels and electrical units, each with a capacity of 4,000 horsepower, will be put in. Power will be transmitted to the town of Myrtle Point, Coquille, Marshfield, North Bend and Bandon. The work is under the direction of J. S. N. Smith, consulting engineer.

Notwithstanding the fact that the San Francisco Gas and Electric Company has slightly increased the capacity of its electric generating stations and the City Electric Company is generating 6,000 kilowatts and will have an additional 6,000-kilowatt steam-turbine unit installed in April, there is still a large unsatisfied demand for electric power. It is reported that an additional central-station electric plant is to be installed by new interests in this city. Some of the isolated electric plants, which have been started in the basements of buildings since the fire, are costing their owners more than purchasing current would.

The San Francisco office of the Westinghouse Electric and Manufacturing Company has been moved into the six-story Electrical Building at 165 Second Street, after a long period of temporary locations since the fire. W. W. Briggs, the district manager, has been visiting in East Pittsburg.

Sanderson & Porter of New York city have opened a Pacific Coast branch office at 907 Union Trust Building, San Francisco, which has been placed in charge of Wynn Meredith. During the last ten years Mr. Meredith has been prominent in the engineering of a number of the large electric power-transmission projects from Southern California to British Columbia. A number of radical improvements in electrical-engineering practice in the West originated with him.

A.

PERSONAL.

Mr. Frank F. Fowle has opened an office in the Marquette Building, Chicago, as consulting electrical and telephone engineer.

Mr. George R. Carr, vice-president of the Dearborn Drug and Chemical Works of Chicago, has left for a business and pleasure trip to the City of Mexico.

Mr. H. W. Hanna of Chicago has been appointed manager of the Chicago, Lake Shore and South Bend Traction Company, with headquarters at Michigan City, Ind.

William H. Heiss, who was assistant manager of the United States military telegraph during the Civil War, died at his home at Sioux Falls, S. D., a few days ago. He was 81 years old.

John Burry, electrical engineer and inventor of the Burry printing-telegraph system, died suddenly on March 12th at his home in New York. He was 47 years old and a native of Switzerland.

Mr. Everett Morss, president of the Simplex Electrical Company of Boston, has been elected a member of the corporation of the Massachusetts Institute of Technology. He is a graduate of the class of '85.

Mr. Arthur Williams of the New York Edison Company has been appointed to represent the National Electric Light Association on the executive committee of the Empire State Gas and Electric Association.

Mr. A. Press has become connected with the American Transformer Company of Newark, N. J. He will act in the capacity of chief electrical engineer. At one time Mr. Press was in the employment of the Siemens & Halske interests.

Mrs. Clarence H. Mackay has been unanimously elected to membership in the Roslyn (L. I.) Board of Trade. The action of the board is considered a complimentary acknowledgment of her work in bettering the schools and other public institutions.

On March 13th the directors of the American Institute of Electrical Engineers transferred these associates to full membership: Henry James Shedlock Heather, Johannesburg, Transvaal, Africa; Howard Saunders Warren, New York city; Walter Farrington Wells, Brooklyn, N. Y.

Mr. John W. Brashears, who for many years has been first assistant to Mr. W. A. Converse, chemical director of the Dearborn Drug and Chemical Works, Chicago, in charge of the analytical laboratories, has been appointed assistant superintendent of the manufacturing department.

Mr. R. S. Stangland has been placed in charge of Muralt & Co.'s construction office at New Fort Lyon, Colo., and will superintend the erection of the complete lighting, heating and power plant which his firm is building for the United States government at the New Fort Lyon Naval Hospital.

Mr. A. W. Brady, president of the Indiana Union Traction Company of Anderson, Ind., has gone to Washington to meet a number of electric railway men to confer with the Interstate Commerce Commission relative to the preparation of a system of accounting for electric railways throughout the country.

Dr. R. V. Wagner, inventor of a number of X-ray appliances, died of cancer at the Passavant Memorial Hospital in Chicago on March 12th. Dr. Wagner was head of the firm of R. V. Wagner & Co., Chicago, and some of the appliances which he invented were the means of prolonging his life for several years. He was born in Logansport, Ind., in 1860, and was graduated from the Central

Medical College, Indianapolis, in 1880. He practiced medicine one year and came to Chicago, where he engaged in the manufacture of electrical appliances for physicians.

Mr. Thomas A. Edison has left the Manhattan Eye, Ear and Throat Infirmary, where he was operated on for antral abscesses about two weeks ago, and returned to his home in West Orange, N. J. He is said to be practically recovered. Mr. and Mrs. Edison had planned to leave last Saturday in a private car for Florida. They will remain in the South for several weeks.

The funeral of the late Allan C. Durborow was held from the Church of the Epiphany, Chicago, on March 13th. Among those in attendance were a number of electrical men. The floral tributes were profuse and beautiful. As a tribute of respect the flag on the house of the Illinois Club, of which Mr. Durborow was a member, was displayed at half mast on the day of the funeral.

Mr. Edwin E. Downs, who has been appointed general manager of the Sterling, Dixon and Eastern Railway Company and the Lee County Lighting Company, to succeed Edward B. Kirk, resigned, arrived in Dixon, Ill., a few days ago and assumed the management of the properties. Mr. Downs took up electrical work in the employment of the Thomson-Houston Electric Company 18 years ago. Since then he has held responsible positions in constructing, managing and operating electrical properties in Michigan, Indiana, Oshkosh (where he was president and general manager of the Winnebago Traction Company), San Francisco and Chicago.

ELECTRIC LIGHTING.

Louis Miller contemplates installing an electric-light plant at Arcadia, Mo.

Neal H. Nye has been granted a franchise for an electric-light plant in Pender, Neb.

The Columbus (Neb.) Light, Heat and Power Company has been incorporated with a capital stock of $150,000.

The Yorktown (Tex.) Light and Ice Company, recently incorporated, has purchased the plant of F. Koenig & Sons.

The Board of Aldermen of Houma, La., has been discussing the subject of an electric-light plant, and $6,000 has been set aside as a fund for a plant.

High water in the Kalamazoo River has been threatening the destruction of the $50,000 municipal dam which furnishes the power for the city lighting plant at Marshall. Dams above that at Marshall went out, raising the water rapidly.

Three different interests are asking a franchise to furnish commercial lighting in Galena, Ill., among them the Galena Iron Works, the Tri-state Light and Power Company and Mr. L. J. Highland, the latter offering to take over the city light plant.

The Buena Vista Smelting and Refining Company has been granted a 20-year franchise for a street-lighting, heat and power plant by the town board of Buena Vista, Colo. The company will get its power from a plant on the Arkansas River.

The Town Council of Ladysmith, British Columbia, has decided in favor of installing an electric-lighting plant for municipal and domestic purposes. Specifications and prices are now being obtained for the work. Address the mayor or town clerk.

G. I. flame arc lamps are described in a four-page folder distributed by the General Electric Company. This lamp is a simple American development of the flame-arc principle, using gravity feed without clock mechanism, and is suitable for any standard make of flame-lamp carbons.

The Board of Public Works of Marion, Ind., has instructed the superintendent of the municipal lighting plant to ascertain the cost of a direct-connected engine and generator of 500 kilowatts capacity and a 250-horsepower water-tube boiler to increase the capacity of the plant.

By a decree of the Federal Court, in the interests of the Knickerbocker Trust Company of New York, the sale of the Crawfordsville (Ind.) Water and Light Company will be conducted by Edward Daniels, master in chancery, in a short time. No bid is to be accepted for less than $75,000.

The plant and franchise of the Mangum Electric Light and Power Company at Mangum, Okla., has been sold by W. T. Funderburk for $60,000 to interests represented by C. J. Patterson and J. W. Chambers. These two men have been operating a plant in Ada, Okla., and will now move to Mangum, where the plant will be enlarged and the extensive field developed.

Prof. A. C. Humphrey of New York and London, an authority on gas service and the valuation and accounting of public-utility plants, testified before the railroad commission of Wisconsin in the case brought to force the Madison Gas and Electric Company to give better service at lower rates. Mr. Humphrey testified that in his opinion the [illegible]

[illegible]

The General Electric Company has issued Bulletin No. [illegible] devoted to tungsten lamp for series incandescent street lighting. Data and prices, candlepower distribution curves and illustrations of the lamp and ornamental brackets used in street lighting are given. The lamps are rated at an efficiency of 1¼ watts per candlepower, with an estimated life of approximately 1,000 hours. On this basis a comparison with the carbon-filament lamp, taking 3.5 watts per candlepower, shows that the tungsten lamp gives a saving of 90 kilowatt-hours per lamp, and at two cents per kilowatt-hour this makes the actual value of the tungsten lamp $1.80 greater than the carbon-filament lamp. It is said to be possible to substitute 40-candlepower tungsten lamps for 25-candlepower carbon-filament lamps and yet secure considerably greater profits. The ampere range of the various types of lamps is from 3.7 to 8 and the candlepower from 32 to 60.

ELECTRIC RAILWAYS.

Mayor Henry H. Lombard of North Yakima, Wash., has been elected president of the Yakima Inter-valley Electric Railway Company, which proposes to build a line from North Yakima to Granger, Wash.

The Fidelity Trust Company has been appointed receiver in Wisconsin for the Chicago and Milwaukee Electric Railway Company. This course was taken to enable the defendant company to pay its creditors and save the system to the public.

The Virginia and Truckee Railway Company, operating a steam road between Reno and Virginia City, Nev., is planning to change to electric operation. Chief Engineer Kirk of the road is figuring on running two electric trains each way daily. The plan is to use the overhead trolley in the city limits and the third rail the remainder of the distance.

The total traffic of the four elevated railways of Chicago for February was 11,781,297 passengers, compared with 10,865,262 in February, 1907. The Metropolitan and Oak Park lines show a decrease, while the South Side and Northwestern roads had an increase. There are periodical rumors of a consolidation of the four roads, but nothing authoritative has developed.

City Electrician Caffrey of Reno, Nev., is quoted as saying that the Virginia and Truckee Railroad Company is contemplating the plan of running all trains by electricity. The company is said to have asked Mr. Caffrey for estimates in regard to the cost of operating two trains each way between Reno and Virginia City each day and several trains between Reno, Carson, Steamboat and other points.

The Greater Des Moines committee has been active in interesting Des Moines citizens in the proposed building of the Des Moines, Winterset and Creston Electric Railway. Creston and Winterset citizens are said to have subscribed liberally to the stock of the company, and Des Moines men are now urged to the support of the project. At a recent meeting 50 prominent citizens were guests of the committee.

The Cheyenne (Wyo.) Tribune says that the city of Sheridan will have the first street-car system in Wyoming, if present plans mature. S. A. Broadwell is negotiating with the City Council for a franchise and promises to have a part of the line in operation next fall, if granted a franchise. The plan contemplates connecting the large coal camps with the city. These camps employ more than 5,000 men. Coal can be obtained at less than 75 cents a ton, and while it is probable the Big Goose Falls will be used to furnish power during the summer, an auxiliary steam plant will be put in at one of the mines, it is said.

With the adoption of electricity as a motive power on the Oakland (Cal.) side of the bay by the Southern Pacific Company the routes of several of the trains are to be changed. The change to electric power on the East Bay lines will be completed in a year, according to the statement made by Assistant Superintendent Roberts. Engineers of the company are now preparing for the change, and orders have been placed for the rolling stock. Alameda and Berkeley will be given the electric service as well as Oakland, and it is possible that if the Hayward and San Leandro line is started at the same time the trains to these points will also be electrically driven.

POWER TRANSMISSION.

C. E. Mitchell, C. E., Toronto, Ont., who has been retained by the City Council of Prince Albert, Saskatchewan, estimates the cost of developing 10,000 electrical horsepower on Steep Creek, near [illegible]

[illegible]

The city of [illegible] and Power Company. C. W. Humphrey, E. E., of Chicago, represents the city in the negotiations.

Chicago men have been in Blue Rapids, Kan., endeavoring to secure [illegible] water-power right [illegible] Blue River at that point. It is their intention to [illegible] the dam and [illegible] to be distributed to factories.

In the condemnation proceedings of the Northern California Power Company against the Pacific Power Company, the jury returned a verdict granting the plaintiff the land sought to be condemned by it and granting to the defendant the sum of $32,500 in remuneration for the land, which consists of but 12 acres. The suit hinged on which company started first to make use of its water rights. The Northern company had already spent $93,000 on a dam across Battle Creek, and the reservoir thus created would submerge the proposed plants of the Pacific company. It is said neither company is pleased with the verdict, and the Northern company has given notice of appeal.

PUBLICATIONS.

The Lord Electric Company, 213 W. Fortieth Street, New York, has issued a bulletin illustrating the Earll trolley catchers. This is the first description of the Earll trolley catchers, although the device has been in service long enough to demonstrate excellent qualities. The trolley catchers are interchangeable with the Earll trolley retrievers.

Portland-cement mortars and their constituent materials have been under investigation at the structural materials testing laboratories of the United States Geological Survey at Forest Park, St. Louis, Mo., for more than a year, and a report on the work—the joint product of Messrs. Richard L. Humphrey, the engineer in charge, and William Jordan, Jr., his assistant—has just been issued by the Survey as Bulletin No. 331.

A special publication, No. 9009, just issued by the Westinghouse Traction Brake Company, Pittsburg, is entitled "Magnetic Brakes." It is a reprint of a paper presented by Mr. A. L. C. Fell before the Tramways and Light Railways Association in London, with notes by the Westinghouse company. Mr. Fell's paper is an exhaustive one on the subject of brakes and is supplemented with curves, tables and detail drawings. The Westinghouse Traction Brake Company will send its experts to investigate any local situation and make recommendations as to the adaptability of the magnetic-brake equipment.

Bulletin No. 4561 from the General Electric Company is an interesting 16-page pamphlet on illumination, giving solutions of many of the problems involved and containing a large number of cuts of the Gem lamp and fixtures especially suited for its installation, etc. Illumination tables give the foot-candle values on different horizontal planes when the lamp is used with various types of Holophanes. The Gem unit is easily renewed, fits the standard socket and burns on any standard circuit. It gives a downward efficiency of from 1¾ to nearly one watt per candle, and is especially useful for all interior lighting. The Gem units give low investment charge and cheap renewals.

SOCIETIES AND SCHOOLS.

The railroad telegraph superintendents will hold their next annual convention at the Windsor Hotel, Montreal, Que, June 24th, 25th and 26th.

The success of last year's electrical show at the University of Illinois has led to its repetition. This year's show will be held on March 26th, 27th and 28th. Outside exhibitors are asking for space.

On March 11th was held a meeting of Lewis Institute Branch, American Institute of Electrical Engineers. Prof. John D. Nies of Lewis Institute gave an illustrated popular lecture on "Niagara's Power" to a large audience.

Owing to the change of date of the Omaha electrical show from April 13-18th to May 4-9th, the first annual convention of the Nebraska Electrical Association has been changed from April 15-16th to May 6-7th, at Omaha. Mr. William Bradford of Lincoln is secretary.

A new physics laboratory, to cost $250,000, is to be built at Urbana by the University of Illinois. It will be three stories in height, with a frontage of 178 feet and a depth of 125 feet. There are to be two lecture rooms, both on the ground floor, one seating 300 and the other 125 persons. The east wing will be used largely for smaller labora-

tories which are needed for special research work. The west wing will be used for the larger laboratories for electrical measurements and for the sophomore courses in general physics.

Armour Institute Branch American Institute of Electrical Engineers held a meeting on March 12th at which Ralph H. Rice of the Board of Supervising Engineers, Chicago Traction, gave an interesting talk on "Chicago Traction Problems." An abstract of this lecture will appear in a subsequent issue of the Western Electrician.

The Builders' Club, composed of architects, contractors, manufacturers and supply men from all parts of the state, has been organized in Oklahoma City to promote the building interests of Oklahoma. Over 60 members have been enrolled, and quarters have been secured in the Martin Building, Harvey and Main streets. F. E. Harkness is secretary.

There was a good attendance at the last meeting of the Toledo Section of the American Institute of Electrical Engineers. The meeting was addressed by C. F. Sloctemyer, who spoke on "Steam Turbines." The address was interesting in the comparison of the steam turbine of today with early discoveries. The present-day advantages were pointed out, and particularly in electrical work the uniform angular velocity of steam turbines was held out by the speaker as a salient feature.

The first meeting of the Central Electric Railway Association for the year will be held at the Claypool Hotel, Indianapolis, Ind., on March 26th. A large attendance is expected at this meeting, as the Central Electric Traffic Committee will make its report, and it is believed that some definite action will be taken to make it a permanent organization. Through the courtesy of A. A. Anderson, general manager of the Indianapolis and Louisville Traction Company, all members are invited to take a trip over the 1,200-volt direct-current traction line to Louisville.

At the meeting of the Electrical Section of the Western Society of Engineers on the evening of March 11th, Prof. Morgan Brooks, head of the department of electrical engineering at the University of Illinois, presented a paper on "Alternators in Parallel," which was illustrated by a number of tests demonstrating the ease of synchronizing by Professor Brooks' method. A machine at the Harrison Street station of the Commonwealth Edison Company was used for this work. Among those engaging in the discussion were Messrs. D. W. Roper, James Lyman, Peter Junkersfeld, E. F. Smith, W. L. Abbott and G. H. Lukes. A report of the meeting appears elsewhere in this issue.

MISCELLANEOUS.

The first license under the new electric-wiring ordinance in Colorado Springs, Colo., was issued from the office of the city clerk to the Central Electric Company. The ordinance provides that any firm contracting to do electric wiring must pay $50 a year for a license. The effect of the ordinance, it is expected, will result in reduced danger from fires, as wiring by inexperienced workmen is prohibited.

Consul George H. Pickerell of Para, Brazil, forwards an official notice inviting tenders for the leasing of the electric street-railway and lighting system belonging to the state of Amazonas, Brazil. Bids for this proposition must be deposited with the treasurer of the state of Amazonas, Manaos, on or before April 1, 1908. The consul suggests that interested persons will save time by writing direct to the official named above or the American consular agent in that place. Copy of the notice may be obtained from the Bureau of Manufactures in Washington.

Walter Wellman, commander of the Wellman-Chicago Record-Herald polar expedition, lectured in Chicago on March 16th on Arctic exploration and his efforts to reach the North Pole by aerial flight. During his closing remarks he said: "The trial we made of the airship demonstrated the rationality and simplicity of the method, and with the valuable experience already gained the future promises fruition of our desires."

During January the Duquesne Steel Foundry, which operates a large plant in the Pittsburg district, decided to adopt the gas-power system to operate the works, formerly driven by steam. The initial equipment will consist of a 400-horsepower (maximum) Westinghouse gas engine of the three-cylinder vertical enclosed type, direct-connected to a 240-kilowatt generator, which will serve the various motors in the plant. The plant will operate on natural gas, which is available in large quantities in the Pittsburg district at such low rates as to render gas power the cheapest form of power available in this section of the country.

The committee appointed by the British Treasury last year to investigate the charges made that the National Physical Laboratory was developing into a commercial institution and in this way competing with private testing laboratories, has been issued. The essence of the report is that the complaints in question are more fancied than real, but that in order to allay the suspicions which evidently exist a clear line should be drawn in the future between what is called "contractual testing" and "investigation testing," the former being defined as testing materials to ascertain whether they comply with the conditions laid down in specified contracts.

Washburn-Crosby Company of Minneapolis, operating by hydraulic power at the Falls of St. Anthony a group of flour mills which are among the largest in the world, has found it necessary, of late years, to depend more and more upon steam and electric power for the large amount of energy required to turn the long lines of machinery involved in the "continuous" process of flour-making; and the most recent development in this respect is the purchase of an Allis-Chalmers steam turbine and generator of 1,500-kilowatt capacity. This will generate three-phase, 60-cycle alternating-current, at 480 volts, for operating induction motors to drive the new "C" mill.

Speaking on the subject of "Intermunicipal Competition" in Chicago a few days ago, Charles Ferguson, president of the Municipal University of Kansas City, said that the most important political work of the next decade in America is to be the emancipation of the cities from the control of political machines. "It is questionable," he said, "whether what is called 'public ownership' will have any considerable career in this country. In general the service corporations are not going to be put into politics. Their managers must come to think of themselves as quasi-public officers and agents of the public. The stockholders must become merely preferred creditors and as such must content themselves with decreasing dividends in proportion to the diminishing risks and the increasing security of the business."

TRADE NEWS.

The Hoosier Storage Battery Company of Evansville, Ind., has been incorporated to take over the Evansville Battery and Electrical Company, of which the late Henry Porter was the founder and president. The new company has a capital stock of $25,000. The incorporators and directors are J. C. Zutt, Willis Copeland, A. F. Karges and others.

BUSINESS.

The American Conduit Company, New York, and 502 Marquette Building, Chicago, has compiled figures showing the proper quantities of material in concrete and will gladly furnish information on the subject.

For lighting and power plants in small towns, factories, office buildings, public and private institutions, etc., there is a steady demand for alternators of moderate capacity. Allis-Chalmers Company states that its AB alternators of the new "self-contained" type are especially suited for requirements of this kind where a belted generator not exceeding 150 kilowatts output is needed, and although put on the market only recently they have already been installed in every section of the country.

The Westinghouse Machine Company, builder of the Roney mechanical stoker, reports for the first two months of this year a good demand for stoker equipment. Perhaps the most interesting orders have come from cold-storage companies, three of which have engaged seven equipments. A municipal lighting station at Troy, Ohio, has adopted Roney stokers, and the Pennsylvania Light, Heat and Power Company of Allegheny, Pa., operating a large central station at that place, increases its present equipment with two stokers of large capacity. Several other orders are reported.

The Dyno and Chemical Manufacturing Company of Aurora, Ill., is now prepared to furnish the "Dyno" commutator rebuilder. The company says that its product has been thoroughly tried and tested and has given entire satisfaction. The "Dyno" commutator rebuilder is a composition that can be used on all dynamos and motors, and is said to clean the commutator perfectly and leave a non-heating surface. It is used to prevent sparking, cutting, blowing of fuses, short-circuiting, and to increase the life of commutators. It leaves a high glossy finish and prevents the dust and dirt from adhering to the commutator. The manufacturer will gladly mail sample of the "rebuilder" to anyone interested.

DATES AHEAD.

Electrical Committee, Underwriters' National Electric Association (general meeting), 32 Nassau Street, New York city, March 25th and 26th.

Electrical show at University of Illinois, Urbana, Ill., March 26th, 27th and 28th.

Iowa Electrical Association (annual meeting), Savery Hotel, Des Moines, April 22d and 23d.

Iowa Street and Interurban Railway Association (annual convention), Savery Hotel, Des Moines, Iowa, April 23d and 24th.

Missouri Electric Light, Gas and Street Railway Association, Marquette Hotel, St. Louis, April 23d, 24th and 25th.

Omaha Electrical Show, Auditorium, Omaha, Neb., May 4th to 9th.

Nebraska Electrical Association (annual meeting), Omaha, Neb., May 6th and 7th.

Missouri Independent Telephone Association, Kansas City, May 6th and 7th.

Southwestern Electrical and Gas Association (annual meeting), El Paso, Tex., May 7th, 8th and 9th.

National Electric Light Association (annual convention) Auditorium Hotel, Chicago, May 19th to 22d.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 10, 1908.

881,108. Apparatus for Electrolysis of Brine. Courtland F. Carrier, Jr., Elmira, N. Y., assignor to the Elmira Electrochemical Company, [illegible] N. Y. Application filed April 25, 1907.

[illegible] cell has decomposing and oxidizing [illegible] mercury there- [illegible] through the decomposing compartment diminishing in superficial area in the direction of flow.

881,114. Electric Vibrator. John M. Dinkins, Indianapolis, Ind., assignor to the Hercules Electric and Manufacturing Company, Indianapolis, Ind. [illegible] July 27, 1906.

[illegible] and armature.

881,115. Electrically Operated Fender for Street- [illegible] Denver, Colo. Application filed June 17, 1907.

[illegible]

881,136. Apparatus for Regulating the Depth of Moored Floating Bodies. Karl O. Leon, Stockholm, Sweden. Application filed November 16, 1906.

A submarine mine has a moored floating body enclosing the detonator and a floating contact buoy connected by a cable to it. An electric motor in one of the floating bodies winds or unwinds the cable as the variation of the water pressure in a gauge on the contact buoy closes the motor switch one way or the other.

881,138. Electric Block Signal. Edward P. Matter, Alexandria, Va. Application filed May 13, 1907.

A short piece of rail associated with the block circuit is arranged to engage a contact shoe carried by the train and thus to close the circuit of an electrically operated signal on the train, when the block immediately preceding is occupied.

881,148. Apparatus for Examining Submerged Bodies. Désiré Pépin, Sr., Montreal, Quebec, Canada. Application filed May 24, 1907.

One of two telescoping tube sections has a frusto-conical drum secured to it and an eye-piece is carried by the other section. Brackets are attached to the inner face of the former and a horizontally mounted mirror is carried by the brackets and adapted to reflect light downwardly. Electric lights are carried by the brackets and mounted directly beneath the mirror.

881,181. Battery Holder. Emory S. Egge, Montgomery, Ala. Application filed August 14, 1907.

A means for coupling electric battery cells comprises battery terminal plugs of conical shape adapted to be secured to the terminals of the cells, and a coupling conductor having its ends formed into conical spirals to receive the conical plugs.

881,235. Gas Igniter. Carlo T. Giorgi, Florence, Italy. Application filed October 5, 1904. Renewed February 1, 1908.

The burner is provided with a main valve and with a side passage and by-pass. A hollow member is slidably mounted within this passage and is provided with a constriction and with an opening adjacent thereto. Electromagnetic mechanism controllable from a distance governs this member for actuating the main valve.

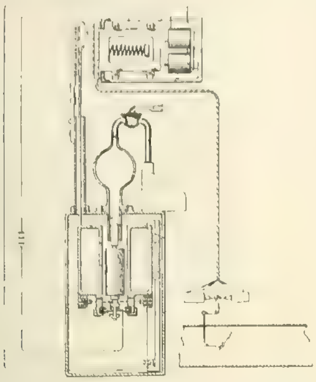
881,247. Electric Pump Regulator. Andrew Koesche, Chicago, Ill. Application filed September 13, 1907.

Combined with a movable tripper is an electric switch comprising stationary and movable contacts, a lever carrying the movable contact, a two-arm angle lever having one arm engaged with the tripper and a spring connected to the other arm and to the contact lever, a lug on the latter and a projection on the angle lever to engage this lug.

881,264. Electric Signal Device. Elias Schermerhorn, Amsterdam, N. Y., assignor of one-half to William P. McKeough, Amsterdam, N. Y. Application filed September 1, 1906.

A casing has two compartments, one for the battery and the other for [illegible] A lamp [illegible] light purposes [illegible] [illegible]

881,272. Automatic Draft Regulator. Henry J. Westover, New York, N. Y. Application filed January 8, 1907.



NO. 881,272.—AUTOMATIC DRAFT REGULATOR.

A magnetic core connected with the draft regulator is controlled by two solenoids. The circuit of one of these is governed by variations of steam pressure. That of the other coil is governed by variations in percentage of CO_2 in the flue gases as determined by an automatic gas-analyzing apparatus. (See cut.)

881,284. Wall Bracket for Electric Lights. William R. Atkinson, New York, N. Y. Application filed April 23, 1907.

This bracket is intended to be mounted on molding work. It has an insulating base, secured between the grooves and provided with side plates connecting with the wires in the molding.

881,297. Socket for Electric Lamps. Charles G. Burton, Peru, Ind. Application filed March 14, 1907.

The socket has a key switch, one contact of which does not complete the circuit, even when the switch is "on," unless the lamp has been inserted.

881,300. Electric Switch. Everett M. Coffin, Oakland, Cal. Application filed March 7, 1906.

A push-button wall-pocket switch has a pivoted rocking contact with a spring-controlled shifter.

881,306. Electric Switch. George Cutter, South Bend, Ind. Application filed June 13, 1906.

This rotary snap switch has a switch blade provided with a pair of contacts insulated from each other and movable to connect the line-wire contacts or to connect each line-wire contact with a lamp contact.

881,344. Electrical Sign Receptacle. Frank J. Russell, New York, N. Y. Application filed April 5, 1907.

The receptacle comprises a pair of cup members nested one within the other and clamped upon opposite sides of the supporting element, one of the cup members carrying both plug contacts and one of the wire connections.

881,359. Trolley-pole Controller. Cisco R. Traxler and Edward E. Lineback, Winston Salem, N. C. Application filed April 16, 1907.

A weight attached to the trolley rope is arranged to move in a tubular guide, which has a longitudinal slot connected with a lateral seat that engages a projection on the weight. If the trolley leaves the wire the weight is released and lowers the pole.

881,360. Telephone Relay. Charles W. Underwood, Crowley, La. Application filed July 6, 1907.

An armature is in operative relation to the telephone receiver magnet and mechanically connected to the transmitter element. The wire support for the armature has a localized central connection thereto and means for putting the wire under longitudinal strain or stress and for centering the armature to the polar extremities of the receiver magnet.

881,371. Electrical Plug and Receptacle. Pennell C. Brown, Boston, Mass., assignor of one-half to Frank J. Russell, New York, N. Y. Application filed October 20, 1906.

This attachment plug has a base carrying external plug contacts and internal receptacle contacts operatively connected. A connection piece has interior conducting elements having a snapping engagement with the receptacle contacts, and separate release buttons supported by the connection piece and movable against the conducting elements.

881,387. System of Control for Electric Motors. Arthur C. Eastwood, Cleveland, Ohio. Application filed March 6, 1907.

In an electric-railway system there is in combination with a train of cars an electric generator driven on the train and electric-driving motors on certain of the cars. A stationary power-conductor is mounted along the railway through which and the rails of the railway the generator may deliver a variable voltage to the motors, and there are means on the train for varying the voltage delivered by the generator.

881,390. Illuminated Sign. James W. Ellis, Denver, Colo., assignor of one-half to Andrew P. Thompson, Denver, Colo. Application filed October 2, 1907.

A letter for an illuminated sign consists of a back having the desired outline and a projecting rim conform- [illegible]

881,4[illegible]. Electric Equipment for Tree [illegible] Charles E. Hallister, Waterbury, Conn. Application filed [illegible]

[illegible]

881,4[illegible]. Valve Stem and Tire-deflation Alarm. Abbott F. Kay, Chicago, Ill. Application filed August 3, 1906.

[illegible]

881,447. Apparatus for Registering Telephonic Calls. Carl W. Sharer, Philadelphia, Pa., assignor to the Keystone Telephone Company, Philadelphia, Pa. Application filed April 26, 1907.

A numerical registering device at the subscriber's station is provided with means for operating it and at the same time producing a pair of signals, one electrical and one mechanical, to indicate that it has been operated.

881,453. Apparatus for Protecting Grain Stacks. John P. A. Anderson, Madrid, Iowa. Application filed February 25, 1907.

This protection for grain stacks from lightning and rains comprises a flexible waterproof cover, an insulator on top of the cover, a metal disk, a lightning rod point on the top and center of the disk, insulator and cover, lightning rods connected with the point and extended over the insulator, and means for electrically connecting the ends of the rods with the ground.

881,456. Dynamo-electric Machine. Henry Berg, Orange, N. J. Application filed August 8, 1905.

In combination with the field magnets and a solid ring armature are fans or wings upon each end of the armature adjacent to its periphery and adapted to create a current of air away from each end of the armature during its rotation.

881,460. Magneto for Sparking Mechanisms. Harold H. Brown, Boston, Mass. Application filed February 14, 1907.

The movement of the armature shaft is obstructed until the machine reaches a certain speed.

881,464. Expression Device for Keyboard Musical Instruments. John W. Darley, Jr., Baltimore, Md. Application filed December 13, 1905. Renewed August 2, 1907.

An electrically controlled wind musical instrument is provided with sound-producing means and means for causing the loudness of the sound produced to vary from a pre-determined degree with the speed of the operating mechanism without changing the pitch.

881,470. Trolley. Charles Harkness, Providence, R. I., assignor to the United Traction Improvement Company. Application filed November 28, 1906.

The trolley pole carries two independent vertical stems, in each of which an independent gravitating trolley wheel is supported and mounted for vertical movement under torsional strain tending to preserve the wheels in alignment.

881,479. Chronograph. Ezra B. Merriam, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 22, 1904.

Means for recording the frequency of an alternating current comprise an electromagnet connected to be energized by the current, a table above the same, a bridge over the table, a guide depending from the bridge in line with the electromagnet, and a loose weight in the guide carrying a marking point.

881,503. Automatic Street Indicator. Thomas Tighe and Charles S. Cross, New York, N. Y. Application filed May 31, 1906.

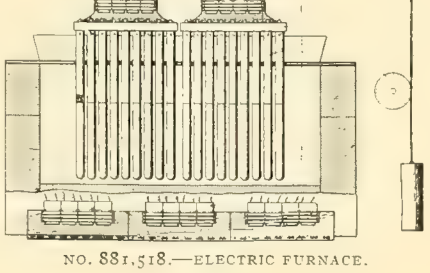
An electric motor drives the device carrying the street names through a clutch acting intermittently.

881,517. Electric Furnace. Charles E. Wilson, Ferris, W. Va. Application filed September 15, 1906.

The melting receptacle is provided with main electrodes and an exciting electrode movable between the main electrodes, toward one and away from the other. The melting receptacle can be tilted so as to prevent the accumulation of molten metal from contacting with one electrode.

881,518. Electric Furnace. Charles E. Wilson, Ferris, W. Va. Application filed September 15, 1906.

In this furnace two suspended terminal heads carry a number of pencil electrodes. While one set is in use the other can be renewed. (See cut.)



NO. 881,518.—ELECTRIC FURNACE.

881,5[illegible] [illegible]

[illegible]

881,531. Current Collector for the Third Rail of Electric Railways. John G. Barker, White Plains, N. Y. Application filed August 24, 1907.

[illegible]

881,533. Sterilizing. Edward P. Beckwith, Cazenovia, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 9, 1905.

The water-purifying apparatus consists of a number of concentric insulating tubes provided with a conductive coating, means for establishing an electric stress between the coatings to produce ozone, and means for supplying water to the innermost tube, the tube having openings through which the ozone is entrained to purify the water.

881,539. Electric Bell. Donald M. Bliss, New York, N. Y. Application filed March 1, 1906.

A waterproof casing surrounds the mechanism, which consists of an electromagnet with vibrating armature and a separate electromagnet to act as circuit interrupter.

881,554. Production of Electrotypes. Sherrard O. Cowper-Coles, London, England. Application filed February 25, 1907.

A matrix comprises a lead sheet, an intermediate layer of elastic material and a backing of another sheet of lead.

881,565. Safety-limit Switch. Henry A. Everett, Barrington, N. J., and Arthur Parker, Philadelphia, Pa. Application filed July 23, 1907.

A single pole, double-throw switch has a pin in its blade that normally engages a finger pivoted on the base. When the finger is moved by clockwork a spring operates the switch.

881,580. Method of Recovering Copper from Ore or Matte by Electrolysis. Henry K. Hess, Philadelphia, Pa. Application filed January 31, 1907.

The process consists in immersing porous briquets containing particles of comminuted ore and clay in an electrolyte together with a lead electrode in permanent contact with the briquets and subjecting the same to the action of a current for the liberation of the copper.

881,585. Electric Motor. Edward Hopkinson and Julius Frith, Manchester, England, assignors to Mather & Platt, Limited, Manchester, England. Application filed December 29, 1905.

This induction motor has a stator with two oppositely disposed parts provided with polyphase windings producing oppositely moving magnetic fields therein, and a number of independent rotors revolving about separate axes and arranged between the parts of the stator.

881,587. Trolley-wheel-placing Device. Hubert G. Husted, Oberlin, Ohio. Application filed July 29, 1907.

An auxiliary device for placing the trolley wheel and for drawing it into alinement with the wire comprises a pivoted idler provided with a central annular groove, auxiliary reverse spiral grooves on each side thereof, and terminal flanges and a pivoted support for the idler upon the pole.

881,588. Method of Exhausting Vapor Conductors. Alexander M. Jackson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 4, 1903.

The vacuum in a mercury-arc rectifier with a number of chambers is established by connecting each chamber to the exhaust pump and, while the exhaustion is proceeding, maintaining an arc in the rectifier.

881,596. Electric Carrier. Sam H. Libby, East Orange, N. J., assignor to the Sprague Electric Company. Application filed May 18, 1906.

In an automatic carrier system there is an electrically operated carrier, a switch for controlling the circuit of the carrier motor, a switch-operating arm projecting laterally from the carrier, and a member mounted on the carrier in the plane of the arm and projecting beyond the end of the carrier for engagement with the switch-operating arm of a following carrier.

881,597. Projector. Charles E. Lord, Cincinnati, Ohio, assignor to the General Electric Company, Schenectady, N. Y. Application filed October 19, 1904.

In connection with an arc lamp is a reflector built up of a number of rotatably mounted slats, each having a surface of high reflecting quality and a surface of low reflecting quality. Means for rotating the slats permit the projection of a beam of light of high intensity or of low intensity as desired.

881,599. Means for Transmitting Power from the Axles of Railway Cars. Lawrence C. Maher, Philadelphia, Pa. Application filed June 29, 1907.

A generator carried by the body of a car is connected with a driven wheel by a flexible shaft. A driving wheel

secured upon the axle of the car has a spring for forcing the driven wheel into contact with it. An armature upon which the driven wheel is journaled and an electromagnet are so arranged as to draw the armature upward and thereby lift the driven wheel out of contact with the driving wheel when the magnet is energized.

881,616. Advertising Machine. Elsworth Pickel, Portland, Ore. Application filed November 8, 1906.

An advertising strip is driven by a motor and controlled by an electromagnet.

881,628. Telephone Cut-out. Edwin W. Smith, New York, N. Y. Application filed July 12, 1907.

In combination with a number of party lines and a main line is an armature normally in circuit with the lines, and a number of magnets, one for each party line, connected to the main line and adapted to move the armature to cut out the party line not in use.

881,635. Cab Signal System. David P. Thomson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 2, 1907.

A railway having both rails conductively continuous and having sources of alternating current connected at intervals across the rails is equipped with a signal system that has a coil carried by a vehicle in front of the front wheels and in inductive relation to the alternating current in the rails, and electro-responsive signal means on the vehicle connected to the coil.

881,636. Balancer Set. Louis E. Underwood and Richard W. Douglass, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.

Two compensator machines are connected between the neutral and the opposite sides of the line. Each machine has a shunt-field regulator.

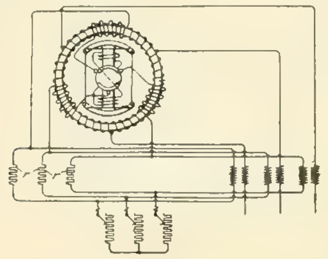
881,638 and 881,639. Floor-dressing Machine. Cyra B. Wattles, Providence, R. I., assignor to the Electric Floor Surfacer Company, Gardiner, Me. Applications filed June 12, 1905.

This is a portable motor-driven planing and finishing machine.

881,642. Electric Relay. Edward Weston, Newark, N. J. Application filed June 21, 1904.

A pair of electromagnets has an armature pivoted at one end of the poles. A pair of contacts on this armature corresponds with a pair of stationary contacts supported on a bar secured to the base.

881,647. Self-excited Alternator. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 19, 1906.



NO. 881,647.—SELF-EXCITED ALTERNATOR.

There is a main armature winding, an auxiliary winding, a field winding provided with a rectifying commutator, brushes bearing on the commutator and connected to the auxiliary winding, and a short-circuited winding carried by the field magnet in inductive relation to the auxiliary winding. (See cut.)

881,652. Coin-controlled Mechanism for Telephone Boxes and the Like. Francis X. Bee, Philadelphia, Pa. Application filed September 12, 1906.

The casing has a slot for the passage of coin, a chute leading from the slot, a permanent magnet located beneath the chute, an operating shaft, a series of kick-off fingers carried by the shaft and a retaining bar for holding the coin in the slot until the kick-off fingers have been brought into operative position.

881,663. Fire Alarm. George H. Carroll, Vacaville, Cal. Application filed November 9, 1907.

This apparatus consists of a circuit closer, a tension device and a fusible cord connecting the two, the circuit closer comprising a slide and a contact piece in the path thereof, each forming portions of an alarm circuit. The [illegible] is a [illegible] drum, to which one end of the fusible cord is connected and upon which [illegible].

881,682. Shield for the Use of Linemen. George E. Harrison and George Burns, Detroit, Mich. Application filed August 1, 1907.

[illegible] flexible material adapted to be rolled into tubular terminals of [illegible]

881,683. Electrical Socket Seal. Llewellyn T. Hatfield, Sacramento, Cal. Application filed August [illegible]

[illegible]

[illegible] June 7, 1907.

[illegible]

881,686. Electric Switch. Silvester Hoadley, Gosport, Ind. Application filed August 12, 1907.

A double-pole, double-throw switch has a series of elastic contact fingers or clips.

881,697. Marine Governor. Lewin D. Kissack, Cloverdale, Cal. Application filed May 10, 1907.

A solenoid and plunger are arranged so as to move the engine throttle in one or the other direction when a switch is thrown.

881,712. Telephone Receiver. Hermann G. Pape, New York, N. Y. Application filed June 16, 1904. Renewed January 25, 1908.

In combination with a casing divided to form front and rear compartments is an armature in one compartment, a diaphragm in the other compartment, a magnet having an enclosing shell screwed into the dividing wall of the casing and a connection passed through the magnet between the armature and the diaphragm.

881,742. Electric-light Support. Philip N. Thevenet, Dallas, Tex. Application filed February 26, 1907.

A horizontal rail carries an extensible supporting member, to which is attached a lamp cord and means for vertically adjusting the same.

881,744. Car-axle Driving-gear for Dynamos. William I. Thomson, Newark, N. J., assignor to the Safety Car Heating and Lighting Company. Application filed November 6, 1905.

The dynamo for an axle car-lighting equipment is mounted upon a cross bar secured to the truck. A spring tends to swing the dynamo away from the axle and thus to put tension on the belt connecting it to the axle.

881,745. Car-axle Driving-gear for Dynamos. William T. Thomson, Newark, N. J., assignor to the Safety Car Heating and Lighting Company. Application filed November 6, 1905.

A belt consists of a number of independently operative sections, each of which is adapted to transmit power from the car axle to the shaft of the dynamo.

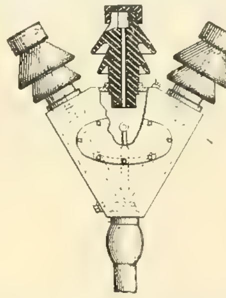
881,765. Starting Device for Mercury-vapor Electric Lamps. Louis A. Audibert, Lodéve, France. Application filed September 14, 1906.

An annular chamber above the cathode, formed by two concentric tubes and containing a quantity of mercury independent of the electrodes of the lamp, is permanently connected to one of the lamp terminals. A contact member, connected to the anode and movable therewith, extends permanently into the mercury in the annular chamber so that the latter forms a liquid-conducting slide maintaining a perfect and permanent contact of the anode with its lamp terminal.

881,766. Railway Block System. Oliver Barnish, Springfield, Mass., assignor of one-half to John M. Newell, Springfield, Mass. Application filed July 8, 1907.

A movable abutment adjacent to the track is arranged to contact with a contact arm on the locomotive and thus to actuate the brake mechanism on the latter.

881,777. Terminal for Electric Cables. Charles W. Davis, Edgeworth, Pa., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Application filed March 31, 1906.



NO. 887,777.—CABLE TERMINAL.

The central conducting core has formed on it a plug of insulating material which is provided with an outwardly and downwardly flaring petticoat and with a groove for the reception of a line wire arranged above the plane of the petticoat. The plug is inserted in an orifice in the case or shell and forms part of a terminal for an electric cable. (See cut.)

881,807. Music-leaf Turner. Robert Langstaff, Donora, Pa. Application filed August 16, 1907.

An arm is mounted on a support and adapted to swing from side to side thereof. An electromagnet carried by the arm has means for energizing it, in connection with a button designed to be secured to a leaf and adapted to be attracted to the magnet and carried by the latter in its traverse.

881,810. Electroplating Apparatus. George A. Lutz, New York, N. Y., assignor to the American Circular Loom Company, Portland, Me. Application filed April 8, 1907.

The apparatus comprises a tank provided with a metal rim, hooks on the rim depending into the tank, anodes suspended on the hooks, a post within the tank and anodes suspended from it, a conductor connecting the anodes with the rim and a cathode plate provided with means to suspend articles to be plated within the pace bounded by the two sets of anodes.

881,811. Electroplating Apparatus. George A. Lutz, New York, N. Y., assignor to the American Circular Loom Company, Portland, Me. Original application filed April 8, 1907. Divided and this application filed August 8, 1907.

[illegible]

[illegible] Fred P. Butman, Holbrook, Mass. Application filed March 27, 1903.

[illegible]

insulating disk into a cup in which a conducting disk is held out of contact with the other disk by means of fusible solder.

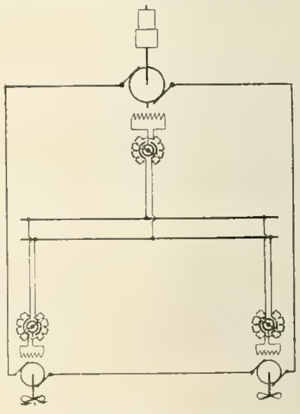
881,854. Change Maker. Edwin R. Gill, Yonkers, N. Y., assignor to the Electric Cash Carrier and Change Maker Company. Original application filed July 26, 1895. Patented April 26, 1904, No. 758,060. Divided and this application filed August 14, 1903. Renewed July 2, 1907.

In combination with a change maker and a motor mechanism therefor is a change recorder and order setting device.

881,862. Electric Ignition Apparatus. Russell Huff, Detroit, Mich., assignor to the Packard Motor Car Company, Detroit, Mich. Original application filed December 22, 1906. Divided and this application filed May 31, 1907.

This ignition apparatus for multiple cylinder engines has a distributor comprising a traveling brush and a series of separated contacts over which the brush travels in succession, the brush being provided with means for transmitting current through each contact in turn while the forward part of the brush is traveling over a portion of the succeeding interval between contacts.

881,864. Means for Transmitting Power Electrically. Gregor Lewin, Schöneberg, near Berlin, Germany, assignor to Siemens-Schuckert Werke, G. M. B. H., Berlin, Germany. Application filed July 2, 1907.



NO. 881,864.—TRANSMITTING POWER.

A separately excited controlling generator has means for varying its field excitation. A number of motors have their armatures connected in series with each other and with the armature of the controlling generator. Means are provided for exciting the fields of the motors independently of the tension in the armature circuit and reversible means for varying the field excitation of each of the motors independently of the other. (See cut.)

881,878. Telephone Switch. Andy N. Wright, Jackson Center, Ohio, assignor of one-third to Harney L. Hill, Jackson Center, Ohio. Application filed July 8, 1907.

Two pairs of metallic strips carry binding posts at their remote terminals and have plug sockets at their adjacent ends.

881,880. Galvanometer. Sidney G. Brown, London, England. Original application filed June 16, 1902. Divided and this application filed April 7, 1903.

A reaction galvanometer comprises an alternating or fluctuating current-exciting electromagnet, a coil delicately suspended between the poles thereof, a cable or artificial line, wires connecting this to the binding screws and leading-in wires containing capacity connecting the binding screws with the delicately suspended coil. The coil is mounted to move rotatively in a horizontal plane and carries a reflecting mirror.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 17, 1908:

448,199. Electric Motor Truck. F. O. Blackwell, New York, N. Y.
448,246. Support for Electric Wires. C. A. Lieb, New York, N. Y.
448,271. Electric Typewriting Machine. E. J. Silkman, Baltimore, Md.
448,273. Electrically Controlled Valve. J. V. Stout, Easton, Pa.
448,274. Electric Temperature Regulator. J. V. Stout, Easton, Pa.
448,279. Electric-lighting System. E. Thomson, Lynn, Mass.
448,280. Electric Meter. E. Thomson, Swampscott, Mass.
448,322. Call System. L. Digeon, Paris, France.
448,325. Electric Alarm Clock. E. M. Edgerton, Chicago, Ill.
448,326. Method of and Apparatus for Developing Mechanical Motion from Electrical Energy. R. Eickemeyer, Yonkers, N. Y.
448,328. Electric Railway. L. B. Entz, New York, N. Y.
448,329. Telephone. S. D. Field, Stockbridge, Mass.
[illegible] Electric Switch. R. D. Pratt, Marlborough, Mass.
[illegible] Electrical Street and Station Indicator. F. H. Soden, Chicago, Ill.
[illegible] Electric Switch. E. H. Johnson, New York, N. Y.
[illegible] Electric Railway. R. M. Hunter, Philadelphia, Pa.
[illegible] Electric Railway Motor. C. J. Van Depoele, Lynn, Mass.
[illegible] Electric Locomotive. C. J. Van Depoele, Lynn, Mass.
[illegible] Electric Railway System. C. J. Van Depoele, Lynn, Mass.
[illegible] Electric Transportation System. S. S. Wheeler and C. S. Bradley, New York, N. Y.
448,603. Electromagnetic Motor. E. D. Chaplin, Holliston, Mass.
[illegible] Electric [illegible]. W. A. [illegible], Pittsburg, Pa.
[illegible] Electric [illegible]. R. M. Hunter, Philadelphia, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Interurban Storage-battery Cars in Germany.

By A. de Courcy.

The Prussian government, which, as is well known, controls all the railroad lines in the kingdom, has recently installed an electric-traction system which uses a new type of accumulator car. Mayence is the central point of the railroad lines, and from here there are three different lines of road which run to three suburban towns of considerable size. These latter are Ingelheim, lying at a distance of 10.8 miles; Rüsselheim, at 7.5 miles distance, and Oppenheim, at 11 miles distance.

One of the new accumulator cars which are used on the Mayence line is represented in the accompanying picture. The compartments are opened, with the top parts of the seats lifted up, so as to exhibit the arrangement of the accumulators, which are placed under the seats in special boxes. The cars measure 12.20 meters between buffers, and their design is somewhat the same as is in use on the Berlin subway, using six compartments with side-opening doors, such as is usual on the European railroads. These compartments are all of the third class, and will hold 10 persons seated, or a total of 60 persons, which is the limit allowed upon the car.

At each end of the car is the motorman's cabin, but this is mounted somewhat differently from the usual compartment, which is generally placed on the level of the car floor. Here it is mounted near the roof of the car, and this has an advantage in giving the motorman a good outlook over the road. The cabins are provided with three windows and are reached by steps placed upon one side.

In the present type of car there are three axles used, without trucks, and the motors are mounted upon the front and rear axles. The motors and controlling devices were furnished by the Siemens-Schuckert Company of Berlin. The accumulator outfit, the part which is of the principal interest at present, was installed by the Accumulatoren-Fabrik Company of Berlin, whose works are located at Hagen.

The cars of the Mayence lines may be regarded as the most recent development of the accumulator car, and owe their success largely to the new battery which has been brought out by the company. It consists of 180 large cells in all, which are placed in containing cases and then stowed under the seats of each compartment. The cells are not removed for charging, but are intended to be charged by flexible cable connected to a socket upon the car, so that the cells remain permanently in place.

As will be observed, it is quite easy to have access to the cells in order to inspect them, by simply raising up the hinged cover of the seat. The large boxes are given a coating of acid-proof varnish. Besides, the joint of the top cover of the seat has a rubber gasket, so as to make it tight. There are two main cases under each seat, containing seven and eight cells, respectively, so that there are 15 cells under each seat and 30 per compartment. When necessary, the boxes can be removed by unscrewing the front board of the seat; they are then taken out at the front. This is only needed when it comes to making repairs upon the cells.

There are nine plates in each cell, of which four are positive and five are negative plates. They are given a large surface; the cell measures 338 millimeters in length and 448 millimeters in height, by 125 millimeters width in the direction of the length of the plates. Positive and negative plates measure 310 by 300 millimeters, with a thickness of eight and six millimeters, respectively. The plates are kept apart by insulating strips. The main cases have gas-tight covers, and there is a pipe which passes to the outside of the box, so as to allow of taking off all the fumes; the latter can escape through a series of openings which are provided in the side of the car.

Each of the cells is connected by means of a lead screw clamp to copper strips which run through the box. This strip is protected by a lead covering, so that it will not be affected by the acid. In the present type of battery, the positive plates are "formed" by the current, so as to give them a thin layer of oxide at the surface, while the negative plates are made of lead grids filled as usual with the active material. The total weight of the entire battery carried upon each car is about [illegible] tons, and it is able to [illegible] per hour, giving a specific [illegible] per kilogramme weight. Each of the cells weighs about 70 kilogrammes. The normal capacity of the cell is 240 ampere-hours, but owing to the hard usage which it undergoes when mounted upon the car, especially due to the heavy current needed in starting the motors, it does not furnish more than 200 ampere-hours. The positive plate has an average life of 100,000 car-kilometers, while the negative plate has a lower duration, which is estimated at 60,000 car-kilometers.

On a single charge, the experiments show that the car can make nearly 40 miles distance, when running at a speed of 25 miles an hour. In this way it can make twice the trip from Mayence to Rüsselheim and return, or one trip from Ingelheim to Oppenheim and return. The cars are charged at Mayence in this case from a plant which is located there.

The Batteries are Underneath the Seats in the Side-door Compartments
THE NEW INTERURBAN STORAGE-BATTERY CAR USED IN GERMANY.

Two 25-horsepower motors drive the car by single-reduction gearing with a ratio of 1 to 4.3. The motor is said to have 84 per cent. efficiency, and its total weight, along with the gearing and case, is 1.32 tons. The distribution of weight upon the axles of the car is 14 tons on each of the end axles and 10 tons on the middle axle, or 38 tons in all. For this reason the driving axles are constructed of nickel steel.

A view in the inside of the motorman's cabin is given on page 244. Most of the apparatus, including the controller, is placed on the left-hand side of the cabin. The controller has nine principal contact points, besides four points for the electric-braking system, by means of short-circuiting the motors. On one end of the car is mounted a socket which is used to receive the plug of a flexible cable coming from the charging plant. The battery can be charged either in one or in two series, and to this end there is a change-over switch placed on the car above the charging socket.

The compartments are lighted and heated by electricity. Two ceiling lamps are placed in each compartment. For the heating, there is an electric heater placed under the floor, between the seats, and the heat enters the compartment through a set of openings. However, the part of the car which

lies over the motor can be heated by the latter alone, without needing any other heater. In this case the partition between two of the compartments above the motor does not reach to the ceiling, so that both compartments are heated at the same time.

Considering the cost of the present outfit, the battery is estimated at $3,250. The motor and the rest of the electric oufit figure for $2,750, and the car itself for $3,300. As to the weights, the car and its load come to 23 tons; the two motors, 2.6 tons; the battery, 10.1 tons, making a total of 35.7 tons in all. The present system of lines started with the use of five cars of the above type, but

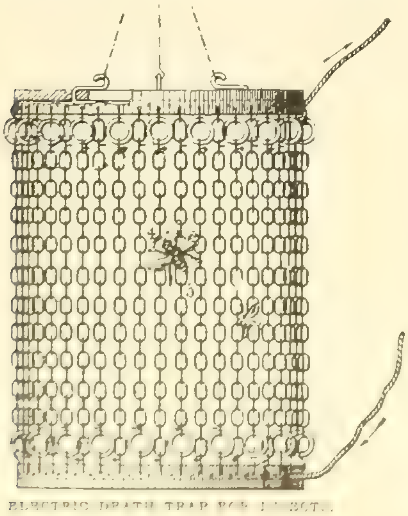
INTERIOR OF MOTORMAN'S CAB IN GERMAN STORAGE-BATTERY CAR.

after these were given a trial in the actual conditions of service they gave such good results that the minister of railroads decided not long since to have 57 new cars of the same pattern constructed. Later on this number may be still further increased. It is to be remarked that the Accumulatoren-Fabrik have also equipped the cars which are now running upon another successful line in Germany, this being the Pfalz traction system in Ludwigshafen.

[Storage-battery cars were abandoned in the United States several years ago, owing to lack of economy in operating cost when compared with the overhead-trolley system. But the batteries were generally removed for charging. It is interesting to note the present revival of the system in Germany on a rather elaborate scale. Whether the present system, evidently admirable in many respects, will prove economical and durable after extended trial still remains to be seen.—Ed. W. E.]

Electric Death Trap for Insects.

A Frenchman, Alphonse L. M. Chaulin of Paris, has invented an electric insect exterminator that is said to be very effective. This "electrocutor for insects," as Mr. Chaulin terms it, is a very simple contrivance consisting of two metallic rings joined by a large number of chains so as to form a hollow collapsible cylinder. The chains are spaced a small distance from each other so as not to touch.



ELECTRIC DEATH TRAP FOR INSECTS.

Each chain is composed of connected metallic links with a link made of insulating material at one end of the chain. The chains are fastened to the terminal rings with a regular link end and an insulated link end alternating.

When the "electrocutor" is suspended and made "alive" by connecting the terminal rings to opposite poles of a source of electricity, no current flows until an inquisitive insect crawls or flies between two neighboring chains, which act causes it to terminate its investigations and its career of activity without much ado. The "electrocuted" insects do not carry any insect poison about the house and are saved from the slow torture of sticky insect paper. The new device is protected by fuses from damage due to short-circuits that may be caused by accidentally getting two adjacent chains in contact. It was recently patented in this country.

Notes on Electric Haulage of Canal Boats.[1]

By Lewis B. Stillwell and H. St. Clair Putnam.

The following notes are based upon the results of tests conducted by the authors during the autumn months of 1907 on a section of the Lehigh Canal near Mauch Chunk, Pa. The object of the tests was to determine:

a. Pull required to propel canal boats at various speeds and with varying numbers of boats in tow.

b. The relative merits, for the purpose contemplated, of locomotives supplied by trolley and operating upon a track of 42-inch gauge and a monorail system.

c. The best speed and length of tow as fixed by physical conditions.

d. The power required to operate the canal between Coalport and Bristol.

e. The equipment required for such operation.

The data presented in this paper are included under the headings (a), (b) and (c) of the foregoing summary.

The upper section of the canal from lock No. 2 to Coalport, a distance of 10,095 feet, is equipped with the "locomotive system." On this section an ordinary mining locomotive is used. Two locomotives were tested, each weighing under test conditions 16,000 pounds without testing-instrument equipment and crew. Each locomotive is equipped with two direct-current motors of 28 horsepower, operating on 500-volt trolley circuits. The locomotive wheels are 28 inches in diameter and gear ratio of 69/15. The wheel-base is 44 inches. The outline drawing of this locomotive is shown in Fig. 1.

The locomotives were operated on a track of 42-inch gauge and ballasted on the river section with broken stone, elsewhere with gravel. Forty-pound rails were used. The track was uneven and comparatively rough.

On this section two levels of the canal, aggregating 5,600 feet in length, were in the open river exposed to the river currents. The voltage of the trolley circuits was varied to obtain various towage speeds; an experimental generating plant, connected as shown in Fig. 2, being used as a source of power supply.

The section of the canal from lock No. 3 to lock No. 7, a distance of 10,555 feet, was equipped with the "mono-rail system." On this section three traction machines were used. These machines are hereinafter designated "tractors." Two of these tractors (Nos. 1 and 2) were manufactured in this country. The electric equipment of each comprised one direct-current 40-horsepower motor. The gear ratio was 5.78 to 1; diameter of wheels, 12 inches, and length of wheel-base 42 inches. The construction is illustrated in Fig. 3. The ratio of leverage on lever wheels was 4.7 to 1; that is to say, the lower wheels are pressed upward against the lower face of the rail with a force 4.7 times the drag on the tow line. The adhesion of the machine, therefore, is a function not only of its weight but also of the pull which it exerts. Each tractor weighs 6,450 pounds, and under test conditions with instruments and crew 7,350 pounds. Tractor No. 3 was manufactured in Paris and equipped with one 25-horsepower mining motor. Its wheels are 11.25 inches in diameter, gear ratio is 3.4 to 1, and wheel-base 42 inches. The general design is the same as that of tractor No. 1.

Owing to the fact that the frame of this tractor had not been designed to receive a motor of the exact dimensions of that with which it was equipped, it was impossible to locate the motor in its proper position; it was necessary, therefore, to use 500-pound counterweight to secure equilibrium of the machine. The weight of the tractor complete was 5,093 pounds; including counterweight, test apparatus and crew, 6,493 pounds.

The mechanical construction and workmanship of tractor 3 made it superior to tractors Nos. 1 and [illegible] shown not only by inspection but also

[illegible]

very conclusively by the results of tests. In our comparative calculations of power required respectively by the locomotive and mono-rail systems, therefore, we have used the results obtained in using tractor No. 3.

The tractors were operated upon a mono-rail supported at a height of four feet above the ground by steel posts placed at intervals of 18 feet. The rail, as used in the installation at Mauch Chunk, is an ordinary 10-inch I-beam weighing 75 pounds to the yard. The mono-rail, with supports and braces complete, weighs 120 pounds per yard and is erected along the canal outside the towpath. The construction is illustrated in Fig. 4.

A fourth tractor, No. 4, built in Paris, was also subjected to certain tests. This machine, without testing crew and instruments, weighed 3,465 pounds. It was equipped with one direct-current 500-volt motor of 15 horsepower. The diameter of wheels was 12.75 inches and the wheel-base 24 inches. This machine is illustrated in Fig. 5 (page 246).

For this smaller machine a section of mono-rail tract 1,200 feet long was erected on wooden posts between locks Nos. 2 and 3. The rail in this case was a 7-inch I-beam, weighing 45 pounds per yard, and was erected at a height of four feet from the ground. It was not deemed necessary to undertake complete tests of tractor 4, as certain preliminary tests showed that the machine was not adequate in mechanical strength and power equipment for the service. Volt and ampere readings were made, however, in connection with dynamometer readings, and from these the approximate performance of the machine was determined. In the tests the tow-line was approximately 200 feet long. Four canal boats were loaded and used in all comparative tests made.

Compared with electric-railway operation, the rate of acceleration practicable of attainment in

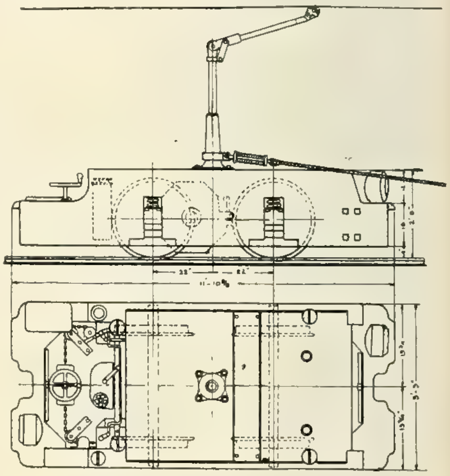


FIG. 1. EIGHT-TON MINING LOCOMOTIVE USED FOR TOWING CANAL BOATS.

towing canal boats is low. Acceleration, however, is relatively unimportant, as the time of run is long compared with the time consumed in acceleration. The greatest pull is exerted when the last control point is reached, but this does not greatly exceed the pull required at full running speeds.

In running without load the tractor machines preserve approximately the same relationship as they do when operating under load conditions, though the relative magnitude of the valves is changed. When developing large draw-bar pulls the mechanical losses in tractor 3 are 50 per cent. in excess of those of the mining locomotive. Mechanical losses in tractor 1 exceed those of the mining locomotive by from 70 to 80 per cent. Under light running conditions these excess losses are reduced to about 7 per cent. in the case of tractor 3, though the excess remains approximately 70 per cent. for tractor 1.

The running light losses are, in themselves, relatively unimportant, as the amount of power required is small and the amount of idle running relatively very small; but, as showing errors in design and workmanship, which are corroborated by the results of the heavy load tests, they are important. We shall not here enter into a theoretical discussion of the design of these tractor machines. It is apparent that their mechanical design can be improved materially. When running light it would be reasonable to expect that these machines, if properly designed, should effect a saving in power consumed almost proportional to their less weight as compared with the mining locomotive.

Under load conditions, especially as the draw bar pull approaches the maximum of which the locomotive is capable, the latter machine, theoretically, should show the higher mechanical efficiency. This is due to the fact that the mining locomotive utilizes its entire weight for traction; to obtain a similar draw-bar pull with the tractor, the two driving wheels on top must have a pressure upon them equal to the weight of the mining locomotive.

As the weight of the tractor is 10,000 pounds less than that of the mining locomotive, a pressure of at least 10,000 pounds must be exerted on the lower or pressure wheels. It is evident, therefore, that the track and rolling friction of the tractor must be greater than that of the mining locomotive by the amount of this excess pressure on the track. Considering track friction only, this excess should amount to about 60 per cent. at maximum pull. The tests of tractor 3 show an excess of about 30 per cent. at 3,000-pound rope pull, though the test results are not exactly comparable, as motor and gear frictions are included and are different in the two machines.

Assuming that the tractor may be so designed that its aggregate mechanical friction per ton of weight does not exceed that of the mining locomotive, it is obvious that when running light less power should be required to move the former at a given speed than is required by the latter. Assuming good mechanical design, it follows that the tractor under light loads should be more efficient than the mining locomotive, and that at some load between the limits of very light load and full load the efficiency curves of the two machines should cross. So far as comparative efficiency is concerned, therefore, great care must be taken in designing the tractor to minimize friction losses if it is expected to make a good showing as compared with the mining locomotive.

In order to assist in determining the cause of the apparently excessive friction of these tractors at low rope-pulls and when running light, tests were made on a wet rail to determine the relative amount of reduction in friction due to a bad rail, and other tests made pulling the tractors with the gears and motor disconnected. The results of these tests show that at a speed of six miles an hour the wet rail effects a saving of about 16 per cent. in total friction, running light, and at the same speed the gear and motor friction amounted to 28 per cent. of the total. It is apparent from the tests that frictions at light loads are relatively small and at large pulls the difference is to a large extent lost as the mechanical friction approximates the theoretical amount to be expected from the pull exerted.

It would seem that the mechanical efficiency of tractors of this type might be improved by giving attention to the following facts:

1. An increase in the size of wheels would tend to decrease losses.
2. The wheel base should be long and the "flange clearance" small.
3. The mechanical construction must be such that alignment of all bearings is preserved under all conditions of operation.
4. The point of rope attachment should be carefully selected in order to reduce flange friction to a minimum.
5. The rail surface should be as good as on ordinary railway tracks, and the construction should be such as to minimize vibration.
6. The use of guides for the pressure wheels should be avoided if practicable. If used, the vertical motion in the guides for the pressure wheels should be free.
7. The pressure wheels should have no flange.
8. Arrangements for oiling the bearings of tractors, as well [illegible] railroad practice.

Our conclusions [illegible] speed, as fixed by conditions of [illegible], are:

a. Single boats, loaded or empty, can be operated [illegible] at speeds [illegible] exceeding five miles an hour, but on the canal for satisfactory working [illegible] probably about the limit of average speed for single tows.

b. Two-boat tows are handled satisfactorily at speeds of from 3 [illegible] miles an hour.

c. Four-boat tows loaded can be operated with a fair degree of success at speeds up to three miles an hour except on very sharp convex curves.

d. Four-boat tows, light, were found impracticable as tested. It is possible that improved steering gear might remedy the difficulties encountered, except that no conceivable steering gear would make it possible to handle four-boat tows, light, in a heavy wind.

The average efficiency of the mining locomotive is about 1.5 per cent. higher than that of the tractor, both with alternating-current and direct-current equipment and the average efficiency at the trolley is about 2.8 per cent. higher with direct current than with alternating current.

In this case, as in the case of direct-current equipment, it is evident that the difference in efficiency of the mining locomotive and the tractor, and of alternating-current and direct-current equipment, are relatively unimportant as compared with other factors upon which the choice of one or the other as a system of electrical haulage must depend.

For the conditions existing on the Lehigh and Delaware canals, it is estimated that the efficiency of a system of electric power transmission and conversion supplying direct current to motors will approximate 70 per cent. from bus-bars at power house to motor terminals. If alternating-current motors be used, the calculated corresponding efficiency is 75 per cent. Based upon these efficiencies, and the traffic conditions as existing on the Lehigh and Delaware canals, the watt-hours required at the power house per total ton-mile and per ton-mile of freight handled are given in the following table:

Watt-hours per Ton-mile at Power House
(Average Freight Haul, 55.6 Miles.)

Ton—2,000 Pounds.	Direct Current.		Alternating Current.	
	Mining Locomotive.	Tractor	Mining Locomotive.	Tractor
Watt hours per total ton-mile..				
Four-boat tows	24.6	24.8	22.6	23.0
Two-boat tows	30.9	32.5	32.5	33.8
One-boat tows	42.8	45.3	48.3	50.2
Watt-hours per freight ton-mile				
Four-boat tows	33.9	37.2	32.5	33.1
Two-boat tows	44.5	49.7	46.7	48.6
One-boat tows	61.5	69.0	69.5	72.2

It should be noted that the calculated power for canal transportation, as set forth in the above table, applies only to the especial conditions imposed by the physical limitations of these particular canals and by the speeds for loaded and for light boats w[illegible] operation.

[illegible]

[illegible] that is so important that unless the minutest details of efficiency are carried out we will never see the commercial towing of canal boats. When the [illegible] Canal he made the statement that the ratio of cost [illegible] my electric tow. The mule is still on the towpath and the propellers are going backward, and well they may; they are expensive, and few have paid. Therefore, it becomes absolutely necessary that if this subject is ever to be pushed to a completion successfully the question of electrical efficiency, the minimum amount of electricity to be used, shall be paramount.

I have been very much interested in this discussion tonight, because I have had opportunity to make the same tests, and I have come to the same conclusions. When the canals of Europe were bought up by the railroads, before legislation prevented their doing so, some of the railroads attempted to use their locomotives for their line upon the towpath, and it was found that where you have a very heavy motor, where the power is to be applied so slowly, the efficiency is exceedingly small, the amount of fuel consumed is out of all proportion to the contents carried, and it was abandoned, and there is the very essence of the whole subject. Canal transportation is essentially, and always will be, a means of transportation the very slowest that can be, and it never can be changed. The speed of the canal boat must always be slow, because the distance between the bottom of the boat and the canal bottom necessarily must be short.

There is another consideration which is a serious one. That is, as they pull the boat and get any reasonable speed, the wash on the bank is very damaging.

Joseph Sachs: It seems to me that if you have gotten rid of your adhesion proposition, you might also get rid of your man on your tractor entirely, and run a small cable or wire to your boat, and let the fellow who does the steering do the regulating and starting and stopping of the motor. It seems to me that that will prove the ultimate development in such a tractive system. I firmly believe that such a structure and method of obtaining traction is ideal, and with all due deference to my friend, Mr. Lamb, I believe it has more rugged mechanical advantages than perhaps any other, aside from having the advantages put forth by Mr. Stillwell.

Dr. C. P. Steinmetz: I am very much interested in this paper, since the topic appears one which is very proper to be presented. Through the rapid expansion of our railway system, the canals have taken a very secondary position, but it is gratifying to see how the general interest in canal boats in water transportation is revived at present, and we are talking now of the Mississippi waterway, and our state of New York is spending, or intends to spend, $100,000,000 in rehabilitating the Erie Canal, and perhaps before they are done it will be a good

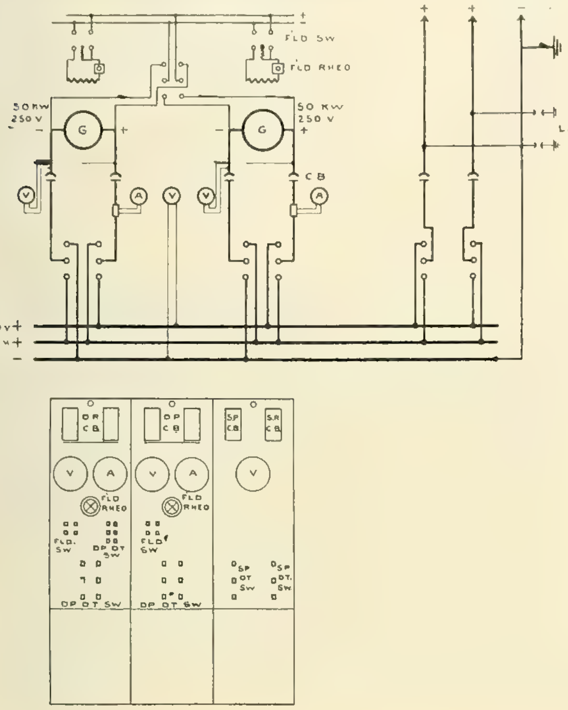


Fig. 2. Switchboard Diagram.

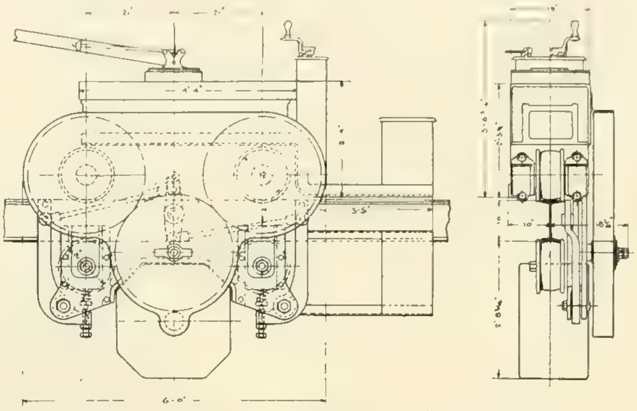


Fig. 3. Tractors Nos. 1, 2 and 3.

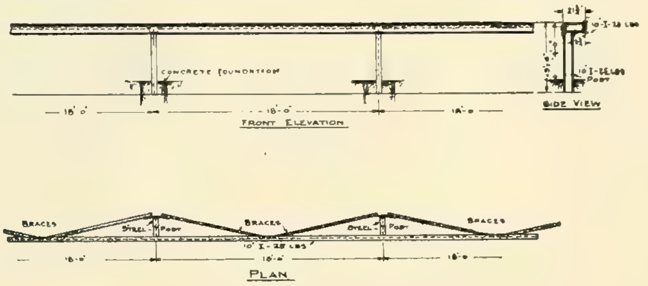


Fig. 4. Assembly of Monorail System.

ELECTRIC HAULAGE OF CANAL BOATS.

deal more. In short, the general interest in this subject is greatly revived.

I should, however, like to have seen the paper more comprehensive, and perhaps some time Messrs. Stillwell and Putnam may give us a paper going into the whole situation, not merely a comparative test of two rival systems, but covering the subject of canal haulage and in some similar manner as these gentlemen have discussed the question of electric railroading; that is, comparing the relative advantages, efficiencies, financial economies, etc.,

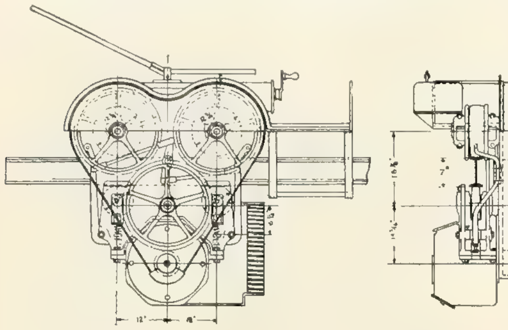


FIG. 5. TRACTOR NO. 4 AS USED ON LEHIGH CANAL.

of the different systems of electric haulage proposed, of steam propulsion, and of other methods which have not been mentioned, for instance, the rope drive, where rope is laid down at the bottom of canal or river and raised up to propel a boat, carried over a drum, and dropped again, which system, I understand, gives good service abroad; also the mule.

When we look at the mule propulsion of a canal boat (and having lived for a number of years on the shores of the Erie Canal I have seen a number of canal boats glide past pulled along by the combination of three mules and a man and profanity) we must admit that the method is rather antiquated. I am sure, however, when looking into the subject we may find that mule power, after all, under these conditions is the most economical form of power, and that it would be extremely difficult to compete with the mule in point of economy.

Now, first as regards interest on investment and depreciation. Mule power has a very low first cost, and the mule is very long-lived, I understand. Then here are given some figures on the cost per ton-mile. I think it is something like 40 watts per ton-mile. Assume a tow of, say, a thousand tons on the Erie Canal, which is the only canal I am a little familiar with, at 40 watts per ton-mile; that would give 40 kilowatts per mile, or at two miles an hour, about 80 kilowatts consumption. Now 80 kilowatts at one cent per kilowatt-hour gives you 80 cents an hour, and for 16 hours a day that would give you about $15 a day for the power alone. For a set of three or four mules, with a duplicate set of mules, and perhaps some reserve mule power, I do not think the feeding of them would come anywhere near like that cost. I have not looked into the subject, but I believe it is worth looking into and seeing how the efficiency compares. In addition thereto the depreciation of the motors naturally is higher than it is on the mules, and this would be higher with the remainder of the electric plant.

One other essential feature which we have to consider in canal towage, which is a condition essentially different from the railroads, is that most of the canals are public highways, that is, any boat has a right on it just as much as on a public street. It is not like the railroad, where the operating company can decide on the motive power to be used on the road and exclude everything else. If you install electric propulsion, you interfere with the mule or steam propulsion, or any other established method of propulsion of the state or national canal.

Then there is one more feature. If you watch the canal traffic, in very many cases, as, for instance, on the Erie Canal, it is extremely light and intermittent. In the first place, it is only for part of the year, and in some years the traffic is much lighter than in other years. Any equipments established to take care of the maximum traffic, you see, would lie idle a part of the year and would be very uneconomically used in every year. You see, to take care of the present canal traffic, in many instances an electric system would be rather uneconomical, due to the very uncontinuous service.

It appears to me that in the case of many of our canals the way in which they are of value to [illegible] the same as the value of a country road on which a trolley line has been built. There is not much traffic on the country road, because the traffic goes over the trolley line, but it is useful to maintain the country road, because [illegible] but in retaining it, you [illegible] make use of the [illegible]. The reverse is the case with the railroads.

It appears to me, therefore, that if electric haulage on canals shows a superior efficiency to other [illegible] it would ever [illegible] would not

be the traffic which exists now on these canals, like the Erie Canal, but a new volume of traffic would have to be created, just as the trolley lines have not taken the traffic of the steam railroads, but a new traffic has been built up; and I can well see that it might be possible for a profitable system of electric haulage on the numerous waterways of the country to be established. It would be of extreme importance. A further careful investigation of the whole situation, I believe, would be of very great benefit to all of us, and of considerable interest to the engineering profession.

Mr. Stillwell: In presenting these notes we have carefully avoided as far as possible anything that might be interpreted as special pleading in favor of any given system. The comparison of the two traction engines which we have made resulted in certain determinations of comparative energy involved, and of actual energy involved, which will have an application wider than we have here attempted to give it.

With reference to Dr. Steinmetz's remarks in regard to a broader treatment of the subject than is attempted in this paper, I would say in connection with the same investigation, which was conducted by Mr. Putnam personlly and under his immediate direction, he went into the subject of the economy of the system as compared with mules very thoroughly. I am glad to say that the results were agreeably surprising to us, because we had not undertaken the investigation with any great feeling of optimism as to results, but we did establish, to our own satisfaction at least, that if a canal is working at anything approximating to its full capacity, electrification of the canal in general would pay handsomely. In the case of this particular canal, with some improvements in the locks and with an increase of traffic to a point approximating its full capacity, we estimated that including all the capital charges the cost of operation could be reduced below one-half a cent a ton-mile, very close to four mills a ton mile. The grand average of cost of freight transportation in the United States by the railroads is very close to four mills per ton-mile without any capital charges. Locomotive repairs are paid for out of operation. Therefore, we may say if the canal did work to its capacity, even with these small barges, it will show a result which, expressed in the ultimate unit of cost per ton-mile, is superior to the average result attained in steam-railroad practice today. With larger barges and larger locks, I should expect that the result would be further improved, but everything depends, as Dr. Steinmetz suggests, upon the amount of the traffic. The occasional mule is a proper engine when the traffic is very light, but if the traffic can be worked up, it will pay to electrify.

The Tungsten Lamp in Topeka.

The Topeka Edison Company is about to try the experiment of furnishing 100-watt tungsten lamps at a rental charge of two cents a day. While this is only an experiment, and may not work satisfactorily, it is thought that this figure is a reasonably safe one for long-hour burners with an average lighting of five hours per day. Manager John T. Huntington says: "We think that the tungsten lamp will affect the use of the present enclosed arc lamp for inside lighting, but do not believe it will wholly replace it. The tungsten lamp is going to be very valuable indeed both to the central station and to its customers. At present we are most interested in the larger units, with which to compete with the mantle gas lamp, and to replace our own electric arc lamps where their use produces bills beyond the means of the customer. When the tungsten lamp is perfected to such a degree that it will be manufactured in sizes of, say, 20 candlepower, a tremendous field in residence lighting will be opened up that we cannot now reach. We will then be able to replace the kerosene lamp in many homes where nothing else has ever been used."

Military Use of Wire Fences for Telephoning.

By W. D. Hornaday.

In the West and Southwest, where there are long stretches of unbroken wire fences, these wires are frequently used to convey telephone messages from one point to another. In some localities the fence wires are converted into regular telephone lines with permanent equipment for practical use. These lines are often from 10 to 30 miles long, and are a great convenience to the people of the ranches.

The United States Army Signal Corps is well trained in the use of wire fences for telephone purposes. In the military maneuvers that take place in the ranch region the Signal Corps plays an important part in directing the movement of the troops by improvised telephones. In some localities, where the country is rough or heavily wooded, it is impossible to convey the signals from one point to another by the usual method of flags or other visual signals. It is then that the telephone is brought into play. Each detachment of Signal Corps men is equipped with a field telephone attachment. It requires the work of but a minute or two to connect this attachment with a fence wire and to get in direct communication with headquarters.

The use of the fence wires for telephone communication obviates the necessity of constructing temporary field telephone lines by the Signal Corps.

SIGNAL CORPS MEN UTILIZING WIRE FENCE FOR FIELD TELEPHONE WORK.

It sometimes happens that a little difficulty is obtained in using the wires on account of some poor connection or break, but it usually does not take long to discover and remove the cause of the trouble. On some of the big ranches straight lines of wire fences 50 to 75 miles long are frequently found, and these afford excellent opportunity for good military field-telephone service. As a matter of necessity, all ranch fences must be kept in good repair. To do this fence riders are constantly employed.

The good condition of the fences makes the use of the wires by the army Signal Corps men all the more practical and satisfactory. It is stated that in the event of any great military movement in the ranch region of the Southwest the wire fences would be found of great service as improvised field telephone lines. The attachment consists of a grounding piece and a transmitter and receiver. The equipment is light of weight and has little bulk. It is easily carried from place to place, and mounted on horses the Signal Corps is able to rush from place to place, changing the telephone attachment from one fence to another as the necessity of communication demanded. It is said that the army tests which have been made of the fence wires for telephone purposes have proved highly successful. At the military maneuvers of the troops held near Fort Sam Houston, Tex., last year, the work of the Signal Corps in the use of the field telephone was a most interesting feature of the programme. It is planned to give another elaborate demonstration of field telephoning at the maneuvers of the troops of the departments of Texas and Colorado, which are to be held at the same place during the coming summer.

High-potential Insulator of Novel Construction.

An insulator for high-tension line which embodies many novel features has been invented by Louis Steinberger of New York city, who has been granted a patent on the invention. The principal feature of the insulator is the provision of two hoods between which the line wire is clamped, each of these hoods being of special construction, as is also the clamping device. The accompanying diagrams show the general design of the insulator. Fig. 1 is a central longitudinal section, above which

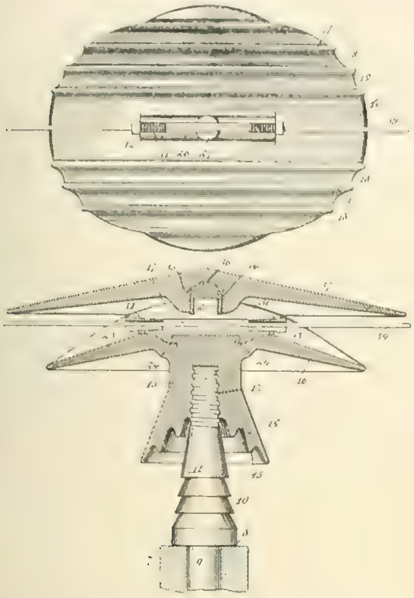


FIG. 1. HIGH-POTENTIAL INSULATOR.

is shown a plan view of the lower hood. Fig. 2 is a transverse central section taken at right angles to the one shown in the lower part of Fig. 1.

The supporting pin (9) fitting into the cross-arm has a number of petticoats (10) and a threaded stem (12), all in one piece. Upon this stem is screwed the main insulator body (13), which is shown with a triple petticoated base. The upper portion of this insulator body is spread out into the hood (16), which has on its upper surface a series of longitudinal ribs (17) of substantially arcuate form, each rib being parallel with the general direction of the wire and extending from edge to edge of the hood. Each rib terminates in beads (18) protruding slightly beyond the edge of the insulating hood. Between these beads are concave recesses (19). It is said that this arrangement facilitates the dripping of moisture which gathers in streams and flows through longitudinal channels (20) parallel with the wire, being discharged upon opposite sides of the wire so as to miss the cross-arm. Auxiliary wires (21) may be placed in these channels in cases of emergency or whenever desired, the weight of the wires retaining them in position.

A wide channel extends across the center of

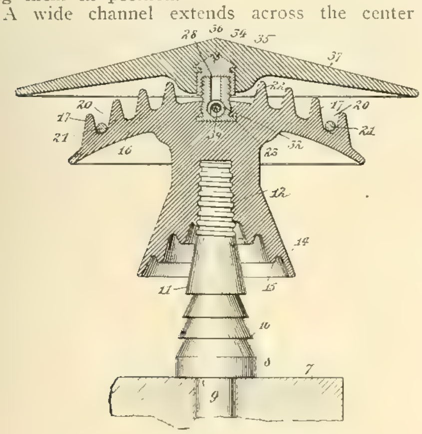


FIG. 2. HIGH-POTENTIAL INSULATOR.

the hood. A plate of metal (23) is provided upon its under surface with hooks (24) directed toward each other and imbedded within the body of the insulator hood, thus constituting anchorages which prevent the removal of the plate. This plate is provided with a superposed tubular portion having a slot extending throughout its length. Lugs (27), each of substantially semi-cylindrical form, are mounted integrally upon opposite sides of the slot and together constitute a divided stem, the two parts of which are separated by a slot (28). The inner ends of the tubular member are provided with threads, and the core (30) extends entirely through the latter and may be closed by tubular clamps (31), threaded externally. Each of these clamps is provided with a square head (32) and with a slot (33) extending entirely through the clamp. The clamp is preferably made with a tapered head as indicated.

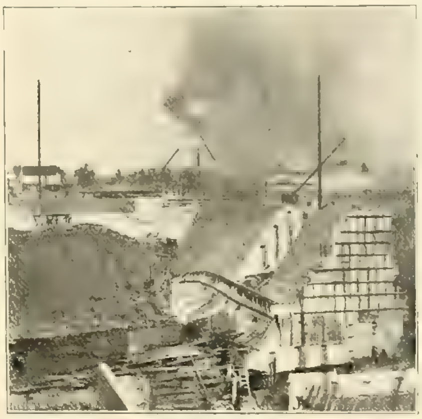
A screw cap (34), provided with anchorages (35) and (36), is imbedded within the upper or sheltering hood (37), in such a manner that by turning the hood the screw cap may be connected with or disconnected from the divided stem (27). By aid of this screw cap the sheltering hood may be removed or replaced at will. This hood covers the entire insulator and largely shields it from the elements.

In setting up this insulator the body portion is screwed upon the upper end of the insulator pin and turned to such an extent that the plate (23) and its tubular portion are parallel with the general direction in which the wire or cable (39) is to lie. The wire may now be lifted into position or threaded through the tubular member. The cored guard clamps (31) may next be screwed into the ends of the tubular member. Preferably, however, these cored plugs are placed approximately in their respective positions before the wire is placed in position. The plugs are turned so that their slots (33) are uppermost and register with the slot (26), and the wire is raised and simply dropped into the slots. The guards are then turned half a revolution (see lower part of Fig. 1) so that slots (33) are now downward, whereby the wire is firmly and securely locked within the tubular slotted member and cannot be dislodged or removed except by unscrewing the slotted clamping members. The sheltering hood is next screwed into position. This squeezes together the semi-cylindrical portions (27), thereby still further augmenting the locking action of the clamps and effectually preventing any movement whatever of the locked parts.

The invention is not confined to any particular material.

Hatfield Power Site to Be Made a Park.

The hydro-electric power development of the La Crosse Water Power Company at Hatfield, Wis., is progressing rapidly, and it is said the entire



VIEW OF A PART OF THE HATFIELD DAM DURING CONSTRUCTION.

plant may be put in operation about July 15th. Machinery is now being installed in the large power house, and poles and other material for the transmission lines from Hatfield to La Crosse and Winona are being distributed along the right-of-way.

The large concrete dam which creates the water-power has formed a large artificial lake, the shores of which offer a good opportunity for the development of a beautiful park and summer resort. Mr. E. G. Boynton, vice-president of the company, says that the length of waterfront following the various indentations, bays and coves, measures over 20 miles, all high shore, with many beautiful groves of pine and oak. A fine continuous driveway is planned around the lake, crossing the river at Hatfield and again below Dells Dam. Brush and scrubby timber will be removed, and the entire tract, comprising about 1,000 acres, further beautified under the direction of a competent landscape artist. Building lots and acreage properties, with shore rights will then be offered to the public, subject only to regulations regarding the care and preservation of the standing timber and park features.

The accompanying picture is a view looking toward Hatfield, showing the end of one section of the dam during construction.

The Conning Tower in Smoke Inspection.

Paul P. Bird, chief smoke inspector of Chicago, has planned several conning towers equipped with telephones and located on a number of high buildings in the Loop as an aid to the abatement of smoke. If a chimney is seen smoking, the lookout calls up the engineer of the building and tells him to remedy the fault at once. Formerly offenders were notified by mail, but this was not so effective as the telephone plan.

Improvements in the Audion.

[illegible] also described in the issues of July 27, 1907, and November 9, 1907.

Some of the late improvements are shown in the two accompanying diagrams, which represent the circuits of receiving stations using different forms of the oscillation detector. By (V I_1 E) is represented an elevated conductor system including the

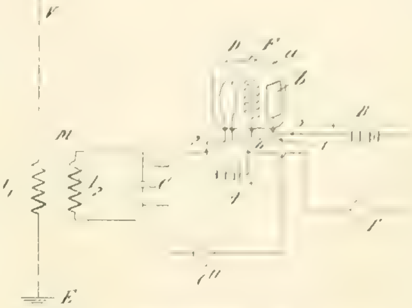


FIG. 1. IMPROVEMENTS IN THE AUDION.

antenna (V), earth connection (E) and primary (I_1) of the transformer (M), the secondary (I_2) of which forms part of the tuned receiving circuit (I_2 C). (D) represents an evacuated vessel, preferably of glass, having sealed therein three conducting members, (F), (a) and (b). The electrode (F) is shown as consisting of a filament, preferably of metal, which is connected in series with the battery (A) or other source of current of sufficient strength to heat the filament, preferably to incandescence. The conducting member (b), which may be a plate of platinum, has one end brought out to the terminal (3). Interposed between these members is a grid-shaped member (a), which may be formed of platinum wire, and which has one end brought out to the terminal (1). The local receiving circuit, which includes the battery (B), and the signal-indicating device (T), which may be a telephone receiver, has its terminals connected to the plate (b) and filament (F) at points (3) and (4). The oscillations to be detected are conveyed to the oscillation detector by the conductors which connect the filament and grid to the tuned receiving circuit.

It has been determined, experimentally, that the presence of the grid increases the sensitiveness of the oscillation detector. In associating such a detector, or audion, with a closed tuned circuit, it will be noted, by reference to Fig. 2, that the secondary (I_2) closes a circuit containing a battery (B) through the electrode (b), conducting member (a') and the conducting gaseous medium intervening between them. Also, by reference to Fig. 1, it will be seen that a similar closed circuit ex-

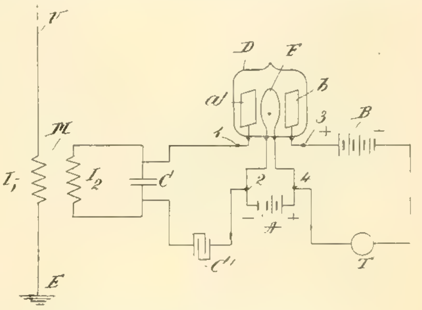


FIG. 2. IMPROVEMENTS IN THE AUDION.

ists between the battery and the electrode (b) and grid or conducting member (a).

In order to close each of the circuits to the passage of direct current from this battery therethrough, or to prevent the development of a difference of potential between the members (a) and (b), or between (a') and (b), and to prevent the members (a) or (a') from receiving an electrical charge from the battery, there is inserted the condenser (C') in the otherwise mechanically closed circuit. The presence of the condenser produces a great increase in the sensitiveness of the oscillation detector, as determined by the very marked increase in the sound produced in the telephone (T) when the condenser is present, over the sounds produced therein under the same conditions when the condenser is not employed.

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A NEW PROCESS of manufacturing continuous [illegible] cathode tube. The latter is given a rotary movement and is made to rub against infusorial earth to remove the bubbles of oxygen. The electrolytic bath is formed of a 22-degree (Baumé) solution of copper sulphate, to which is added five kilogrammes of sulphuric acid and 20 kilogrammes of infusorial earth per 100 liters of solution. The anode is made of 96.5 per cent. copper, which must be quite free from arsenic, bismuth or lead, as these would be deposited along with the copper. But the presence of iron, cobalt, nickel or zinc is no disadvantage under the present conditions. As to silver, gold and platinum, they remain in the anode deposits and can be taken out later on. The copper is deposited on a tube of nickel-plated iron, and the resulting copper tube is easily taken off. The tube is rotated at about 20 revolutions per minute. A current density of two amperes per square decimeter is employed working at two and one-half volts. It is said that tubes prepared in this way are superior to any which have been produced hitherto.

FROM A PRIVATE source the Western Electrician is informed that Dr. Waldemar Jungner, a Swedish gentleman said to be well known from the storage battery that bears his name, has invented a process by which electricity is produced from fuel without the medium of rotating power machinery. The details are not as yet disclosed for patent reasons, and the only intimation given of the construction is that Dr. Jungner has discovered a gas which he stores under pressure in closed vessels and then allows to escape slowly into an electrolyte, where it is ionized under combination with the oxygen of the air. The electric charge is led away by suitable conductors. In this process the electrolyte increases in volume, overflows, and the active gas is again extracted therefrom by the heat from any kind of fuel.

That this battery is not a toy or merely fit for laboratory demonstration is thought to be evident from the statement that Dr. Jungner is installing a 200-kilowatt plant to provide light and power for the famous Kneipp Baths in Norrkoping, Sweden. The inventor declares that he is able to produce electric energy from fuel with an efficiency superior to the ordinary method with boilers, engines and dynamos. He also asserts that this method will go particularly well with the metallic-filament lamps, probably because the units have, no doubt, a small electromotive force.

If the inventor can make good his claims, his method will excite widespread attention. But it is more likely that the scheme will not prove practicable when tried out under working conditions on a scale of some magnitude.

A PAPER that bids fair to become a classic in engineering literature is that entitled "The Electrification of the Suburban Zone of the New York Central and Hudson River Railroad in the Vicinity of New York City," written by Mr. William J. Wilgus, and read before the American Society of Civil Engineers on March 18th last. Mr. Wilgus was formerly vice-president of the New York Central Railroad, and he had general supervision of the work of "electrifying" the New York Central terminal in and near New York city—a work of great magnitude and importance and which has attracted world-wide attention among engineers, railroad and electrical men. Mr. Wilgus gives the reasons for the electrification, the reasons for adopting the direct-current system and the general features of construction, but what makes his paper especially valuable is the concluding portion, in which he sets forth the results of electrification. This portion of the paper, somewhat condensed, is given elsewhere in this issue of the Western Electrician.

Mr. Wilgus shows that the nuisances incident to the use of steam locomotives south of the Harlem River have been abolished, and that a greatly increased capacity of the terminal has been made possible. Moreover—and this is an especially gratifying result to electrical men the reduction in [illegible] operation has been most surprising. The [illegible] carefully the comparison between [illegible] operation was made, and then enumerates savings effected by the use of the electric locomotive, for varying services and conditions, ranging from six to 27 per cent., the latter being net saving in cost in road service.

This is a great triumph for the electric locomotive. The electric system was installed not primarily, in this case, for its economy, but for its great advantages in other respects. Yet it has shown a very striking saving in cost of operation when compared with its steam rival. In addition, the use of electricity promises a large future growth in remunerative traffic, owing to the increased efficiency and attractiveness of the service. All electrical men will rejoice at this showing, for the fact is of great importance as a precedent in the electrification of trunk-line railroads.

READERS of the Western Electrician who are asking for "something about meters" will be gratified to learn that in our issue for April 4th we shall begin the publication of a serial article on the subject of "The Installation, Laboratory Testing and Repairing of Electric Meters" from the pen of Mr. Joseph B. Baker. This serial will be published weekly for a period of about three months, and it will be freely illustrated with diagrams and half-tone illustrations. An idea of the scope of the article may be obtained from the following outline:

- The Meter Installation.
  - Capacity of the Meter.
  - Installing.
- Conduct of Routine and Special Testing.
- Formulæ and Test Constants.
- The Test Room.
  - Organization.
- The Laboratory.
  - Functions and General Equipment.
  - Secondary Standards.
  - Primary Standards.
  - The Testing Switchboard.
- Special Equipment and Methods.
  - Lamp-bank Room.
  - Storage Battery for Test-room Potentials.
  - Standard Clock and Sounder.
  - Comparing Meter Speeds.
  - Testing on Inductive Loads.
  - Miscellaneous Apparatus.
- The Repair Shop.
  - General Equipment.
  - Meter Repairs.
  - Rehabilitation of Old-style Meters.
- Training of Meter Inspectors.

It will be seen that this dissertation on electric meters (meaning, as may be judged from the above, watt-hour meters used on customers' premises) is of both technical and practical value. Indeed, we feel sure that our readers generally will thank us for the opportunity of availing themselves of the results of the careful, systematic and thorough examination which Mr. Baker has made of this important subject. Nearly all central stations, large and small, sell some current for light or power through metered circuits, while the larger plants dispose of by far the greater part of their output in this manner. Therefore, the value of a thorough understanding of the installation, testing and repairing of recording watt-hour meters is easily understood. Then, too, some of the readers of the Western Electrician approach the subject from the viewpoint of the man at the other end of the line—the consumer—and to them also this series of articles will be pertinent and instructive.

The author is well qualified to treat of his subject. He is an engineer of experience who can write. He graduated from the Massachusetts Institute of Technology in the class of 1890 in the regular electrical engineering course, and for 14 years thereafter was engaged in practical engineering work. He had experience in contracting work, in telephone construction, in machine design and as an independent consulting engineer. During this period Mr. Baker contributed a number of articles to the technical press and developed a talent for engineering writing. Later he was connected with the publication bureau of the General Electric Company, and thereafter was technical editor for the fuel-testing and structural-materials-testing divisions of the United States Geological Survey. Since October last Mr. Baker has devoted himself to technico-literary pursuits at his home in the nation's capital.

The Results of the New York Central Electrification.[1]

By William J. Wilgus.

Now that the change of motive power in the [illegible]inal Electric Zone has been completed for sufficient time to gain at least a preliminary idea of the results, the question naturally arises, with what success has the change met expectation?

It has already been explained that the principal reasons for undertaking the work were twofold:

(1) Demand of the public for the abolition of the nuisances incident to the use of steam locomotives south of the Harlem River.

(2) Need for increased capacity of the terminal by the elimination of a large proportion of the switching movements required with steam-locomotive practice; and relief to the main line entrance to the terminal by reducing its use for haulage of dead locomotives and cars to Mott Haven.

As secondary considerations there were:

(3) The possibility of sufficient economy in operation at least to offset largely the additional fixed charges on the cost of the electrical installation.

(4) Opportunities for an ultimate large increase in traffic and corresponding growth of revenue to justify the expenditure for all improvements within the suburban zone.

What do the observations made thus far disclose? The first two expectations have been completely realized.

Park Avenue Tunnel.—The atmospheric conditions in the Park Avenue Tunnel show marked improvement, even with the presence of the remaining New Haven company's steam service.

Increased Terminal Capacity.—The effect on the operating efficiency of the terminal has been very gratifying, the increased capacity being estimated at one-third. There has also been a large reduction in the number of shop or "dead" trains to and from Mott Haven.

Reduced Cost of Operation.—The results, as regards the third expectation, have been most surprising. The operation for a considerable period of steam and electric equipment side by side has afforded an unexampled opportunity for a true comparison of costs of operation. Until now, data on this subject have been based on theory, ignoring many of the indeterminate features of actual operation that have such a weighty effect on costs. For instance, among the variables entering into an analysis of this character are:

(a) Cost and quantity of coal and water at the power station, and on the steam locomotive tender.

(b) Relation of ton-mileage of the motive power to total ton-mileage, including motive power and cars.

(c) Frequency and volume of traffic.

(d) Mechanical and electrical design of motive power as affecting repairs, and hours available for active service.

(e) Fixed charges, depreciation and maintenance on all items of both kinds of service that have a bearing on comparative results, including land, structures and equipment.

In other words, to obtain a true comparison, observations must be made under like conditions in a known service.

With this object in view, a typical steam switching locomotive, engaged in terminal service, and a steam passenger locomotive, assigned to road service, were each selected for observation in the same class of traffic with electric locomotives. The terminal service embraced switching at the Grand Central yard and hauling dead cars to and from Mott Haven storage yard, a distance of six miles. The road service comprised the hauling of schedule trains by the electric locomotive between the Grand Central Terminal and Wakefield, 12½ miles; and the same trains by steam between Wakefield and North White Plains, 11½ miles.

Observers constantly rode the locomotives for the period of the tests, namely, September 12 to 27, 1907, in terminal service, and October 4 to 18, 1907, in road service. Cyclometers and wattmeters registered actual distances, speeds and current consumption. Record was also kept of the number of cars switched and hauled, and the proportion of time each day engaged in actual service, awaiting duty, and laid up for inspection and repairs.

The coal used contained 14,000 B. T. U. per lb., and the cost per ton of 2,240 pounds was:

Steam locomotive in terminal service (anthracite)	$5.00 per ton
Steam locomotive in road service (bituminous)	3.50 per ton
Port Morris power station (bituminous)	3.05 per ton

Water, per 1,000 gallons, cost as follows:

Terminal service and at power station	13⅓ cents
Road service	5 cents

The cost of electric current, when the power station designed load is attained, is taken at 2.6 cents per kilowatt-hour, delivered at the contact shoes of the equipment, and includes all operating and main[illegible] fixed charges on the electrical investment required to produce and deliver the current [illegible] The details of this cost are:

Items.	Operating Cost.	Fixed Charges.	Total.
Power station	[illegible]	$[illegible]	$[illegible]
Terminal [illegible]	[illegible]	[illegible]	[illegible]
Distributing system and sub-stations	[illegible]	[illegible]	[illegible]
Total	$[illegible]	$1.[illegible]	$[illegible]

Locomotive wages are practically identical for each class of service.

Although the fixed charges and depreciation of the electric locomotives are higher than those of the steam, owing to the greater first cost, the net result is in favor of the electric locomotive, due to lower costs for repairs and maintenance. These results are based on actual observation of the steam locomotive covering a period of several years, and of the electric locomotive for two years on the experimental track near Schenectady and one year in the New York zone. The reasons for the lower cost of repairs on the electric machine are the simplicity of construction and the minimum number of mechanical parts. It is also worthy of comment that the electric locomotive costs very much less per day for repairs and maintenance, due to lower expenses for land and structures and fewer days out of service. For instance, the fixed charges and cost of maintenance and operation of the extensive steam engine plant on costly land are comparable with the simple inspection shed charges of the electric locomotive.

The Schenectady experiments indicated that the cost of repairs of the electric locomotive of this type is about two-fifths of that of the steam locomotive of a corresponding age and capacity.

The results of these observations are summarized in the accompanying table. They show that, under the stated conditions, the electric locomotive has the following advantages over its steam rival:

19% saving in locomotive repairs and fixed charges.
18% saving in dead time for repairs and inspection.
25% greater daily ton-mileage.
6% saving in locomotive ton-mileage in hauling service.
11% saving in locomotive ton-mileage in switching service.
16% saving in locomotive ton-mileage in road service.
12% net saving in cost in hauling service.
21% net saving in cost in switching service.
27% net saving in cost in road service.

Even better results may be expected during winter months, when steam locomotives are subjected to many conditions that cause additional expenses not incident to the electric locomotive.

Reduced Cost of Grand Central Terminal Operation.—Owing to the partial use of steam switching locomotives and the presence of the New Haven company's steam road locomotives at the terminal, the full benefits of change of motive power have not yet been secured. However, on the same wage basis for 1907 as for 1906, the month of August, 1907, showed a decrease in cost of terminal locomotive and yard operation of nearly $3,000, although the number of cars in and out increased from 64,984 to 68,519. In other words, the cost of operation decreased nine per cent., while the work done increased 5½ per cent., which is equivalent to a net saving of 13½ per cent.

Increased Revenue.—As to the fourth expectation—increased revenue from a larger volume of business—no definite conclusions can be reached until the extension of electrical service and the completion of the various other improvements afford an opportunity for increase in frequency and [illegible]

[illegible]

[illegible]—[illegible] vations thus far made demonstrate that this pioneer electric installation [illegible] world in the United States [illegible] the purpose that [illegible]

(1) [illegible] of [illegible] locomotive.

(2) Increased capacity at the Grand Central Terminal [illegible]

(3) The [illegible] the [illegible] of the [illegible] 27 per cent. after [illegible] capital charges for electrification.

(4) The outlook of a large future growth of remunerative traffic and other sources of revenue attendant on the use of electricity, much more than sufficient to provide for the increased capital charges for the other improvements.

Several years will be consumed in the gradual rounding out of the work as a whole; but it is gratifying to have this early indication of the success of the undertaking from both the engineering and financial standpoints.

Other Operating Conclusions.—Apart from these results, it is interesting to note the conclusions, suited to this paritcular problem, that may be drawn from a study of the various observations.

Equipment designed for the electric system over which it is to operate offers economies so superior as to overshadow any other advantages that may be claimed for a kind of equipment that can be operated over several systems.

In switching service the economy of electric traction lies in savings for supplies, and in lower unit fixed charges and repairs due to less lost time for repairs and care.

In slow-speed hauling, the advantage lies in the lower unit fixed charges and repairs of the electric locomotive, due to its ability to do more work while busy and to less lost time for repairs and care.

High-speed road service shows advantages for electric traction in all three items—supplies, wages and fixed charges and repairs. The small 18 per cent. increase in current consumption for the greater speed of road service, as compared with hauling service, is in marked contrast to the 165 per cent. increase in coal consumption for steam traction.

Opportunities for large economies lie in the thorough training of motormen in the manipulation of their controllers, a very simple problem as compared with the difficulties of teaching both the enginemen and firemen on steam locomotives to perform their duties so as to result in fuel economy.

Maintenance of Track and Structures.—It is yet too early to express in dollars the comparative effect of steam and electric traction on the cost of maintaining and renewing tracks and structures. Repeated systematic inquiries of all foremen in charge of Electric Zone track maintenance, and of the motormen operating electrical equipment have brought out the practically unanimous opinion that the effect of electric locomotives, apart from slightly greater wear on switches, does not differ from steam motive power on either line or surface of tracks, but that the former has better riding qualities. The superiority of electric traction is mani-

Summary of Comparative Tests of Steam and Electric Locomotives.

Kind of locomotive	Miles per day.	Cars per day.	Busy hours per day.	Hours ready for duty daily.	Percentage of time dead.	Total ton-miles daily	Car ton-miles daily	Percentage of car ton-miles to total.	Car ton-miles per busy hour	Coal or current per car ton-mile	Total cost per car, in cents.	Speed and stops. Average miles per hour.	Maximum miles per hour.	Stops.	Cost per 1 000 car ton-miles. Supplies	Wages	Interest, depreciation, and repairs on locomotives	Total	Watt hours required to do work of 1 lb coal
Switching Service—Grand Central Terminal.†																			
Steam	10.91	55	†1.83	†6.16	†0.52	2 580	916	0.35	501	3.36 lb. coal.	35.2	....	...	...	$8.06	$5.34	$7.61	$21.01	
Electric	11.18	53	†2.01	†6.80	†0.26	1 980	914	0.46	445	264 watt-hr.	28.5	....	...	...	6.88	5.25	4.40	16.53	79
Advantages in favor of electric locomotives	0.22	...	†0.18	†0.64	†0.26	.....	...	0.11	...	....	6.7	....	...	...	1.18	0.09	3.21	4.48	
Hauling to and from Mott Haven.†																			
Steam	40.0	45	†3.36	†5.18	†0.58	16 540	11 720	0.71	3 490	0.46 lb. coal	51.6	11.9	48	0.9	1.12	0.35	0.52	1.99	
Electric	78.4	95	†6.41	†10.42	†0.80	30 370	23 310	0.77	3 640	44.3 watt-hr.	43.2	12.3	45	2.0	1.16	0.31	0.28	1.75	96
Advantages in favor of electric locomotives	38.4	50	†3.05	†5.24	†0.23	13 830	11 590	0.06	150	...	8.4	0.4	8	1.1	...	...	0.24	0.24	
Road Service.*																			
Steam	74.04	28	3.72	‡11.11	‡0.54	25 620	12 660	0.49	3 400	1.22 lb. coal.	126.0	19.9	60	8.6	2.03	0.28	0.46	2.77	
Electric	126.22	43	5.34	‡18.70	‡0.43	33 210	21 510	0.65	4 030	52.3 watt hr.	100.0	23.6	55	2.9	1.37	0.31	0.34	2.02	48
Advantages in favor of electric locomotives.	52.18	15	1.62	‡2.59	‡0.09	7 590	8 850	0.16	630	....	26.0	3.7	5	....	0.66	.....	0.12	0.75	

* Portion of time of locomotives engaged in other service not shown in this table. † Switching and hauling done by same locomotives. ‡ Total time of locomotives in all classes of service.

1. This is the concluding portion (somewhat abridged) of a paper read before the American Society of Civil Engineers on March 18, 1908. The full paper bears the title "The Electrification of the Suburban Zone of the New York Central and Hudson River Railroad in the vicinity of New York City." It is published on page 68 and following pages of the February (1908) Proceedings of the Society. Mr. Wilgus was formerly vice-president of the New York Central and Hudson River Railroad Company.

fest, of course, in the cessation of costly corrosive action of locomotive gas on metallic structures, and the freedom from cinders which, with the steam locomotive, cause heavy maintenance costs for cleaning, rock ballast and pointing brick tunnel arches.

Personnel of Engineering Department. This paper would be incomplete without an expression by the writer, first as chief engineer and later as vice-president of the company, of his deep appreciation of the enthusiastic co-operation and the able and earnest assistance of those associated with him in bringing this work to a successful issue.

The general principles and policies on electrical matters were determined by an electric traction commission, the members of which, in addition to the writer as chairman, were Bion J. Arnold, M. Am. Soc. C. E., M. Am. Inst. E. E.; Frank J. Sprague, M. Am. Soc. C. E., M. Am. Inst. E. E.; George Gibbs, M. Am. Soc. C. E.; and the general superintendent of motive power, rolling stock and machinery, New York Central Lines, at first Arthur M. Waitt, M. Am. Soc. C. E., M. Am. Soc. M. E., later succeeded by John F. Deems. Edwin B. Katte, M. Am. Inst. E. E., M. Am. Soc. M. E., electrical engineer of the company, acted as secretary.

The other improvements, including the preparation of plans and specifications, and the execution of all work, including electrification, by contract and by company forces, were under several corps, the heads of which, for the purpose of co-ordinating their efforts, formed the construction committee. Among the members of this committee, including the writer as chairman, were Charles A. Reed, executive of the associated architects for the Electric Zone, Messrs. Reed and Stem, and Warren and Wetmore; W. H. Knowlton, principal assistant engineer; E. B. Katte, electrical engineer; George A. Harwood, M. Am. Soc. C. E., terminal engineer; Azel Ames, signal engineer; George A. Berry, engineer of company forces; Henry A. Stahl, office engineer; Victor Spangberg, designing engineer, and J. L. Holst, bridge engineer. Associated with this committee were also Ira A. McCormick, general superintendent of the Electric Zone, and A. T. Hardin, Assoc. M. Am. Soc. C. E., assistant general manager, as representatives of the operating department.

To the many contractors, who with few exceptions performed their work with skill and fidelity, appreciative acknowledgments are also extended.

Exhibition Arrangements for the Chicago Convention.

The accompanying diagram shows the booth arrangement for the exhibition of products of associate members to be held in connection with the National Electric Light Association at the Auditorium Hotel, Chicago, May 19th, 20th, 21st and 22d. In addition to details printed in the Western Electrician last week, it may be said that the price of the booths, ranging from $75 to $150, includes the erection of a platform, posts, railings, painting, a sign bearing name of the exhibiting member, furniture, consisting of a table or desk and two chairs, and current and lamps for the lighting of the booth. This will do away with the annoyance incidental to contracting separately for each item. Direct current at 110 volts (two-wire system) for operating exhibits and other special purposes will be available at five cents a kilowatt-hour.

For the convenience of exhibitors, arrangements have been made with the Joseph Stockton Company of Chicago for the handling of exhibits. All packages should be addressed to the exhibitor, in care of the Joseph Stockton Company, sending bill of lading direct to that company, so that it may send its wagons to the freight depots at the proper time. The boxes will be stored in this company's freight barns and delivered into the Auditorium on Saturday, May 16th, and Monday, May 18th. In order to avoid delays, it is suggested that all shipments be made so that they will reach Chicago a few days before Saturday, May 16th. The rates for cartage applying to each individual shipment are as follows: Rate per hundredweight, 10 cents; minimum charge (up to 300 pounds), 50 cents; minimum charge (above 300 pounds and up to 750 pounds), 75 cents.

The color scheme is receiving a great deal of attention, and it is the desire of the exhibition committee to make the exhibition attractive not only commercially, but also from the artistic viewpoint. The secretary of the committee has prepared application blanks to be signed in duplicate by intending exhibitors. Frank H. Gale, Schenectady, N. Y., is chairman of the committee, and Walter Neumuller, 55 Duane Street, New York, is secretary. The Chicago members are H. M. Post, Western Electric Company, and Homer E. Niesz, Commonwealth Edison Company.

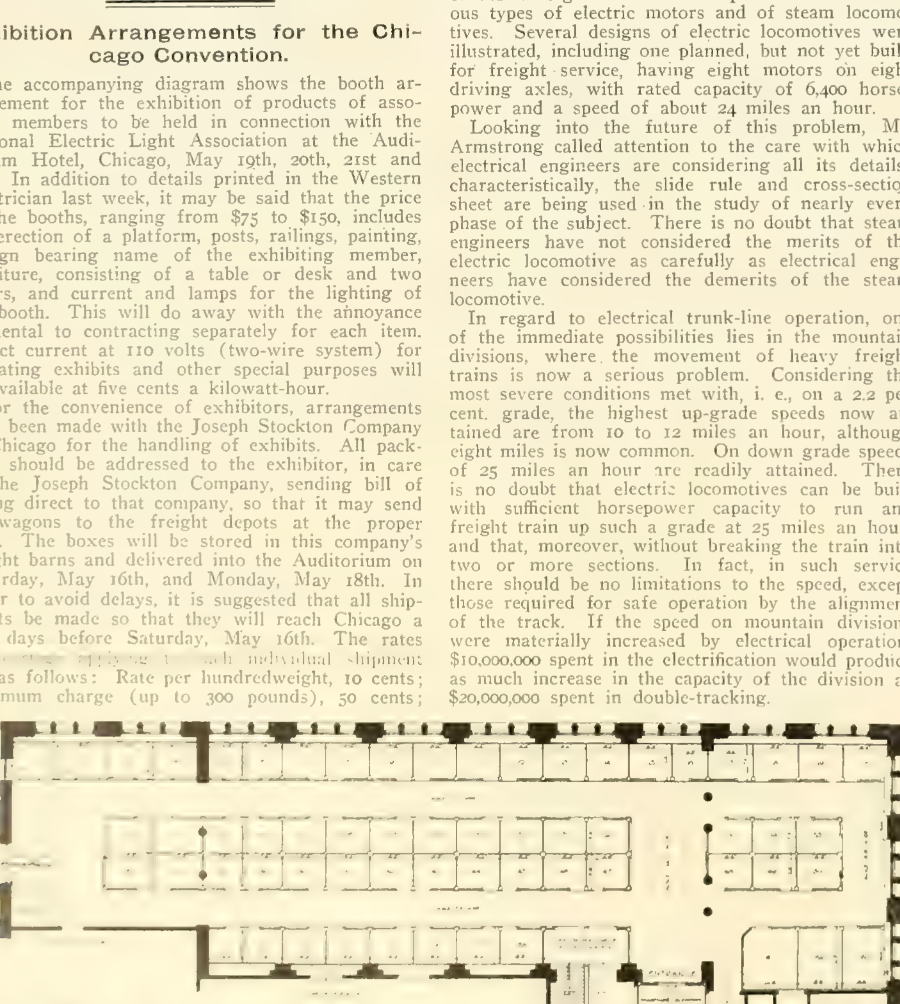
Electricity and the Transportation Problem.

A successful meeting of the Chicago Section of the American Institute of Electrical Engineers was held on the evening of March 19th. It was preceded by an informal dinner and smoker at a Madison Street restaurant, attended by about 80 members. The speaker of the evening, Mr. Albert H. Armstrong of Schenectady, electrical engineer for the General Electric Company, was present, and after cigars had been lighted Mr. H. R. King, chairman of the section, introduced Mr. Armstrong, who announced the nomination of Mr. Ferguson for president of the Institute, and also gave the names of the other gentlemen on the directors' ticket. Mr. Ferguson was detained at home by a slight illness, but the announcement of his nomination was received with hearty applause. Mr. Armstrong also complimented the section on the large attendance at the dinner.

The meeting itself was held in Kimball Hall on Wabash Avenue. The attendance was over 200. Mr. King called the assemblage to order and then called Mr. Bion J. Arnold, past president, to the chair. Mr. Arnold introduced Mr. Armstrong, whose subject was "The Relation of Electricity to the Problem of Transportation." The speaker did not read a paper but delivered a talk, illustrated by a number of excellent lantern-slide pictures. Beginning with the electric motor, he outlined briefly the development of the electric railway, showing features of the West Jersey and Seashore, New York Central, New York, New Haven and Hartford, Baltimore and Ohio, and other equipments. The gasoline-electric car was described, and several curves were given to show the performance of various types of electric motors and of steam locomotives. Several designs of electric locomotives were illustrated, including one planned, but not yet built, for freight service, having eight motors on eight driving axles, with rated capacity of 6,400 horsepower and a speed of about 24 miles an hour.

Looking into the future of this problem, Mr. Armstrong called attention to the care with which electrical engineers are considering all its details; characteristically, the slide rule and cross-section sheet are being used in the study of nearly every phase of the subject. There is no doubt that steam engineers have not considered the merits of the electric locomotive as carefully as electrical engineers have considered the demerits of the steam locomotive.

In regard to electrical trunk-line operation, one of the immediate possibilities lies in the mountain divisions, where the movement of heavy freight trains is now a serious problem. Considering the most severe conditions met with, i. e., on a 2.2 per cent. grade, the highest up-grade speeds now attained are from 10 to 12 miles an hour, although eight miles is now common. On down grade speeds of 25 miles an hour are readily attained. There is no doubt that electric locomotives can be built with sufficient horsepower capacity to run any freight train up such a grade at 25 miles an hour, and that, moreover, without breaking the train into two or more sections. In fact, in such service there should be no limitations to the speed, except those required for safe operation by the alignment of the track. If the speed on mountain divisions were materially increased by electrical operation, $10,000,000 spent in the electrification would produce as much increase in the capacity of the division as $20,000,000 spent in double-tracking.



[illegible] LIGHT CONVENTION

Another feature worth considering is the subject of braking. It is well known that the present air brakes have certain limitations. In releasing the brakes on a long train those nearest the locomotive are released first, and so on, thus gradually progressing through the train, so that there is quite an interval before the brakes at the remote end of a long train are released. This is liable to snap the train in two, and often is the cause of such accidents. With some types of electric locomotives that can readily be designed the locomotive holds the train back on down grades by running as a generator and returning power to the line. In this case the air brakes are used only as an auxiliary, and great saving in the wear of brake shoes results.

The experience of the last few years with installations actually in operation and experiments carried out under service conditions has placed manufacturers in a position fully to guarantee electric locomotives for any performance required. Electrification of steam railroads is going to be very expensive as to capital investment, but will doubtless be undertaken at first in particularly suitable sections. Nevertheless, the equipment of these isolated divisions will be designed of such a character as to be readily extended over long lines. This latter work is bound to come as railroad officials closely watch the performance of the electric locomotive and become convinced that it is making good.

Discussion.

In opening the discussion, Mr. B. J. Arnold, as chairman, declared that Mr. Armstrong has probably had more to do with the calculations determining the feasibility of various electric-railway projects, from the manufacturers' view point, unless it be the engineers connected with the Westinghouse company, than any other man in the country. He had clearly pointed out the advantages of the electric locomotive, and would no doubt be glad to bring out further points to convince any steam engineers that were present.

In answer to the question, what load factor would make electrification pay, Mr. Armstrong said that a study of mountain-division electric projects has shown that, if there were 10 trains each way per day on a section of some 150 miles operated by hydro-electric power, there would be a return of 10 to 15 per cent. on the investment. As far as load factor on the generating station is concerned, this would be 40 to 55 per cent. for such a service, which is a better load factor than many city stations have. The saving in fuel and in operation, though certain to result, is not the main feature to be considered. The most important advantage of electrifying the mountain divisions is that this would increase the capacity of the entire trunk line to handle more traffic and more quickly; in other words, it would enlarge the neck of the bottle.

Mr. Storey, of the Santa Fe Railroad, admitted that the electric locomotive had many distinct advantages, as Mr. Armstrong had clearly shown. On his road, however, they have no problems coming within the requirements that were declared to be necessary to justify electrification.

Mr. Thompson, of the Chicago and Northwestern Railroad, believed that there was little question but that at some time in the future the electric locomotive would almost entirely replace its steam competitor. The latter will be relegated to the place now held by the stage coach. Electric operation is particularly suitable for tunnel service and heavy suburban traffic. While there was no immediate electrification project contemplated by the road he was connected with, there might be some future development in this line in connection with the extensive new terminal facilities to be constructed soon in Chicago.

Mr. Arnold said, smilingly, that for about 20 years he had been working to put the steam locomotive out of business, but he had not quite succeeded. In connection with the New York Central work it should be noted that only a portion of the entire project had been carried out. He was convinced that the operating expenses of the completed section were decidedly in favor of the electric service. The electrification of the Sarnia Tunnel, which had been planned by him, had been carried out as a high-tension single-phase road at a saving of 20 per cent. over what it would have cost if the third-rail, 600-volt, direct-current system had been adopted. In mountain-division work the increase in capacity of the present trackage was undoubtedly the chief advantage of electrification. He felt confident that as soon as the relative merits of the direct-current against the single-phase system are better understood and as soon as the financial conditions improve there would be quite a number of very extensive electrification projects carried out. There are two or three roads in Chicago that could electrify their suburban and terminal facilities with a sufficient saving in the operating expenses to warrant the investment. In this connection there were a number of politic obligations on the part of the steam-railroad officials, such as the smoke problem, that might outweigh questions of economy alone.

Mr. Woodmansee, of Sargent & Lundy, asked: What have the results of electric operation in the

New York zone shown practically [illegible] to the relative operating expenses of steam and electric service?

Mr. Armstrong said the results thus far have been very gratifyingly in favor of electric operation. It is almost impossible to give the exact comparative figures, since in steam service the figures for a long division can hardly be analyzed so as to separate those of a small part of the division. In this particular project it should be borne in mind that the interest charges on capital account are now higher proportionately than they will be when the project is completed, since everything has been planned on a much larger scale than has yet been put in operation. A recent paper by Mr. W. J. Wilgus, former vice-president of the New York Central Railroad, before the American Society of Civil Engineers, goes into this subject exhaustively [A portion of this paper is given elsewhere in this issue of the Western Electrician.]

Maintenance of Way Association.

The ninth annual convention of the American Railway Engineering and Maintenance of Way Association was held in the Auditorium Hotel, Chicago, March 17th, 18th and 19th. The meeting was the most successful and best attended of any yet held, and in all the proceedings concerning the varied and important subjects considered there was a concerted effort in the interest of safer and more intelligent operation of railroads.

All the principal railroads of the country are represented in this association, whose members are doing effective and intelligent work in formulating plans and originating ideas for safeguarding the interests of employers, employees and the public in a manner as equitable as possible. The members of the association include some of the leading railway officials and engineers in the country, and the meetings showed a commendable system which was productive of results without the waste of time. The various subjects considered at the meeting found the basis for their discussion in the reports of committees, which made recommendations on the matters submitted to them in plain language. Where the present practice of operation, signaling, construction or maintenance seemed wrong the committees submitted changes without regard to who was hurt.

Details of all the reports and suggestions cannot be given here, but mention of some of the more important recommendations may be made. The subjects reported on by the various committees were the following: Uniform rates; signaling and interlocking; water service; buildings; ballasting; iron and steel structures, including report on impact tests; open vs. ballast deck structures; wooden bridges and trestles; track; yards and terminals; roadway; rail; masonry; records, reports and accounts; ties; signs, fences, crossings and cattle guards; economics of railway location.

Roadway.

The committee on roadway, among other conclusions, recommended that there should be a superintendent of construction in complete charge of the work. To him should report the following officers in charge of the various branches of the work: The engineers, having charge of the contract work and giving lines and grades; the roadmaster, in charge of earthwork and track work; engineer, in charge of masonry and bridges; the yardmaster, in charge of engines and switching; the trainmaster with a dispatcher, in charge of the operation of traffic over the territory covered by the work in hand. If the proportions of the work allow, every person connected with this organization should be relieved from all other duties relating to the operation of the road.

The railroad company should handle with its own force all work which may interfere with the operation of the road, such as track raising or lowering, filling and excavating, handling and laying tracks, moving switches and putting in bridges under traffic. All other work which can be done without any interference with the operation of the railroad should be let by contract, both for economical and political reasons; this consisting of street work and concrete work where practicable.

As far as practicable, all earthwork should be handled by machinery, that is, loaded by steam shovels and unloaded by plows, handled by cable unloaders and moved by spreaders.

The best material to use for filling is sand.

Water, sewer and gas pipes, electrical conduits and wires should be taken care of and the work of moving them should be done by the companies owning them, whether or not the work is paid for by the railroad company.

Ties.

The report on ties contains a compilation of answers received in reply to a circular of inquiry as to causes of cross-tie failure, whether due to decay, rail cutting or spike cutting; a suggested method for analyzing coal-tar creosote, and deter- [illegible]

Rails.

[illegible] the securing of safer steel rails. The rail committee in its report pointed out the desirability and the necessity of all the railroads in the country uniting on a single-rail section. The committee is to prepare specifications for a standard rail section with which the organization may insist that manufacturers comply. It is said that the committee may favor adopting specifications which will require that the manufacturers shear off 25 per cent. from the top of the ingot in order to remove all flaws and impurities which would cause rail failures and consequent wrecks. A form was submitted for adoption upon which it is hoped all the railroads will keep a correct record of all rail failures from which to compile complete data regarding the loss of life and property caused by breaking rails. Among the influential men on the rail committee is Julius Kruttschnitt of the Harriman lines.

Track.

The report on track recommends split switches, for main track, with distant switch signal interlocked with switchstand and pipe-connected derail. The bolted type of frog is recommended, the length to be such that the standard angle bars can be applied; flangeway to be 1⅞ inches; rails to be of open-hearth steel, fillers to be made of rolled steel and to fit snug; bolts of fine B. B. iron, round and true to size, with U. S. standard ends and threads; bolt holes to be accurately drilled, holes to be made 1/16 inch less in diameter than bolts to be used: parts of frogs to be then assembled and holes reamed in order to be straight and of such size as to give the bolts a driving fit. Bottom plates to be made of rolled steel.

The guard rail recommended is 15 feet in length, flangeway 1⅞ inches where track is maintained to standard gauge. If turnouts are located on curve, it is recommended that flangeway be widened to maintain a distance of 4 feet 6⅝ inches from the gauge of frog to the gauge of the guard rail.

The committee recommends to the American Railway Master Mechanics' Association that the present clearance between wheels and driving boxes for new and repair work be increased from one-eighth inch to one-quarter inch.

Roundhouses.

Among the conclusions of the committee on buildings relating to roundhouses are the following:

Reinforced concrete should be used below the floor when it is cheaper than plain concrete.

The additional security against interruption to traffic warrants the construction of a roundhouse with a reinforced concrete roof.

When the roof is of reinforced concrete the columns should be of the same material.

Reinforced concrete should be used for the walls only where special conditions reduce its cost below that of brick or plain concrete and where plaster is not considered satisfactory.

Jib cranes attached to the posts alongside of a number of pits in roundhouses, or, in the case of large roundhouses, a small traveler working around the outer circle, capable of handling two tons, should be installed in such roundhouses as may be designated by the motive power department as requiring such appliances for light locomotive repairs.

Signaling and Interlocking.

On signaling and interlocking the report contains an historical review of the efforts made by various railroad companies toward formulating an ideal system of signaling, and the committee briefly summarizes the requirements thus far adopted by the association and published in the Manual of Recommended Practice. The committee has developed and presents the indications deemed requisite, with their application, shown by means of a diagram, and from which it has deduced the necessary requisites of installation and adjuncts. The requisites of installation recommended depart from the Standard Code of the American Railway Association in six important features:

(1) A distinctive position is recommended for the caution indication of the distant signal in lieu of a special form of arm displayed in stop position of other signals.

(2) Two lights are recommended on every signal in lieu of one, two, three, four, or even five lights under present practice.

(3) The requisite use of two lights is taken advantage of in distinguishing between the different types of signals.

(4) A differentiation is made between signals requiring stop until authorized to proceed, stop and proceed, and stop and investigate, because the first two have been provided properly and necessarily by the Standard Code, and the third one is recognized in universal practice and should be embodied in the rules laid down for the proper conduct of transportation.

(5) A differentiation is made between the indi- [illegible]

[illegible] quently occurs, the same crews may have to run under different systems of signaling on a single run. Under a uniform system these crews would have but one system of indications to learn.

(b) Men leaving the employment of one road will not have to unlearn one system of signaling and learn another in order to qualify to work upon another road.

(c) Uniformity of indications will tend to uniformity in a considerable portion of the apparatus used, resulting in a decrease in various manufacturing expenses, and amount of stock to be carried by manufacturers and railroads, especially at jointly operated plants, and will result in quicker delivery of material.

(d) The expense for damage claims should be reduced and a better legal status secured to the railroad companies on account of less liability to confusion of indications, and on account of the system of signaling proposed having the endorsement of general adoption.

(1) The advantage resulting from uniformity of signaling on the different systems of the country are:

(2) Quicker and more accurate interpretation of signals by enginemen.

(3) Indication of diverse functions by the signals themselves instead of by general orders, special orders, etc., thus relieving the enginemen's minds of a burden of detail.

(4) Classification of indications of the same general meaning, thus avoiding misunderstanding.

(5) Information by the aspect of the signal of the improper display of an indication.

Yard Lighting.

For yard lighting the use of arc lamps of 2,000 candlepower is recommended. For lighting hump and ladder tracks the lamps should be spaced 140 to 150 feet apart and hung 28 feet (or more) above the tracks. For lighting body tracks the spacing should be such that cars will be clearly visible.

Officers and Exhibits.

A. W. Johnson of Cleveland, general manager of the New York, Chicago and St. Louis Railway, was the retiring president of the association. He presided at all the sessions.

Officers elected for the ensuing year are:

President, Walter G. Berg, chief engineer, Lehigh Valley Railroad, New York; vice-president, L. C. Fritch, assistant to president of the Illinois Central Railroad, Chicago; treasurer, W. S. Dawley, chief engineer, Missouri and North Arkansas Railroad, St. Louis; secretary, E. H. Fritch, 962 Monadnock Building, Chicago; new directors—Charles S. Churchill, chief engineer, Norfolk and Western Railroad, Roanoke, Va.; Edwin F. Wendt, assistant engineer, Pittsburg and Lake Erie Railroad, Pittsburg.

There was a large exhibit of railway appliances and material. The convention will be held in Chicago next year.

A 15-cycle Single-phase Railway.

The Visalia Electric Railroad Company's 23-mile standard-gauge electric road, extending from Visalia, Cal., to Exeter and Lemon Cove, was placed in regular operation about two weeks ago. James H. Crossett is superintendent and engineer and Benjamin Maddux is vice-president of the company. The plant was installed by the Westinghouse Electric and Manufacturing Company. This has the distinction of being the first 15-cycle single-phase electric railway in the United States. Cars have been operated at the rate of 62 miles an hour on a test run. Regular interurban cars equipped with 75-horsepower motors have a capacity of 70 passengers each. All cars are equipped with multiple control so that they can be operated in trains. A 45-ton electric locomotive, equipped with four 125-horsepower motors, is used to haul freight trains. This picked up 12 loaded flat cars on a 1 per cent. grade and a 10-degree curve. It also hauled 12 flat cars and two standard passenger cars up a 1 per cent. grade.

Current is taken from the Mt. Whitney Power Company's 15,000-volt, three-phase, 60-cycle transmission system at the railroad company's concrete sub-station at Exeter, where two 375-kilowatt frequency-changer sets give an output of 15-cycle current which is used at 3,300 volts on the overhead trolley wire. All of the cars are equipped with automatic air brakes. All poles are set in concrete.

Chicago Council Passes the Commonwealth Edison Rate Ordinance.

An ordinance fixing the rates which the Commonwealth Edison Company may charge for electricity for light, heat and power in Chicago, and specifying other requirements, was passed by the City Council on March 23d by a vote of 50 to 16. The new rates are to be in force up to August 1, 1912. The city recognizes the right of the Chicago Edison Company and the Commonwealth Electric Company to consolidate and the city is to receive three per cent. of the gross receipts of all the business of the consolidated companies.

The gross maximum rate for current for lighting, or upon an interior distributing circuit carrying electricity for lighting, heating and power through the same meter, is to be 15 cents a kilowatt-hour for a supply not exceeding the equivalent of 30 hours' use per month of the consumer's maximum requirement. This rate is to be in force until July 31, 1908, and from that date to July 31, 1912, 13 cents is the maximum. For current supplied as above stated in excess of the equivalent of 30 hours' use per month of the consumer's maximum requirement, the gross rate (commonly called the "secondary" rate as applied to such longer use of the electricity, to distinguish it from the "primary" rate, applied to shorter use) is limited to nine cents a kilowatt-hour for the period up to July 31, 1898; eight cents during the following year, and seven cents during the last three years of the period.

These rates include the free installation and renewal of incandescent lamps of the company's standard carbon-filament type. Consumers furnishing their own lamps are entitled to a reduction of half a cent per kilowatt-hour from the rates named.

The gross maximum rate and the gross "low" or "secondary" rate for supplying electricity for heating, or upon an interior distributing circuit carrying electricity for heating and also for lighting or power through the same meter, are not to exceed those above prescribed for lighting.

The gross maximum power rate upon a power circuit to an extent not exceeding the equivalent of thirty hours' use per month of the consumer's maximum requirement is fixed at not to exceed 11 cents a kilowatt-hour, except that the company may continue to make, as it does at present, a minimum charge of not exceeding 50 cents per month for each horsepower, or fraction thereof, in rated capacity of motors connected, for any amount of electricity consumed either for general power purposes or for operating elevators, hoists or similar machinery. For power supply (other than for operating elevators, hoists or similar machinery) in excess of the equivalent of 30 hours' use per month of the consumer's maximum requirement, the gross secondary rate is limited to six cents.

If the consumer so desires, his maximum requirement will be determined by meter, where practicable, otherwise it may be fixed by agreement or by estimated average maximum load as shown by experience. The fixing of the rates is not to be understood as compelling the adoption by the company of only the Wright maximum-demand meter for measuring the maximum supply of electricity, or as preventing the company from agreeing upon different methods of charging in cases where the maximum-demand meter system is not practicable, or where electricity is supplied in specially large quantity, or upon a guaranty of some specified consumption, or under some other special circumstances or conditions; but no rate is to be in excess of the maximum prescribed in the several classes.

The company is to publish regular schedules of all its established rates, to be open to public inspection. All rates are subject to a discount equal to one cent a kilowatt-hour when bills are paid within 10 days from date of actual mailing.

Current for arc street lighting is to be furnished to the city at the rate of $75 a year for each 450-watt lamp burning from dusk to daylight.

Section 2 of the ordinance provides for the termination at the will of the city of certain former ordinances in which the consolidated company is interested and specifies the relation of others to the present measure.

Provision is made in the ordinance for examination of the company's books and records by the city as a means of determining the company's compliance with the requirements and for obtaining data to be used in future rate regulation.

Other sections contain amendments to former [illegible] and [illegible] provisions as to the physical construction.

[illegible] upon the company an obligation to maintain its voltage at a compara- [illegible] the fluctuation not to be [illegible] the company to pro- [illegible] the [illegible] company to extend its lines in case reasonable returns in patronage are promised by such extension, and the city electrician is made the arbiter as to [illegible] meter measurements.

A Great Mexican Electric Power Plant.

The annual report of the Mexican Light and Power Company, which has just been made public, shows that concern to be in a prosperous condition and also that it is one of the greatest foreign industries operating in Mexico. The value of the company's investments in Mexico is placed at more than $40,000,000. The work of adding to the great plant is still in progress and preliminary steps have been taken to extend the business of the company to other portions of the republic.

The report shows that during the last year there was expended on capital account a total of $2,475,-331 gold, of which more than $1,000,000 was laid out in the work of completing the hydro-electric plant at Necaxa, near the City of Mexico. Approximately $1,000,000 was expended on distributing lines and equipment in the City of Mexico and the Federal District. The sum of $350,000 was spent during the year on the installation of the second hydro-electric plant, which has cost $668,000 gold up to December 31, 1907.

The company has expended a considerable sum in constructing a provisional dam at Los Reyes and in driving a tunnel to connect the Laguna reservoir with that of Los Reyes. The Laguna dam has been raised to a height that will provide a storage capacity of 30,000,000 cubic meters of water.

Satisfactory progress is being made in the construction of a great dam at Necaxa. The material to be used in the construction of this dam will amount to 1,634,000 cubic meters. The lower part of this dam is now raised to a height of about 60 feet above the river bed. This storage reservoir will be used to supply the large hydro-electric plant that was first erected. The reservoirs which the company now has under construction will have the following ultimate capacities: Necaxa, 44,852,-600; Laguna, 44,013,000; Los Reyes, 26,179,200 cubic meters.

In addition to the large amount of electric power which the company is now supplying in the City of Mexico and the other towns of the Federal District, in the city of Puebla and to many mining concerns of El Oro, the demand for more power is much greater than it can now supply. It has tentative contracts for supplying additional installations representing 3,000 horsepower capacity in motors. This is exclusive of the contract which the company has already made with the federal government by which 3,000 horsepower is to be furnished for the purpose of operating the pumps of the big waterworks and drainage systems of the City of Mexico. The supplying of this power will probably begin the latter part of this year.

The company has many transmission lines reaching out in all directions from its Necaxa plant. The longest of these is 175 miles. The demand for electric power with which to operate the machinery of mines and industrial plants as well as the street-railway lines is great, and it is planned by the company to supply this demand to all within a radius of 200 miles and more from its Necaxa plants.

Marseilles International Electrical Congress.

The International Electrical Congress which is to be held at the time of the electrical exposition at Marseilles, France, this year, will no doubt be an event of considerable interest, and will bring out a number of papers upon all questions relating to electrical affairs. According to the programme of the Congress, which has just been published by the committee, the subjects of the papers will be divided into nine different sections. These are as follows: Rules and legislation for electrical work, both home and foreign; construction and protection of electric lines; technical and commercial operation; electric lighting and domestic applications; use of current for different industries, mining, agriculture, etc.; electrochemistry and electrometallurgy; telegraphs and telephones; education and measurements; hygiene and medicine. Each of these sections will include a number of different subjects, and there will be 53 papers in all.

Prof. Elihu Thomson and Dr. Charles P. Steinmetz of the General Electric Company and Mr. William J. Wilgus of New York have been added to the American honorary committee for the Marseilles electrical exposition of this summer.

An Author's Mishaps.

In announcing the appearance of Vol. VII. of the annual "Copper Handbook" Horace J. Stevens of Houghton, Mich., says, with becoming frankness: "I deem it but fair to advise you that the revision of the book from Vol. VI has not been complete. Owing to an unfortunate train of mishaps, including fire, Pasteur treatment on account of the bite of a rabid cat, blood-poison, three surgical operations and a number of minor mishaps, not helped by a panic and several printers' strikes, [illegible] that it was impossible for me to [illegible] the detailed mine descriptions in Chapter XV. of Vol. VI. Everything else, however, has been revised most thoroughly." Concluding his circular, Mr. Stevens says: "I am sorry to send out a book not entirely revised, but the loss of five months' time, about $20,000 in cash and a square foot of skin interfered with my previous plans."

Some Chicago Traction Problems.

A special meeting of Armour Institute Branch of the American Institute of Electrical Engineers was held on March 12th to hear an informal talk to the students on "Chicago Traction Problems," by Mr. R. H. Rice of the engineering department, Board of Supervising Engineers, Chicago Traction. The meeting, which was presided over by Chairman T. C. Oehne, was exceptionally well attended on account of the general interest in the subject and because the speaker was formerly associate professor of electrical engineering at the institution.

In prefacing his remarks, Mr. Rice referred to the tendencies of the times in regard to the economics of public utilities, especially in relation to municipal ownership and municipal control, showing that the tendency is now strongly for private ownership under competent public control. This policy was probably best illustrated by the new Chicago traction ordinances. These ordinances, approved by popular vote last April, have become models in the treatment of this problem for other cities in this country and abroad. The main provisions of the ordinances, well known to the readers of the Western Electrician, were analyzed, and the organization of the Board of Supervising Engineers, thereby created, was explained in detail.

In considering the work that has been done on the rehabilitation of the Chicago street railways particular mention was made of the three types of track construction used, electric track welding and conduit laying in the old cable slots. [These were described and illustrated in the Western Electrician of November 2, 1907.] Of this conduit work about 600,000 duct-feet was laid during the last year. A peculiar phenomenon has been observed in these conduits along Cottage Grove Avenue, particularly in the half-mile stretch from Forty-third to Forty-seventh streets. The cables laid in the ducts underneath the track were observed to shift their position longitudinally and creep bodily as much as 18 inches in the direction of traffic. To what this was due has not yet been ascertained; at any rate, it necessitated anchoring the cables securely. The connection of the underground feeders through laterals to the overhead work presented some interesting problems, not the least of which was the installation of suitable lightning arresters to protect the different parts of the system.

On the assumption of a relative conductivity of the rails to pure copper of 1 to 11, each rail represents a conductivity equivalent to about 1,500,000 circular mils of copper. The four rails in a double track are therefore equivalent to about 6,000,000 circular mils copper, which makes an excellent return circuit. Further to guard against electrolysis a 1,00,000-circular-mil copper cable is laid between the tracks. This is cross-connected to each rail at distances not over 330 feet apart. The joints produced by the electric welding process have proved very good, only a small percentage showing defects; most of them have a higher conductivity than the straight rail. All special work, such as crossings, crossovers, etc., has not been welded, extra heavy bonding being here used. During the last year nearly 50 miles of single track has been relaid, about three-fifths of it on the South Side.

The calculation of feeders was described in a general way. This problem is quite intricate and requires a close estimate of future loads as well as a thorough study of the present traffic. Still another complication is that it has not been positively decided whether new power houses shall be built or whether the additional power required will be purchased from the Commonwealth Edison Company as has been so extensively done of late. In a large portion of the work the calculations have allowed a maximum drop of 100 volts on branch lines and only 50 volts on heavy trunk lines. These figures, however, have not been definitely decided on for the system as a whole. To aid in the determination of what figures may be relied on for the materials used a number of tests of conductivity, chemical composition, etc., are now being conducted in the laboratories of Armour Institute of Technology.

The New Plant in Shawneetown.

The city of Shawneetown, Ill., has been without an electric-light plant for several years, the old central station and equipment having been sold out. The present plant is up-to-date and was privately financed, to be turned over to the city for operation as a municipal station, but before this could be accomplished injunction proceedings were instituted to prevent the consummation of the plan. The plant will now be operated by private interests. Street lights are now in service on the moonlight schedule, and a few buildings are being lighted. The present management of the lighting company will proceed carefully with the work of connecting up old wiring installations, none of which will be supplied with current except when a rigid inspection discloses the fact that the wiring is safe.

The March of the Steam Turbine.

Interest will be taken in the following table showing the aggregate steam-turbine business of the Westinghouse Machine Company at the beginning of the year, classified according to industries. This table shows a summary of 640,700 kilowatts or 930,000 brake horsepower. The output is distributed among 282 plants (3,298 horsepower per plant) and 493 machines, averaging 1,886 horsepower per machine.

DISTRIBUTION OF WESTINGHOUSE STEAM TURBINES.

Classification.	Plant Capacity Up to 1,000 K.W.	Plant Capacity Above 1,000 K.W.	Total Numb'r of Plants.	Average Capacity of Turbines in K.W.	Total Capacity in K.W.
Electric railways......	18,000	144,500	69	1,075	282,000
Railroad electrification	....	3,000	1	[illegible]	40,000
Central stations......	23,550	45,000	[illegible]	1,440	[illegible]
Isolated plants........	3,200	....	[illegible]	400	3,200
Municipal	1,000	.....	11	570	8,200
Railroad car shops...	9,200	....	1	490	[illegible]
Textile mills........	8,200	......	22	595	[illegible]
Cement mills	700	......	5	1,012	7,100
Iron and steel works...	1,000	....	1	500	5,000
Pulp and paper mills...	800	....	5	778	7,000
Rubber works..........	600	......	4	621	4,350
Powder works.........	1,200	....	2	400	1,200
Machinery Manufact'rs	8,400	....	12	876	15,000
General Manufact'rs...	5,750	....	11	45[illegible]	7,250
Mining and Irrigation..	8,000	....	19	686	21,350
U. S. Government.....	1,750	....	4	1,225	12,250
Miscellaneous.........	6,700	....	14	483	8,700
Total....	99,250	223,400	282	... ...	640,700

But in addition to this output listed above, there were at that time under construction at East Pittsburg 148 machines. These bring the grand total of the turbine business of this company up to the gratifying figure of 864,300 kilowatts or 1,253,000 brake horsepower.

Referring to the above table, it is particularly gratifying to note the rapid advancement in steam railroading, textile mills and mining. Although there are comparatively few railroad electrification plants yet installed, their capacity is large—11,670 kilowatts per plant. In paper and textiles, there are 27 plants, aggregating 20,700 kilowatts or 767 kilowatts per plant. Nineteen mining properties have adopted turbo-electric drive. Thus, while the most fruitful field for the turbine in the early days of its development was in electric traction and electric-lighting work, its field has greatly broadened out into the general industries, until today nearly 15 per cent. of the total represents manufactures, as against 34 per cent. electric lighting and 51 per cent. in traction. That this result has been achieved with practically one type of turbine is a creditable reflection upon its fundamental design. An idea of the size to which modern central stations have grown is furnished by the fact that nearly 35 per cent. of the total capacity tested is contained in stations of over 10,000 kilowatts capacity. A decade ago, at the beginning of the turbine business, stations of this size were few and far between. Today, most large cities can boast of at least one if not several stations of this capacity.

Niagara Power for Toronto.

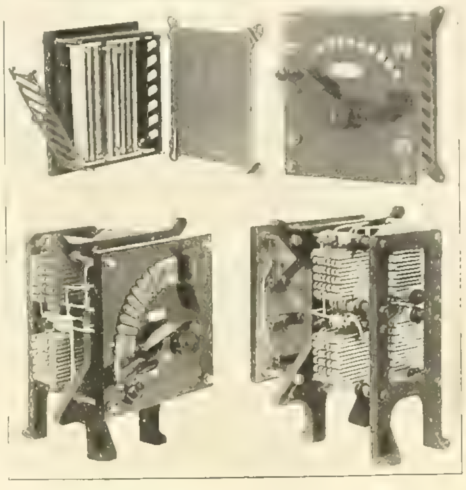
By a unanimous vote the Toronto City Council has decided to ask the Hydro-electric Commission to supply the city with 10,000 horsepower at a rate not to exceed $18.50. This action of the City Council in applying for cheap power will bring the question of cheap power to an acute stage. After years of agitation the power question has now reached the point where important action must be promptly taken by the Ontario government. As the matter now stands, the government has a contract with the Ontario Power Company for the supply of power at Niagara Falls at $10.40 per horsepower, or $10 per horsepower for all after 25,000 horsepower has been ordered. That is, the Ontario Power Company will generate and sell to the government at this low rate at the place of generation. After this it must be transmitted and distributed.

The various municipalities which have sent in applications for this power have already passed by-laws authorizing their councils to spend the money necessary for a distributing plant. It is said that the city of Toronto will have to spend from $3,000,000 to $5,000,000 for that purpose. With the generation and the distribution thus provided for the transmission from one plant to the other is the missing link. That is the matter which the government must now settle, and there is good reason to believe that it will settle it by undertaking the construction of transmission lines from the Falls to London and Toronto. This would involve a liability of over $3,000,000 to be financed by the government, but really paid for by the municipalities, as the cost of transmission is included in the estimated cost of power delivered at the cities' boundaries.

Recent Direct-current Starting Rheostats.

[illegible] therefore as great as to have the motor itself reliable. The Westinghouse Electric and Manufacturing Company has developed a line of face-plate starters which are satisfactory and fully meet the specifications and conditions laid down by the National Board of Fire Underwriters and the American Institute of Electrical Engineers.

All starting rheostats are intended for use only when bringing the motor up to speed, and are not designed for regulating the speed. Speed-regulating rheostats may be obtained, but they are intended either to vary the field current of the motor, or else they must be able to regulate the much larger armature current. The rheostat which regulates the armature current must be capable of carrying the full line current continuously. Therefore this



Bar-type Starting Resistance Open for Inspection. Face Plate of 80-Ampere Starter.
Grid-type Starter, 240 Amperes' Capacity. Grid-type Starter, 240 Amperes' Capacity, Rear View.
RECENT DIRECT-CURRENT STARTING RHEOSTATS.

type of rheostat is considerably more expensive than the starting rheostats, which are in service for only the short and infrequent periods of starting. The lower cost of the starting rheostat does not interfere with its satisfactory operation for the intermittent service of starting, for which it is designed.

The starters for motors on 110 volts up to 22 horsepower, or 220 volts up to 35 horsepower, use the bar type of resistance, which consists of a resistance wire wound on iron bars, which are first covered with a fireproof material. The ends of the bars are held in place by porcelain pieces, as clearly shown in one of the illustrations. The construction is strong and rigid, so that adjacent turns on the same bar cannot short-circuit, nor can turns on one bar come in contact with turns on another bar. The whole construction—resistance, iron frame, slate front, contact arm, etc.—is fireproof.

Another feature embodied in these starters is the low-voltage release. The contact arm will fly back to the off position if the current is shut off from the line, or if the voltage falls below a fixed limit. This prevents damage to the motor should the current again be thrown on or the voltage rise suddenly to its full value. The method of connecting the magnet of the release coil will be found of special benefit where the field of the motor is to be regulated. The magnet is connected across the line independently of the shunt field, and is unaffected by variations in the field current.

The small button-type of rheostat shown in one of the illustrations is used on the smaller types of motors and is capable of carrying 80 amperes. For the larger motors larger contacts are required. This requirement is met by furnishing renewable contacts. In this larger type of starter a special short-circuiting brush is provided which cuts out the last contact, insuring the lowest resistance possible.

For starting motors on 110 volts of 25 horsepower or 220 volts, 45 horsepower and larger, the grid type of resistance is used, which is fully ventilated and will stand the heavy duty required in starting large motors. All contacts, brushes, fingers and springs may be removed from the front with ease.

As these rheostats are used only in starting, the handle will not remain on any point except the last, unless held. They are intended to bring the motor up to speed in 15 to 30 seconds, according to size, and are made for full-load conditions.

QUESTIONS AND ANSWERS

Meaning of "Series-parallel."

[illegible]

[illegible] parallel branches, or, in other words, a circuit [illegible] several sets of these series rows are connected in parallel, or a number [illegible] parallel and several sets of these are then placed in series. The former is the more common arrangement; it is illustrated by the lamp wiring in street cars, where sets of five are in series and several of such groups are in parallel across the 550-volt line. Common street-car controllers are called series-parallel for a slightly different reason. For the lower speeds they connect the two motors in series across the line and for the higher speeds they connect the motors in parallel, i. e., each one directly across the line. Each motor, however, has its field in series with the armature and an adjustable resistance, which finally is connected in parallel or shunt with the field.

Ammeter in Storage-battery Charging Circuit.

G. W. K., Hope, N. D.: Please inform me how large an ammeter is required to charge a storage battery of three cells, each having 50 ampere-hours capacity and six amperes charging rate. A 110-volt circuit will be used.

ANSWER.

An ammeter reading to 10 amperes will be best. This will allow charging the battery at the normal rate of six amperes (which will take from nine to 10 hours), or at a more rapid rate, say 10 amperes for 5⅔ hours. If a still more rapid charge is necessary occasionally, an ammeter reading to 15 amperes will be required. This would permit charging at, say, 15 amperes for nearly four hours. This rapid charging is not recommended as a regular practice, since it injures the cells.

Electric Flatirons for 130-volt Circuit.

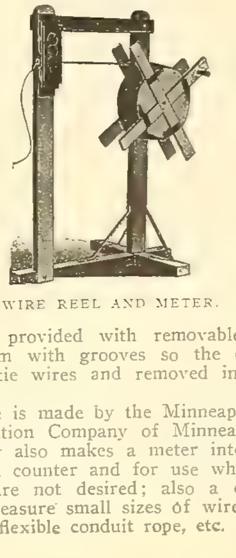
J. H. O., French Gulch, Cal.: Are electric flatirons made for 130-volt, direct-current circuits?

ANSWER.

This is an unusual line-voltage, for which irons are specially made to order by most manufacturers of such appliances. The price does not greatly exceed that of the standard 110-volt irons. One large company keeps in stock a line of irons suitable for voltages from 116 to 125; this type is said to work as well for 130 volts. If the line-voltage is liable to fluctuate much over 130 volts, an iron specially built for this voltage would doubtless be less liable to burn out.

Wire Reel and Meter.

The wire reel and meter shown herewith is a desirable machine for measuring the various sizes of wire, cordage, etc., and is for the use of dealers and contractors handling electric wire. In the meter the wire passes between two self-adjusting rollers, which admit of wide range, and will measure accurately large or small sizes. The pointers are movable and readily adjusted to the zero point.



WIRE REEL AND METER.

The reel is provided with removable cross-bars and the drum with grooves so the coil can be bound with tie wires and removed in a compact form.

This device is made by the Minneapolis Electric and Construction Company of Minneapolis, Minn. The company also makes a meter intended to be fastened to a counter and for use where the reel and frame are not desired; also a cable meter, which will measure small sizes of wire as well as large cables, flexible conduit rope, etc.

Refuse Destructors and Electrical Generating Plants.

[From the London correspondent of the Western Electrician.]

It is worthy of note that with one or two important exceptions, combined electricity works and destructors have only been erected in Great Britain in towns of quite moderate size. Generally speaking, electrical engineers here, as a collective body, are not enamored of the combination, first, because the beneficial result to the electricity undertaking is regarded as somewhat infinitesimal, and again on account of the detrimental effect which the necessarily more or less polluted atmosphere of the neighborhood of a destructor has upon the electrical machinery. The makers of destructor plants refuse to admit either contention, yet, in fact, their energies have been devoted, during the last few years, to so improving their methods of operations as to be in a position to refute both arguments.

The records of combined destructor and electricity works are curiously inconsistent—a result due probably to the varying nature of the locality and consequently to the quality of the refuse to be cremated, so that, from the economic point of view of the electrical engineer, it is difficult to lay down general principles to be applied in all cases.

A feature to be specially noted is that in very rare cases does one find an electric-lighting company running combined works under agreement with the local authority, practically sufficient evidence of the views of electrical engineers. One notable case where a company did run a combined works in the local interest was at Lambeth, but after a few years the local authority sued the company for creating a nuisance in doing a thing put upon it by an agreement, and after legal proceedings, the destructor works were dismantled at a loss to the company of $300,000. At the same time, the system of cremation by fire has, of course, been generally recognized as the most satisfactory.

Improvement has been made in the design of destructors since their combination with electricity works was first advocated, and the following notes of a new plant just opened at Greenock are specially directed to showing the manner in which the objections to the polluted atmosphere and its effect upon the electrical machinery have been met. It will be observed that the refuse is not touched by hand and that a considerable degree of automatic working has been introduced.

The question of combining electricity generation with the destruction of the town's refuse was first raised at Greenock by a member of the corporation as far back as 1896, but having regard to the meager information then available, and the difference of opinion as to the utility of existing installations, it is not surprising that the proposal was not seriously considered. The old method of dumping the refuse went on, and it was not until 1905 when complaints from residents in the vicinity of the dump had again brought the question of a destructor before the corporation in a manner which could not be ignored that a special committee was appointed to deal with the subject. The position of the Electricity Department, which had been increasing its output, principally for power purposes, at a rate beyond all anticipation, was also under consideration, and it was agreed that the possibility of utilizing the destructor for steam-raising purposes should be specially considered by the committee.

The members of the committee visited a large number of combined installations, including Liverpool, Hackney, Fulham and Partick, and issued their report in November, 1905, in which the various systems then in operation were fully discussed. As a result of their investigations, the committee recommended (a) that a combined destructor and electricity works should be installed; (b) that a "top-feed" type of destructor should be adopted. The corporation adopted the report, and the electrical engineer was instructed to prepare plans and issue specifications for a combined scheme. The tenders for the destructor were submitted to the Council in April, 1906, and, after full consideration, it was unanimously agreed to place the contract for this section of the work with the Horsfall Destructor Company of Leeds.

The buildings are laid out in four bays, the destructor furnaces occupying the bay nearest the entrance. This bay is 110 feet long by 40 feet wide and 41 feet high. The two center bays accommadate two sets of boilers for destructor and coal firing, respectively, while the east bay (the largest of the four) is the electric power station. A pump room, which serves both sets of boilers, adjoins the power station, and the economizers, of which there are two, are housed outside the main building. The chimney, [illegible] feet in height and 10 feet internal diameter, is situated at the end of the boiler house. A concrete retaining wall and water reservoir have been built at the south end of the site, and water is conveyed by an 18-inch pipe from the reservoir into the power station for condensing purposes.

The destructor, which marks a noteworthy departure in the design of these installations, consists of six large cells and combustion chambers, with three water-tube boilers arranged so that each pair of cells with its boiler can be worked independently. This arrangement of independent "units" permits of any section of the plant being shut down for repairs or cleaning without interfering with the working of any other unit. By firing the two cells of each unit alternately a steady steam pressure is maintained in the boiler, while the combustion chamber is also kept at a sufficiently high temperature to cremate thoroughly the noxious gases which escape from the newly charged refuse. The furnace grates, which slope from back to front, have each an area of 25 square feet, and are constructed to efficiently burn a full cartload of refuse at one charge. The grate bars are perforated with a large number of small holes, and a high-pressure blast is forced through these by means of electrically driven fans.

It is generally recognized that to insure complete combustion in destructor furnaces an air-blast system is the best, but hitherto the blast has been delivered at comparatively low pressure. The grates and fans are constructed for a specially high pressure, and are fully expected to show a distinct gain in efficiency over the older system. The fans, of which there is one to each furnace, are coupled direct to Phœnix variable-speed motors of the totally enclosed type. The starting and regulating switches are conveniently near the furnace doors, and a throw-off switch is actuated in such a way that the opening of the door automatically stops the fan.

Incidentally, an attempt has been made to improve the unfavorable atmospheric conditions existing in most destructor installations, and ventilation is provided for by carrying the fan inlets to the under side of the storage platform and turning them inward, so that all dust and fumes emitted during the process of "clinkering" are drawn in and delivered back to the fires. Auxiliary steam-jet fittings for steam blast have also been provided, but these are only intended to be used in the event of a breakdown to the fans.

The method of storing and charging the refuse into the cells has been specially designed to reduce manual labor to the lowest possible minimum, and forms a striking comparison to some types of destructor still in use, in which the refuse is stored in loose heaps and fed into the furnaces by hand labor. In the system at Greenock the refuse is delivered from the carts to the furnaces without handling of any kind, and, while effecting a saving in the cost of labor, insures a degree of cleanliness which is really remarkable, having regard to the nature of the materials dealt with.

The tipping pit is situated at the north end of the destructor house, and the refuse, which is delivered by carts, is discharged through a specially shaped hopper into a storage tub placed ready in the pit. The pit has accommodation for four tubs with two hoppers, the latter being arranged to move on rails across the pit. When the tub has been loaded, the hopper is moved clear from above it, and electrically operated overhead cranes lift the tub and deposit it on the storage platform, where it is kept till required. The storage platform extends the full length of the furnace blocks, and has accommodation for 80 tubs. Thus the storage of refuse takes place in closed boxes, away from the heat of the destructor.

When ready to charge, a tubful of refuse is lifted from the storage platform and placed on a movable cradle on the top of the cell. The weight of the tub causes the cradle to descend, and by a system of levers and balance weights the water-sealed door is lifted from its seat, and drawn on rails to one side, permitting the lower edge of the movable cradle to descend into the mouth of the charging doorway. The storage tub is provided with hinged lids at the bottom, which are held shut when the tub is suspended by the crane, but when released these lids open outward, and the whole of the refuse thus falls directly into the furnace and spreads itself over the grate. The empty tub is then lifted by the crane, and the water-sealed door, actuated by the balance weights, is mechanically drawn back to its seat. The whole operation of charging the cell and withdrawing the tub occupies less than a minute, and as the furnace door is open for only a few seconds, the inrush of cold air, with consequent reduction of furnace temperature, is reduced to the smallest possible amount. The crane has a lifting capacity of three tons at 30 feet per minute.

The time required to cremate a charge varies from one to one and a half hours, and the fire is then cleaned through a large clinkering door at the front of the cell. This door is of specially strong construction and is provided with two small doors attached to it so that the fires can be adjusted and managed without opening the main door. The clinker is withdrawn from the furnace into buckets suspended from an overhead clinker railway, and may either be delivered directly to the clinker crushing and screening mill or deposited in heaps until required.

A main flue of large area is provided for each pair of cells, from which the hot gases are carried through the combustion chamber of a water-tube boiler, and a dust catcher is built in between the combustion chamber and the boilers. All the flues are lined throughout with fire brick, and in the furnaces specially made fireclay blocks set in fireclay cement have been employed.

Of the Babcock & Wilcox marine water-tube type, the boilers are constructed for a working pressure of 200 pounds per square inch and fitted with superheaters to raise the temperature of the steam to 500° F. To meet any special demand for steam, auxiliary grates have been fitted for coal firing and a by-pass is provided direct from the destructor combustion chamber to the main overhead flue, so that in the event of a breakdown to a boiler or an excess of steam being generated the whole or a portion of the hot gases may be taken by this route instead of through the boilers. After leaving the boilers the gases pass by way of the overhead main flue to an economizer, thence to the chimney. The economizer is built in two sections of 120 tubes each. A by-pass is also provided so that the gases may be passed direct to the chimney.

From each boiler steam is led from the superheater to a 10-inch main and carried direct to the main header, which supplies the electric-generator engines. The feed piping is connected by a branch pipe to the system supplying the coal-fired boilers, the arrangement being designed so that the destructor boilers can be fed either through their own economizer or from the hot-feed main to the coal-fired boilers.

In the engine-room there are two Bellis-Westinghouse direct-coupled generating sets, each capable of a normal output of 750 kilowatts when supplied with steam at 200 pounds pressure. The engines are of the triple-expansion type of 1,140 horsepower each and are fitted with expansion valves to take overloads up to 50 per cent. The exhaust steam is taken through an oil separator into a surface condenser, which serves both sets of engines. With the exception of a steam feed pump the whole of the auxiliary plant, including pumps, stokers and fans, is driven by electric motors. An ample supply of water for condensing purposes is available from the town's aqueducts.

The electric generators are of a substantial design and capable of withstanding heavy overloads without injury. No. 1 unit generates current at 500 volts, but No. 2, which comprises two machines, is arranged to deliver current at 250 volts or 500 volts as required. A motor generator having its parts interchangeable with the steam generators is installed to transform current from 500 volts to 250 volts, or vice versa.

The main supply from the station is for power and lighting purposes at 500 volts and 250 volts, but two rotary converters with transformers have also been installed to deliver alternating current at 3,300 volts to an outlying district. The main direct-current switchboard stands on a platform raised about two feet above the floor and consists of 12 panels. Each panel is provided with circuit-breakers, ammeter, change-over switches and energy meter. The bus-bars are in duplicate and are raised on brackets above the switchboard, so that all back connections on the board are accessible.

Indiana Telephone Items.

Forty telephone managers from Northern Indiana, including representatives from 10 counties, held a meeting in Warsaw on March 17th. The action of the Indianapolis and Fort Wayne companies in reducing the time limit on toll calls from five to three minutes was objected to. The managers of the smaller Independent companies protested also that they had not been consulted when night rates were discontinued by the larger companies in this district and other localities in the state. The telephone men present took action to establish a toll-line clearing house for the district. It is proposed to bring the matter to the attention of the state convention to be held in Indianapolis on May 20th and 21st.

Under the policy of elimination of local exchanges and thereupon giving entire attention to long-distance business under agreement with Independent companies the Central Union Telephone Company is preparing to abandon service in a number of cities throughout Northern Indiana. The first Central Union exchanges to be closed on April 1st are those at Goshen and Garrett. Word also comes from South Bend that the company will turn over the South Bend exchange to the Home company. This will also include the business at Mishawaka and several other rural points.

In the Indianapolis telephone controversy George M. Brill and W. H. Crumb of Chicago have been engaged for the examination of the electrical and mechanical equipment, and the Audit Company of New York for the examination of the books and finances. These experts are to make a report to the committee appointed from the Board of Trade and Commercial Club, which in turn will make a report to the mayor and board of public works as to the necessity of granting relief to the Indianapolis Telephone Company. The clamor among the telephone subscribers in the city for consolidation is not so great as a week ago, and it is believed that sufficient relief will ultimately be given to the Indianapolis Telephone Company so as to

[illegible] the [illegible] competition. [illegible] place has been [illegible] in the controversy to the effect that a consolidation of the two companies in Indianapolis would not only be in violation of the Sherman anti-trust law, but would be the first step toward the destruction of the system of Independent lines throughout the country. S.

American Telephone and Telegraph Company's Annual Report.

The annual report of the directors of the American Telephone and Telegraph Company, dated March 10, 1908, gives the results of the business for the year 1907, as follows: Profits, $23,479,290.10; interest, $7,209,902.16; balance, $16,269,387.94; dividends paid, $10,943,644; carried to reserve, $3,500,000; carried to surplus, $1,825,743.94.

The following were the corresponding figures for the year 1906: Profits, $17,857,687.37; interest, $4,886,750.61; balance, $12,970,936.76; dividends paid, $10,195,233.50; carried to reserve, $1,773,736.62; carried to surplus, $1,001,966.64.

The number of subscribers' stations at the end of the year operated directly by the associated companies which constitute the system in the United States was 3,035,533, an increase of 308,244. In addition to this number there were 755,316 exchange and toll stations connected to the system by toll and long-distance lines, but operated by local, co-operative and rural independent companies or associations having sub-license or connection contracts. Adding also the company's telephones employed for private-line purposes there was a total of 3,839,000 stations connected to the Bell system as against 3,070,660 stations at the close of the previous year, an increase of 768,340 stations.

The total mileage of wire in use for exchange and toll service was 8,610,592 miles, of which 1,141,687 were added during the year. These figures do not include the mileage of wire operated by sub-licensees.

Including the traffic over the long-distance lines, but excluding sub-licensees, the daily average of toll connections was about 494,000, and of exchange connections about 18,130,000, as against corresponding figures in 1906 of 462,000 and 16,478,000; the total daily average for 1907 reaching 18,624,000, or at the rate of about 5,997,000,000 per year.

In the report President Theodore N. Vail says in part: In the early part of the past year there were signs of a coming change in general business conditions, and steps were taken to stop all construction not necessary either for immediate demand or to put the plant in condition to economically meet future demand. The result of this action has been satisfactory. The construction expenditures during the latter part of the year were largely reduced.

The amount added to construction and real estate by all the companies, excluding sub-licensees, constituting our system in the United States during the year 1907 was $52,921,400, distributed as follows: For exchanges, $44,184,800; for toll lines, $4,426,400; for land and buildings, $4,310,200. The amount added in 1900 was $31,619,100; in 1901, $31,005,400; in 1902, $37,336,500; in 1903, $35,368,700; in 1904, $33,436,700; in 1905, $50,780,906, and in 1906, $79,366,949, making the grand total of expenditure upon these properties during the eight years $351,835,655.

During the year $36,626,666 was applied out of revenue to maintenance and reconstruction purposes. The total amount of maintenance and reconstruction charged against revenue for the last five years was over $147,000,000. This expenditure is reflected in the superior condition of the plant, the theory and practice being that the plant must be kept in standard condition at the expense of revenue.

The Western Electric Company desired to extend its relations with our company and the associated companies, and to cover with its operations the entire telephonic field, whether connected with the Bell system or not. At the same time it was thought that the management, which would remain the same, if brought into closer touch with the general organization of the Bell system, could avoid duplication of effort in electrical and mechanical development and in this way and by the concentration of the purchase and distribution of supplies effect greater efficiency and economy. To this end contracts have been made with most of the Bell companies, and the contract between our company and the Western Electric Company has been modified in respect to the sale of telephones and telephonic apparatus.

A proposition was made by our company to purchase the outstanding share capital of the Western Electric Company at a price agreed upon with some representative shareholders as fair and equitable. Over 30,000 shares have accepted the offer, making the total holdings of our company over 120,000 out of 150,000 shares.

Much of the agitation against legitimate telephone business is founded on false and exaggerated statements of the profits originally made by the early Bell companies. These statements have been used by the promoters of both good and bad enterprises. As a matter of fact, the shareholders of the American Bell Telephone Company and its predecessors paid into the treasuries of those com[illegible]

[illegible]

In connection with the improvement shown in [illegible] whatever may have been the general business conditions. Everything indicates that the current year will be no exception to this.

[illegible] thirtieth year of corporate organized work in the development of the Bell telephone system. In the mind of Mr. Bell the invention and its application had simultaneous growth. During the first year such of the many "imaginations" and ideas as to development as were demonstrably practical were assimilated and the business was established on the lines now followed which make our company with its associated companies a national system with millions of subscribers connected by millions of miles of circuit with local exchange systems, all bound into one large comprehensive system by the toll and long-distance lines with their 163,000 miles of poles and 1,664,000 miles of wire, the whole interdependent and intercommunicating, an aggregation or union impossible to destroy in detail, and impossible to reproduce as a whole.

The strength of the Bell system lies in this "universality." It affords facilities to the public beyond those possible on any other lines. It carries with it also the obligation to occupy and develop the whole field. The urban field was the first to receive attention and the development keeps pace with the demand. The semi-urban and rural demand came later.

Tables appended to the report show that on January 1, 1908, the company had 163,218 miles of toll-line poles and 1,664,081 miles of toll wire. The total miles of wire was 6,946,511; exchanges and branch offices, 5,108; miles of underground wire, 3,883,051; miles of submarine wire, 6,322; total employes at exchanges, 88,274; total stations, 3,035,533. The number of daily calls per station averages about six.

Telephone News from the Northwest.

An ordinance has been offered in the Minneapolis City Council which seeks to limit the charge which a telephone company may make for service to $48 a year for business service and $30 a year for residence service. The ordinance would affect only the Northwestern Telephone Exchange Company, as the Tri-State Telephone Company already has those rates in effect, they being a part of the franchise under which the company is working.

A. W. Decker was elected secretary of the local telephone association at Janesville, Iowa, and D. G. Bloomer, president. F. R. Decker is manager.

W. E. McKee, for several years manager of the Interior Telephone Company, at Montezuma, Iowa, has resigned.

The Iowa Telephone Company is now located in its new telephone exchange at Burlington, Iowa, which represents an expenditure of $150,000. It is a two-story building, fireproof, and of concrete construction.

The Independent Telephone Company of Council Bluffs, Iowa, has established means of connecting the city with Omaha. A 75-pair cable, which will be encased in waterproof cement, will span the river. R.

GENERAL TELEPHONE NEWS

Among recently incorporated telephone companies are the following: Marsland Telephone Company, Marsland, Neb.; Sod Town Telephone Company, St. Michael, Neb.; Harlan County Mutual Telephone Company, Alma, Neb.; Purdy Telephone Company, Purdy, Mo.

The Southwestern Telegraph and Telephone Company has bought the property of the Texas Telephone Company, headquarters at Wichita Falls, Tex., and this property will hereafter be operated as the Wichita Falls division of the Southwestern company. C. B. Felder, formerly general manager of the Texas company, has accepted the position of superintendent of this new division, and under his direction will be placed also the exchanges of Wichita Falls, Henrietta and Bowie, and the territory to Ringgold, Jacksboro and Graham.

Stockholders of the Central Union Telephone Company held their annual meeting in Chicago on March 18th. A financial report of the year's operations was read by President L. G. Richardson and showed a fair increase in earnings over the previous year. It was shown that the company had nearly 400,000 stations in operation in Illinois, Indiana and Ohio at the close of the fiscal year, December 31, 1907. From developments at the meeting it was reported that the Central Union company would be willing to absorb the Independent telephone company which operates in Indianapolis if the property could be purchased at a fair figure. There is some opposition in Indianapolis to two systems. The Independent company is seeking a new franchise with increased rates, and is said not to be for sale.

CORRESPONDENCE.

Continental Europe.

[illegible] figures, the number of electric traction lines on the Continent which are using the single-phase system [illegible] Italy, 5; Austria, 2; Belgium, 1; Holland, 1; Swe[illegible] on the overhead-trolley system, and a type of loco[illegible] cases in which the voltage is lowered for the motors, or in other cases the current is sent directly into the motors from the line. The French Westinghouse Company is now quite active in this field and has installed several single-phase lines in France and Italy, among these being the Tergnier-Anizy line in France and the Valle Brembena and Rome-Civita Castellana systems in Italy.

The central electric plant of Breslau, Germany, will soon install a steam-turbine-alternator group of the Zoelly type, containing a three-phase machine coupled on the same base with the turbine and rated at 2,000 kilowatts. The present alternator has been constructed in the works of the Felton-Guilleaume-Lahmeyer firm, while the Gorlitz works furnished the steam turbine. Of the four-pole type, the alternator is designed to give 5,000 volts.

In France there is a project of considerable importance on foot for hydraulic and electric work which is to be carried out upon the Orleans Canal. The plans call for a hydraulic generating station located on the canal, and a system of power lines which will furnish current for the different locks of the canal in order to operate the pumps for elevating the water. Eleven different sub-stations will be placed at the locks so as to give low-tension current for the motors which drive the pumps. There will also be a sub-station located at the foot of the Vallée reservoir, so as to operate the pumps which are used for the water-storage supply.

At Beraun, in Bohemia, has been constructed a central plant, which is now in operation for the town lighting. It supplies the lines on the three-wire direct-current system. The company is now using the new Kolben metallic-filament lamps, which work upon 120 volts. For the street lighting it employs the Regina arc lamps or the Wolfram incandescent lamp of 50 candlepower.

A concession for a hydraulic system of large capacity has been lately awarded by the Austrian government to the firm of Romberg & Rusch of Dornbrin. The present project relates to the building of turbine stations supplied from the Millstätter Lake, and there will be erected three different stations, one of these being located in the valley of the Drau, on the river of the same name, and it will use a head of water of 85 meters. The other two hydraulic plants will be supplied from the Leisser River, and will take a head of water of 17 and 100 meters, respectively. The first-mentioned plant on the Drau River is to contain 12 main turbine groups of 5,000 horsepower each, of which two groups will be used as a standby. This will give a total of 50,000 horsepower supplied by the plant. In the second station there will be installed three groups of 2,000 horsepower each, while the third plant is to use machines to the extent of 18,000 horsepower. For the three plants there will be installed machines having a total output of 84,000 horsepower. A contract has been made by the above firm with the Austrian government for the supply of current in order to use electric traction upon a section of the state railroad lying between the Vorarlberg district and Switzerland.

A. DE C.

Great Britain.

London, March 14.—A paper just read before the Institution of Electrical Engineers, both in London and at the local section in Manchester, makes a proposition in regard to the standardization of fuses, but to judge from the remarks during the respective discussions, the idea does not appear to be well taken up. Incidentally, it may be stated that the sub-committee of the engineering standards committee, which has this matter in hand, realizing the tremendous difficulties surrounding the knowledge of fuses generally, has split the subject up into subdivisions, and various members have agreed to attack the problem from different points of view. The paper referred to is the result of some of these researches, and it dealt with the suitability of various metals for fuses on low-tension networks. One interesting fact was made known during the discussion in London, viz., that Mr. W. M. Mordey, who is well known for his experiments upon enclosed fuses, found the most satisfactory filling to be the dust scraped out of the inside of boiler flues. This was passed through a sieve, and gave very satisfactory results when it was not rammed too tightly. Mr. Mordey also referred, in the discussion, to the transverse cracks which appear on copper wires when used as fuses, a phenomenon which, he said, induced Edison to give up his experiments with platinum for lamp filaments.

A decree has just been issued stating that all

wireless installations on British ships must be licensed.

Following the custom so common here and elsewhere, among engineering and other societies, the Tramways and Light Railways Association has just decided to hold annual conventions in various parts of the United Kingdom. This year it will be held in London in conjunction with the Franco-British Exhibition.

Two applications have been made to the Brighton Corporation for permission to run electric omnibuses in the town. To judge by the success of the electric buses in London their introduction into the provinces, where the conditions are at all favorable, must come in a very short space of time.

The London County Council is seriously considering a proposition to purchase the old cable tramway in London which runs to the top of Highgate Hill. At present the commissioner of police refuses to issue permits for the cable cars to run on the track, as they are in too dilapidated a condition. The directors of the company, therefore, have taken the bull by the horns, and have deposited a bill in Parliament asking for powers to convert the line to trolley traction and, incidentally, for running powers over certain of the London County Council lines. Whether it is the latter that has given the Council a fright, I do not know, but the highways committee recommends that an offer for the sale of the undertaking to the Council should be accepted. I believe that the Highgate Hill line is the oldest cable tramway now in existence.

The Newcastle-on-Tyne Electric Supply Company, which has achieved fame as the only power company in Great Britain which can be called financially successful, continues to make undoubted strides. Following upon its control of other power companies in the neighborhood, comes the announcement of the issue of a further $2,500,000 of capital. Such a good investment is this company's stock thought to be, that a group of bankers has purchased the whole issue and is now offering it to the public at par as regards the preference shares and at a premium as regards the ordinary shares.

The action taken by the vicar of a church in Brighton for an injunction restraining the corporation from working its motor-generator station, on the ground that the hum of the machinery created a nuisance, has failed. An expert sent down by the court stated that no noise whatever could be heard when any movement of the congregation was in progress and that nothing more than a faint hum was discernible when complete silence was observed. The counsel representing the vicar suggested that a reversion to horse-drawn tramcars should be made by the corporation in order to avert the alleged nuisance!

The Board of Education has made a grant of $250 toward experiments with high-tension currents for horticultural purposes at a college at Bristol. G.

New York.

New York City, March 21.—The New York Central is preparing to extend its electric train service to Yonkers, beginning March 29th. Engines will be changed at Yonkers for the Croton, Peekskill and Poughkeepsie trains, from electricity to steam, as is now done at Highbridge.

A bill has been introduced at Albany which, if passed, will extend the jurisdiction of the Public Service Commission to telegraph and telephone companies. If the measure becomes a law all corporations engaged in the business of electrical communication will come under the same restrictions and broad powers of supervision which under the public utilities act the state now exercises in the case of receivers, common carriers and lighting companies.

Reporting on the signal system in the Subway, Bion J. Arnold, the Public Service Commission's electrical traction expert, makes the assertion that it would be possible to increase the capacity of that line a full 50 per cent., and perhaps more, by changing the tracks at the express stations so that both the present tracks could be used for express trains. He will make a more detailed report later. Mr. Arnold says that had the express stations been constructed from the beginning by being double-decked or otherwise, so that trains could be alternated, first on one side of the platform and [illegible] the Subway [illegible] 50 per cent with the signal system as originally installed, but as [illegible] under present conditions, to revise the present signal system to the greatest extent practicable, consistent with safety, in order to secure capacity. In the report [illegible] recommendation is that the local tracks in the Subway be equipped with safety devices and block signals such as are in use on the express tracks. His chief recommendation to the commission is that the necessary steps be taken to develop and install an [illegible] an auxiliary at station blocks, which will allow the [illegible] platform

promptly on the leaving of the outgoing train without sacrificing any of the standards of safety now maintained between stations.

The span of the Blackwell's Island Bridge over the east channel was connected on Wednesday, completing the steel superstructure from the Queens side of Long Island to the Manhattan side, thus making it possible to cross the East River at this point by means of the bridge. The west channel span was joined last week. The Blackwell's Island Bridge was commenced in 1901. It is expected to be finished before the end of this year. It will then have cost more than $20,000,000. The total length of the bridge is 8,231 feet. The span connected Wednesday, the river span, is 3,724½ feet. The roadway on this span will be 143 feet 3 inches above high water.

The New York Central Railroad has closed contracts with the American Locomotive Works for 143 new locomotives. The orders include 20 Pacific type passenger, 45 consolidation freight, and 29 switching engines, in addition to 12 electric locomotives for the main line, and 12 passenger and 20 freight engines for the Boston and Maine. W.

Eastern Canada.

Ottawa, March 21.—The special power committee of the City Council of Hamilton, Ont., has appointed T. W. Sothman to draw up the specifications for the proposed municipal street-lighting and power plant.

The City Council of St. Catherines, Ont., has settled the lighting question by granting an extension of time to the Falls Power Company to sign the contract to light the city at $39.50 per arc light, beginning August 1st next.

The city of Sherbrooke, Que., has voted in favor of the by-law for taking over the Sherbrooke Power, Light and Heat Company. The object of this by-law was to authorize the City Council to issue municipal debentures to the amount of $170,000, the proceeds of which are to pay for the assets of the light company. In addition to the above amount the city also assumes the outstanding bonds of the company, amounting to $80,000.

Application has been made to the Ontario government for a charter incorporating the Lorne Power Company, which desires to establish its base of operations at Wabageshik Falls. Authority is sought also for a railway operated by steam or electricity from the falls to the township of Denison.

An announcement of important developments in connection with the Ontario government's power policy is looked for shortly. Of the municipalities which last January voted on power by-laws, all but two have made definite application to the Hydro-electric Commission for the supply of power, the applications aggregating nearly 30,000 horsepower.

The city of Brantford, Ont., has become a power center. The promised supply of electrical energy from De Cew Falls reached the city recently, when the Western Counties' Company, which will serve as the local distributing agency of the big Hamilton power merger, turned on the current. The rates proposed are all limited by a civic by-law for the next 25 years. Power for industrial purposes will be sold at $19.50 per horsepower for average use. A. V. W.

Southeastern States.

Charlotte, N. C., March 21.—On April 1st it is given out that a reduction in rates will go into effect for lights furnished by the Georgia Railway and Electric Company in Atlanta. The reduction is 20 per cent. for the city and 15 per cent. to private consumers of electricity, estimated. The reduction, it is understood, is for a period of five years. The company is at present putting into service 25 new cars to take care of increased service on suburban and other lines, the cars being made at the Atlanta plant of the company.

The Holt-Morgan cotton mills at Fayetteville, N. C., have installed a plant consisting of five motors for the electrical operation of the mills, 350 horsepower being taken from the Buckhorn Falls plant some miles away.

The Electric Manufacturing Company at Gaston Shoals has begun to supply power to manufacturing plants. Four cotton mills in Gaffney, S. C., are to make use of this power.

It has been reported that the organization of a $5,000,000 electrical development company has been undertaken to supply hydro-electric power for the numerous cotton mills of Greenville, S. C.

The Southern Electric Construction Company is the result of a consolidation of the Southern Construction Company and the Gilham-Clayton Electric Company. Joe W. Little is named as president of the new concern. The merged concerns have conducted a general electrical equipment business.

The Southern Power Company has closed a contract to supply electric lighting to the town of Davidson, N. C., and also to Davidson College. The same company is extending its prospective field of operations north from Charlotte and will probably take in Salisbury and High Point, 80 miles from this city.

The Tidewater Power Company has taken over all of the properties, franchises, etc., of the Consolidated Railways, Light and Power Company of Wilmington, N. C., the change being made so that the larger company may finance all of the undertakings and plans of the old Consolidated with added improvements.

A recent report from Salisbury, N. C., is to the effect that the Whitney Reduction Company, recently placed in the hands of a receiver, will be reorganized, with E. F. Buchanan as director of the reorganization. It is estimated that $2,000,000 will complete the large plant being constructed on the Yadkin, some miles distant from Salisbury.

By combining the water and electric plants at Goldsboro, N. C., the price of light has been reduced about 33⅓ per cent. by the board of public works.

Charles L. Vannoppen has secured a franchise for a three-mile electric line, with lateral connections on West Market Street, Greensboro, N. C.

The Cape Fear Power Company of Fayetteville, N. C., has changed its name to the Carolina Power Company, capital $350,000, with M. C. Humstone, president. L.

Michigan.

Detroit, March 21.—John E. Moore of Grand Rapids was granted a franchise for an electric railway by the Council of Hastings, with permission to transfer it to the Grand Rapids, Hastings and Battle Creek Interurban Railway Company. The rate of fare is five cents for cities and not to exceed one and one-half cents per mile to any point on the line. Permission is granted to handle freight. The franchise will be forfeited if the road is not in operation by December 31, 1909.

The effort to oust the Detroit, Monroe and Toledo Short Line Railway from operating under the franchise of the Toledo and Monroe Traction Company on account of carrying freight without authority has failed, the Supreme Court of Michigan holding that this does not constitute cause for forfeiture of franchise, but for a regulation of the business done by the company.

The dam at Buchanan, owned by C. H. Chapin of Chicago, was carried away today on account of having been weakened by recent floods. It was erected 14 years ago at a cost of $250,000 and furnished 3,000 horsepower to Niles and Buchanan and South Bend. It was 500 feet long with a head of 11 feet. Only 20 feet remains on each side. The dam will be rebuilt immediately of concrete and in the meantime power will be generated by an auxiliary steam plant.

The Menominee Light and Power Company will build a $400,000 power plant at Chappee Rapids, four miles from Menominee, and transmit power to Marinette, Wis., and Menominee for light and power. Ten thousand horsepower can be developed by Chappee Rapids and 60,000 horsepower is available within a distance of 60 miles from Menominee.

The St. Clair municipal plant has been out of service for several weeks, but it is expected that service will be resumed in two weeks as the new condenser will be installed by that time.

The Council of the Village of Wayne granted a franchise to the Washtenaw Light and Power Company and entered into a contract for street lighting, but the new Council has been questioning the validity of the franchise and the company has requested the return of the bond which was filed when the franchise was accepted, stating that it does not want to enter into any contract which the citizens do not approve. The streets are lighted now by acetylene gas made in a plant owned by the village.

The new turbine at the Wyandotte municipal plant is now in place and the street lights which have been so badly needed for the past two years can be added. D.

Indiana.

Indianapolis, March 21.—C. D. Emmons, general manager of the Fort Wayne and Wabash Valley Traction Company and the local system, has refused to issue passbooks to city officials for use on the city street lines on the ground that, while he believes city officials are entitled to such favors, it is in violation of the new state law to issue free transportation to public officials.

The Indiana state railroad commission at Brazil on March 26th will hear charges against the Terre Haute, Indianapolis and Eastern Traction Company, in which the Merchants' Association alleges discrimination in passenger and freight rates against Brazil in favor of the commercial interests of Terre Haute.

A run from South Bend to Chicago by interurban cars by July 1st is promised by the officials of the Chicago, Lake Shore and South Bend Railway Company. Eleven miles of actual construction work are all that remain to be completed. The new line runs from South Bend to Michigan City and thence to Hammond, a distance of 70 miles. From Hammond to Randolph Street, Chicago, the company will operate over the tracks of the Illinois Central Railroad, thus avoiding the transfer of passengers in the outskirts of the city. Thirty new cars costing $360,000, to be used on the new road, are in the paint shops in Pullman. H. W.

Wallace of Chicago has been appointed manager of the company, with headquarters in Michigan City. A large office building will be erected which will serve as a terminal station and general office for the company.

A meeting of traction managers will be held in Indianapolis on March 25th to establish a traffic bureau in the interest of the trolley lines. The meeting will be held the day previous to the bi-monthly meeting of the Central Electric Railway Association.

Thomas O. Ballard has been granted a franchise for a period of 25 years for an electric-light plant to be operated in Franklin. Mr. Ballard is figuring on installing two gas-producer units of 150 kilowatts each, alternating current. S. S.

Northwestern States.

Minneapolis, March 21.—M. D. Stoner and C. W. Jewett of Bemidji, Minn., have been granted a franchise for the operation of an electric-light plant at Baudette, Minn.

The Harlowton Electric Light and Water Company of Harlowton, Mont., will begin the construction of an electric-light plant shortly. New machinery has been ordered and the plant will light the entire city.

The Ashland Street Railway Company of Ashland, Wis., is authorized to issue common stock valued at $50,000 and preferred stock for the same amount for the proposed extensions to the street-railway and lighting system.

The construction of an electric railway is proposed to run 45 miles northwest of Thief River Falls, Minn., toward Roosevelt. The Commercial Club of Thief River Falls has secured a right-of-way part way. Dr. H. Grundy is also interested.

The Chicago, Ottumwa and Western Railway Company of Bussey, Iowa, has incorporated with a capital stock of $3,000,000. An interurban line is proposed from Ottumwa to Des Moines.

The Wausau Electric Company's property at Wausau, Wis., has been transferred to the Wausau Street Railroad Company, including water power and plant, wires, etc. The railroad company has two water powers; the Little Bull Falls, at Mosiness, was purchased by it some time ago.

The new light and water ordinance, which is being considered at Ortinville, Minn., makes the light rate 13 cents maximum and eight cents minimum per kilowatt-hour. R.

Western Canada.

Winnipeg, Man., March 21.—It is estimated that it will cost $30,000 to place the fire-alarm wires in the conduits built by the Manitoba government in the city of Winnipeg. This includes the cost of the cables and ornamental posts to support the fire-alarm boxes as well as the expense of connecting the boxes with the manholes. The question of ordering all overhead wires underground is being considered by the City Council. F. E. Cambridge is city electrician of Winnipeg.

An agreement has been reached between Port Arthur and Fort William for the purchase of the municipal street-railway system operating in the two towns. Fort William gets that portion of the system running in that city at a price to be agreed upon by arbitration. Port Arthur is to furnish the power for the present system for five years, providing a power cannot be purchased elsewhere cheaper. If one city doubles the tracks the other must do the same.

The following figures have been prepared by City Engineer Keeley of Edmonton, Alb., in connection with the proposed electric-light plant for that city: One 700-kilowatt gas engine and producer generating unit, $92,350; one exciter unit, $6,500; switchboard and wiring, piping, oiling system, erecting machinery and cost of foundation, $16,970; building, 75 by 112 feet, of brick and concrete, $16,970; incidentals, $7,210; total cost of plant, $140,000.

The City Council of New Westminster, B. C., has decided not to reduce the price of electric light one cent per kilowatt-hour as was proposed. By this proposed reduction the city would lose $4,000.

The wireless-telegraph station at North Vancouver, B. C., was opened on March 13th by Mayor Kealy, who sent greetings to Mayor Hall of Victoria, B. C.

Managing Director Buntzen of the British Columbia Electric Street Railroad Company states no time will be lost in construction on the electric line between Vancouver and Chilliwac, and it is expected work will be finished and the line in operation before 1910.

Architect W. W. Hilton of Regina, Sask., has a proposal for supplying that city with electric power from the overflow of the government dam. R.

Pacific Slope.

San Francisco, March 18.—The high-tension power wires of the Bay Counties Power Company supplying the company's sub-stations in Oakland, Cal., are to be removed from Grove and Rose streets, Berkeley, and will be brought into Oakland from the south. A new right-of-way has been secured on the east side of the Berkeley hill through [illegible] that [illegible] tled.

Proposals are now being received by the Board of Trustees of Santa Clara, Cal., for the construction and extension of the municipal electric power house.

The Glendora Light and Power Company has been organized at Glendora, Cal., by J. A. Jo[illegible], H. G. Baker and C. S. Whitcomb for the purpose of putting in an electric plant at that place. The company has a capital stock of [illegible].

The Board of Public Works of Seattle, Wash., has opened bids for copper wire for the municipal lighting plant. The specification called for bids on two grades of wire, one aggregating 250,000 pounds and the other 308,000, but it has been decided to use the heavier grade. For this seven bids were submitted, each being $64,078.

The Eastern Nevada Power Company has filed articles of incorporation at Reno, Nev. The announced purposes of the company are to divert water from the Colorado River and operate a power plant in Lincoln County, Nevada.

M. S. Browning and others interested in the Ogden and Northwestern electric railroad have acquired about all the available water rights in Willard Canyon near Ogden and will develop electric power for the operation of electric railroads. The entire system of the Ogden and Northwestern will be operated by electricity and several extensions are being considered.

H. V. Hart of Salt Lake, Utah, is planning the construction of a power plant on Raft River to generate electricity for use on the property of the Century Gold Mining and Milling Company.

The directors of the Petaluma and Santa Rosa Railroad Company, operating an electric railroad in Sonoma County, California, have decided to spend about $25,000 for new equipment.

The Board of Public Works of Los Angeles, Cal., will award the contract for electric locomotives recently advertised for to the Westinghouse company for $35,000.

W. H. Carlson of the Los Angeles Securities Company is building an electric railroad to connect his Ocean Beach Villa tract with his properties at Hermosa Beach.

The San Diego Electric Railway Company has been awarded a franchise for an electric railway on Hawk and Lewis streets, San Diego. The proposed line will be an extension of the company's Third Street line.

The annual report of the Pacific Telephone and Telegraph Company shows that during the year 1907 the amount spent in betterments was $7,386,644. A total of 44,801 new stations was shown. A.

PERSONAL.

Mr. F. E. Riedhead, formerly of the General Electric Company, is now located in Paducah, Ky., with the Stone & Webster interests.

Prof. J. J. Thomson, F. R. S., of the University of Cambridge, has been elected president of the British Association for 1909, when the meeting will be held in Winnipeg.

Mr. James J. Lambrecht has resigned as president of the Northwestern Interurban Railway Company of Fargo, N. D., and is succeeded by Mayor E. J. Wheeler.

Mr. H. E. Chubbuck, secretary of the Illinois State Electric Association, and one of the best known electrical men in the state, has been appointed general manager of the Wichita Railroad and Light Company of Wichita, Kan.

Mr. P. E. Hurson, for many years employed by the Southwestern Telegraph and Telephone Company of Dallas, Tex., as superintendent of equipment and in other capacities, has been appointed superintendent of construction of the Michigan State Telephone Company, with headquarters at Detroit.

Albert Anderson, president of the Albert & J. M. Anderson Manufacturing Company of Boston, died on March 11th. He was a Norwegian by birth, but started a small machine shop in Boston in 1877 and later built up a successful business in the manufacture of switches, switchboards, line material and other electrical appliances.

The American Society of Mechanical Engineers has engaged Mr. Lester G. French to direct its editorial department. Among the immediate improvements to be undertaken is the establishing of departments in the monthly Proceedings, thus providing a greater variety of technical articles of interest. Mr. French was born in Keene, N. H., in 1869, and very early commenced his training in editorial work and printing at Brattleboro, Vt., where his father was a well-known printer and publisher. In 1891 Mr. French received his degree in mechanical engineering from the Massachusetts Institute of Technology. After four years' shop experience and spending a year and a half as a textbook writer, Mr. French was engaged on the editorial staff of Machinery, and assisted greatly in the development of that paper, of which, for nine years, he was editor-in-chief. Recently Mr. [illegible]

Mr. [illegible] electrical plants.

Mr. W. [illegible] Goddard [illegible] Locke Insulator Manufacturing Company, Victor, N. Y., [illegible] Western and Pacific Coast States investigating high-voltage insulator applications and transmission line and power-house design. Mr. Goddard is making a special study of the [illegible]ous climatic conditions upon the design of insulators for various localities, especially in view of designs for 100,000 volts and higher.

ELECTRIC LIGHTING.

The St. James (Mo.) Ice and Power Company has been incorporated with a capital stock of $25,000.

S. R. Howard of Waterloo, Iowa, has been granted an electric-light franchise in Quasqueton, Iowa.

Work is to be begun immediately on the new plant of the Pine Bluff (Ark.) Light and Water Company.

The Columbus (Neb.) Light, Heat and Power Company has been incorporated with a capital stock of $150,000.

The Sheboygan Falls (Wis.) Light and Power Company has been incorporated with a capital of $25,000. Otto B. Weisse, Emil Weisse and John Van Ouwerkirk are named as the incorporators.

The light plant of the city of Spirit Lake, Iowa, is to be sold or leased, and for this purpose sealed bids will be received until April 15, 1908. Mayor G. G. Fritz, Spirit Lake, Iowa, may be addressed.

City Electrician John W. Bleidt of Little Rock, Ark., has it figured out that the municipal plant of that city supplies 330 street arc lamps of 2,000 nominal candlepower each at a yearly cost of $39.04 each. But no allowance for depreciation or taxes seems to be included.

An effort is being made to compel the Peterson Heat, Light and Water Company to furnish electric lights to farmers along its transmission line between Iowa Falls and Alden, Iowa. The company is a Des Moines concern, doing business in Iowa Falls and Alden.

At a recent meeting the City Council of Galena, Ill., passed an ordinance providing for the sale of the municipal electric-light plant. A second ordinance was then passed granting to L. J. Highland a franchise to do commercial lighting upon his agreeing to place a bid of $18,000 for the city plant and entering into a contract to furnish the city arc lights at $50 a year each.

The electric-light plant in Taylor, Tex., owned by Williams Brothers has passed into the possession of a new company, which takes over all the rights and franchise. The new company, composed of T. W. Morse, C. H. Booth, E. H. Robertson, Howard Bland and others, had planned to construct a new lighting system, but will now enlarge the purchased plant and improve and extend the service.

Bids will be received by John D. Simpson, secretary-treasurer, Moosejaw, Sask., until 8 p. m., April 6th, for certain works to be carried out in connection with the municipal electrical works. Tenders are required as follows: (a), turbo-alternator and exciters; (b), condensers and pipe-work; (c), main switchboard and connections. Plans may be obtained upon deposit of $25, which will be refunded upon return of plans or bona-fide tender.

A new method of suspending arc lamps has been adopted in the suburbs of Paris, by which neither ladders nor pulleys are needed. The lamp is carried at the extremity of a hinged arm which is kept in equilibrium by means of a counterbalance weight within the lamp column. On shifting a ring round the column the arm descends to the required level for trimming the lamp, and on raising the counterpoise the bracket ascends to its former position. By the use of this system one man is enabled to attend to 50 lamps, whereas formerly he could only care for 30 lamps.

After a preliminary inspection of the municipal street-lighting plant and pole lines at Topeka, Kan., C. W. Stewart of St. Joseph, who was engaged by the mayor and Council to prepare plans and specifications for the remodeling and enlargement of the plant and make an approximate estimate of the cost of the same, submitted a report showing that the cost of the improvements would amount to $61,275. The committee thereupon decided to recommend to the Council that the bond-issue question be submitted to a vote of the people. Unless the bonds are voted the plant probably will be aban-

doned and the Edison company will furnish arc light at $55.

With the capacity of its lighting plant increased by the addition of a new turbine-generator unit, the Board of Public Works of the city of Wyandotte, Mich., is planning a large extension of the lighting system.

ELECTRIC RAILWAYS.

The plans of M. H. Miller of Fort Dodge, Iowa, promoter of the Spirit Lake, Emmetsburg and Fort Dodge electric railway, contemplate the ultimate connection by electric railway of the cities of Omaha, Des Moines, Sioux City and St. Paul.

The daily average traffic of the Chicago and Oak Park Elevated in February, inclusive of transfers, is reported as 46,716 passengers, against 49,073 for the corresponding month last year. The decrease a day was 2,367 passengers, or 4.81 per cent.

Jobbers of Des Moines, Iowa, held a meeting recently to discuss interurban electric-railway development. Special attention was paid to several of the lines now projected, which will open a vast territory now practically foreign soil. Representatives of the roads were present to furnish facts and estimates.

The Quincy-Terre Haute Traction Company has just completed arrangements with the Virden and Taylorville Railway Company and the Virden and Roodhouse Traction Company (all Illinois electric roads) whereby the latter two lines have consolidated with the former, which will complete the right-of-way for this company through Adams County.

The City Council of Mattoon, Ill., has refused to grant the Mattoon, Shelbyville, Pana and Hillsboro Traction Company a franchise unless it agrees to locate the principal shops in Mattoon. The completion of this road will connect Mattoon with Hillsboro, and make a through route from Indianapolis to St. Louis. Practically all the right-of-way has been secured, and the capital is ready to build the line.

PUBLICATIONS.

The John Nelson Electrical Company of Kewanee, Ill., has published a convenient catalogue of electrical novelties and supplies. All goods ordinarily desired by the average patron are listed, and the company is prepared to quote prices on anything not listed.

A little booklet published by the Trumbull Electric Manufacturing Company, Plainville, Conn., contains an interesting article entitled, "Where Many Knife Switches Fail." This company makes a well-known line of switches and panel boards, and in the booklet it presents briefly a few points which can easily be examined and which will help in judging concerning the efficiency of a switch.

The Fibre Conduit Company of Orangeburg, N. Y., is issuing a series of interesting folders bearing on Orangeburg fiber conduit. This conduit is made of extremely compact wood pulp, which is rendered non-conductive up to 25,000 volts. The folders are attractive and contain full details of the conduit and some interesting pictures. Lightness and economy are two strong points of the Orangeburg product. A laborer can easily carry 30 feet of the conduit in his arms.

A comprehensive catalogue of locomotive grab-bucket cranes has just been issued by the Brown Hoisting Machinery Company of Cleveland, Ohio. The cranes are operated on any standard-gauge railroad track and many are used on trestles. The catalogue has numerous illustrations of the Brown hoist with grab bucket in operation. There are also several detail drawings and much valuable information for anyone interested in the economical handling of coal, ore, sand, ashes, etc.

The Goldschmidt Thermit Company of 90 West Street, New York city, has just issued the first number of a publication called "Reactions," which it will publish quarterly hereafter. In its 24 well-illustrated pages are many interesting articles on recent applications and improvements in the Thermit welding process and on the use of Thermit for purifying molten iron and for other purposes. The company offers to place the name of anyone interested on its mailing list.

Anyone interested in power equipment will find much of value in three new bulletins just issued by the Western Electric Company, Chicago. They [illegible] respectively, of power equipment in railroad shops, boot and shoe factories and cement mills. Thus, [illegible] electric-power apparatus is covered. Each bulletin goes into its subject exhaustively, giving con- [illegible] through electric drive. The merits of Western [illegible] facilities of this company for producing all kinds [illegible] sity of reliability and efficiency are set forth. The bulletins are profusely illustrated with pictures of various types of power machinery and there are some excellent views of electrically equipped plants.

The National Brake and Electric Company of Milwaukee has just issued a bulletin, No. 384, on the new National type of air compressor. In the development of the National type 3VS compressor the aim was to produce a machine the utility of which would be unlimited and which could be depended upon under most unfavorable conditions. The motors furnished as a part of these compressors are for alternating or direct current, according to the purchaser's requirements. The new bulletin gives details of compressors, motors, starters, etc.

In bulletin No. 1104 the Fort Wayne Electric Works gives an illustrated description of its multiphase belted alternators, form B. These machines are built with a special view to convenience and economy for the station manager who is in need of additional generating capacity. Bulletin No. 1105 tells of the Fort Wayne electric fan motors. The company shows a very desirable line of fans for both direct current and alternating current. All details have been given careful attention and perfected to a nicety, resulting in fans of pleasing and satisfactory operation.

SOCIETIES AND SCHOOLS.

Superintendent Zimmerman of the Michigan Power Company and Alex Dow were speakers at two recent meetings of the Engineering Society of the Michigan Agricultural College at Lansing. Mr. Zimmerman spoke of hydro-electric power plants and gave a description of the distinctive features of the Piatt dam of his company and explained the features of the generator setting. Mr. Dow's subject was "The Trend of Modern Central-station Practice."

Students of Purdue University will produce, during April, "The Fair Co-ed," a college musical play, which has been written especially for the Harlequin Club, the student dramatic organization, by George Ade, the famous humorist and playwright, who was graduated from Purdue with a degree in science in '87. The scene of the play is laid on the Purdue campus of the future, in front of the "aerial engineering building."

The next monthly meeting of the American Society of Mechanical Engineers will be held in the auditorium of the Engineering Societies Building, New York, on the evening of April 14th. The general subject of the meeting is "The Conservation of Our Natural Resources," which is now receiving unusual attention, because of the invitation of the President of the United States to the governors of the several states, and to the presidents of the national engineering societies, to confer with him in Washington on this important problem. Dr. Henry S. Pritchett, president of the Carnegie Foundation for the advancement of teaching, will be one of the speakers and will discuss the "Relation of the Engineer to the Body Politic."

Mr. C. L. de Muralt, consulting engineer, and professor of electrical engineering at the University of Michigan, is giving a course of lectures to the senior electrical engineering students at Ann Arbor on the "Electrification of Steam Railroads." Professor de Muralt, who has been lecturing during the last semester on the underlying phases of this subject, such as the power-station equipment, transmission and working conductors, motor characteristics, etc., intends to supplement these by a discussion of the technical and commercial features. Special attention will be directed to such problems as the design of locomotives, the calculation of run sheets, the choice of speeds, study of the peak load, the location of sub-stations, the economics of transmission and other collateral topics.

MISCELLANEOUS.

The reverberatory furnaces were started on March 13th in the Washoe copper smelters of the Amalgamated Copper Company at Anaconda, Mont., and the following day the smelting of copper commenced. The smelters are said to be the largest in the world, reducing about 10,000 tons of ore daily. The limestone quarries of the Amalgamated Copper Company west of Anaconda resumed operations the same day.

The Westinghouse Electric and Manufacturing Company has recently completed the installation of a large number of motors for the San Rafael Paper Manufacturing Company of Mexico. These motors vary in capacity from 10 to 150 horsepower. They will be used in the operation of several machines and tools in the factory of the San Rafael company, which is located about 36 miles from the City of Mexico. The company obtains its electric current for driving the motors from the Mexico Light and Power Company at a potential of 20,000 volts. Six 120-kilowatt, oil-insulated transformers reduce this current to a working pressure of 440 volts. A switchboard to control the various transformers and motor circuits is furnished with the contract, as well as a number of individual switch board panels located near each motor. This installation is considered the most modern and economical plant of its kind in the Republic of Mexico.

Milwaukee papers say that real-estate firms are having difficulty in securing houses for a large number of families which will move from Cincinnati to Milwaukee about April 1st. These are families of employes of the Allis-Chalmers Company who are moving as a result of the company having recently equipped two large factories in West Allis for the manufacture of parts of large generators which were formerly built at the Bullock works in Cincinnati.

The Ad-Klub of Terre Haute, Ind., held its initial banquet on March 19th. The club is composed of members of the leading business houses and industrial establishments of Terre Haute, including the electrical and telephone companies. The various methods of advertising were discussed. Mr. L. E. Holderman, advertising manager of the Terre Haute, Indianapolis and Eastern Traction Company, as toastmaster, kept the gathering in a merry mood. The plans he advocated made a hit with the members.

TRADE NEWS.

Copper is firmer and more active. Within the last few days there has been an increasing degree of strength manifest, and quotations for electrolytic wire bars have advanced from 12⅜ and 12½ to 13 cents.

Charles L. Pillsbury, consulting engineer, formerly of Claussen, Burch & Pillsbury, announces that he has removed his Minneapolis offices from 1212 Guaranty Building to suite 206 Metropolitan Life Building.

A. L. Haase, well known through his connection with the Peirce Specialty Company of Chicago has engaged in business for himself and will act as sales agent and manufacturers' representative, with offices at 46 East Van Buren Street, Chicago. Mr. Haase will act as agent for the Peirce specialties, and in addition will carry a select line of other specialties used in construction work. Mr. Haase's wide acquaintance and experience in the construction line should fit him admirably for his new work.

The Locke Insulator Manufacturing Company of Victor, N. Y., has appointed as its agent for Eastern Canada the Engineering Equipment and Supply Company, Lindsay Building, Montreal, Canada, which company will place in the hands of engineers interested information concerning the Locke products. Mr. S. W. Smith of the Engineering Equipment and Supply Company has long been associated with the lighting interests of Montreal, and for a considerable time was connected with the Canadian Westinghouse Company as sales engineer.

BUSINESS.

Dossert & Co., 242 West Forty-first Street, New York, have received an order for 400 solderless cable connectors from the San Francisco Gas and Electric Company. F. A. Lawson & Co., Pacific Coast agents, write that Dossert solderless connectors have been specified in the plans for the wiring of the new Palace Hotel in San Francisco.

The Kuhlman Electric Company of Elkhart, Ind., reports business as excellent at this time. It also announces that recently, through the Central Electric Company of Chicago, it secured a contract for transformers required during the coming year by the Sanitary District of Chicago. This contract will likely cover apparatus to the amount of several thousand horsepower.

DATES AHEAD.

Iowa Electrical Association (annual meeting), Savery Hotel, Des Moines, April 22d and 23d.

Iowa Street and Interurban Railway Association (annual convention), Savery Hotel, Des Moines, Iowa, April 23d and 24th.

Missouri Electric Light, Gas and Street Railway Association, Marquette Hotel, St. Louis, April 23d, 24th and [illegible]th.

Omaha Electrical Show, Auditorium, Omaha, Neb., May 4th to 9th.

Nebraska Electrical Association (annual meeting), Omaha, Neb., May 6th and 7th.

Missouri Independent Telephone Association, Kansas City, May 6th and 7th.

Southwestern Electrical and Gas Association (annual meeting), El Paso, Tex., May 7th, 8th and 9th.

National Electric Light Association (annual convention), Auditorium Hotel, Chicago, May 19th to 22d.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 20th and 21st.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

New York Electrical Show (second annual), Madison Square Garden, October [illegible]

Chicago Electrical Show (fourth annual), Coliseum, January [illegible], 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 17, 1908.

881,034. Process of Producing Aluminum-magnesium Alloys. Franz Von Kugelgen and George O. Seward, Holcombs Rock, Va., assignors to the Virginia Laboratory Company, New York, N. Y. Application filed April 27, 1905.

The process consists in electrolyzing magnesium oxide dissolved in fused magnesium fluoride and chloride of a more electropositive metal in the presence of a cathode of molten aluminum-magnesium alloy with which the separated magnesium alloys.

881,038. Block Singal. Don D. Miles, Jr., Aurora, Ill. Application filed November 10, 1906.

This system comprises two sets of apparatus located at different points, two sets of lights associated with each apparatus, a single line or conductor between the two sets of lights, and with which the lights are connected, a controlling switch associated with each set of lights and circuit connections arranged so that either set of lights of each apparatus can be connected with the line.

881,043. Electric-light Sign. Mortimer Norden, New York, N. Y., assignor to the Electric Carriage Call Company, New York, N. Y. Application filed August 21, 1906.

There is a combination of interchangeable plates having openings in the form of a letter and a wall surrounding the openings and forming the contour of the letter, attached to and projecting forward from the plate, and lamps attachable to the socket terminals through the openings in the plate.

881,952, 881,953 and 881,954. Igniting Device for Gas Engines. John V. Rice, Jr., Bordentown, N. J. Applications filed June 1 and June 22, 1906.

The first patent relates to a governor for controlling the time of sparking; the second to the construction of a frame for a yielding electrode, and the third to the use of a mercury electrode and a special receptacle therefor.

881,963. Distribution Fixture. William D. Scott, Buffalo, N. Y. Application filed May 11, 1906. Renewed October 7, 1907.

Two series of insulators are arranged radially around a center and in different vertical planes, and a circular conduit is arranged around the same center, but in a plane intermediate of the two series of insulators.

881,965. Fuse and Fuse Box. Frank L. Sessions, Columbus, Ohio, assignor to the Jeffrey Manufacturing Company. Application filed October 20, 1905.

In the fuse box are mounted a pair of adjustable forked terminal jaws for receiving the knife-edge end terminals of an enclosed fuse.

881,967. Electric Insulator. Charles R. Slusser, Montpelier, Idaho. Application filed January 30, 1907.

The body is provided with a straight, approximately diametrical perforation of the size of the wire to be carried and with an upwardly extending bent or distorted slot communicating with the entire length of the perforation and extending to the outer surface, whereby the wire when in place lies free in the middle of the body, but can be inserted or removed only when bent.

881,968. Electric Kettle. David C. Smith, Kalgoorlie, Western Austrlia, Australia. Application filed July 8, 1907.

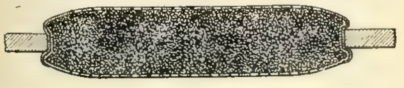
The kettle has a shallow rectangular chamber therein having one end open and extending outside the kettle, the chamber being inclined in relation to the kettle and containing a frame on which are placed the electric heating coils.

881,985. Plug-seat Switch. Bernard O. Wells, Charleston, Ill., assignor to the Sterling Electric Company, Lafayette, Ind. Application filed December 8, 1904.

In combination with a plug seat and a plug adapted to work therein are contact springs mounted on an extension of the plug seat and a plug control circuit changing device carried by the extension and operating in substantial alinement with the plug.

881,986. Automatic Gas Analyzer. Henry J. Westover, New York, N. Y. Original application filed January 8, 1907. Divided and this application filed March 21, 1907.

This device, which controls circuits in correspondence with the proportion of a given gas in a mixture, comprises an outer float, a circuit-closing member carried thereby and insulated therefrom, an inner float, a circuit-closing member carried by the inner float and electrically connected to the outer float, and a circuit including these two members.



NO. 882,144.—STORAGE-BATTERY ELECTRODE.

882,003. Electrical Igniting Apparatus. Edward S. Huff, Detroit, Mich., assignor to Henry Ford, Detroit, Mich. Application filed July 1, 1905.

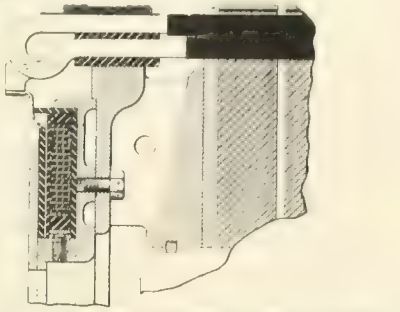
An induction coil has a condenser connected across the ends of the primary, one of the connections being formed through two branches, of which one includes a source of electricity and forms part of a charging circuit and the other forms part of a discharging circuit, each including the primary. Means are included in each branch that are adapted to periodically open and close the charging and discharging circuits, one circuit being open while the other is closed.

882,013. Electric Sign or Illuminating Device. William N. McComb, New York, N. Y. Application filed October 5, 1904.

A unit block is composed of a number of sockets, means for adjusting the same in groups in a vertical direction and means for adjusting them individually in a horizontal direction.

882,020. Means for Transmitting Electric Current with Increased Energy. Ethan A. Stratton, Chicago, Ill. Application filed July 13, 1906.

[illegible]



NO. 882,242.—CROSS CONNECTION FOR DYNAMOS.

882,041. Insulating Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company. Application filed September 21, 1906.

An insulating layer is applied between the rails and the base-plate and means are provided for holding the insulating layer in place embracing an aperture in this layer, an upwardly facing closed socket in the base-plate and a key of insulating material inserted in the aperture and socket.

882,048. Induction Coil. Melville S. Brigham, Detroit, Mich., assignor of one-half to A. R. Bliss, Lowell, Mass. Application filed August 19, 1907.

A number of open magnetic circuit coils are grouped in proximity to one another. The coils have independent primary and secondary circuits. An open magnetic circuit shield is arranged intermediate each pair of adjoining coils.

882,055. Gas-lighting Device. William K. Elliott, Payson, Ill. Application filed August 16, 1907.

This gas lighter comprises means operable from a distance to turn on the gas, an electric jump spark device arranged adjacent the burner to ignite the gas and a push-button for operating the jump spark device arranged adjacent to and encircling the means for turning on the gas.

882,075. Process for Separating the Metals Contained in Copper-nickel Matte. James M. Neil, Toronto, Ontario, Canada, assignor to Frederic C. Norris, trustee, Detroit, Mich. Application filed June 3, 1907.

In this process of reducing nickel from matte, the latter is first treated with sulphuric acid to form sulphates of the metals, the solution formed is electrolyzed with a copper-nickel anode and copper cathode to deposit the copper in the metallic form, and the resultant nickel sulphate solution is treated with a solution of a chloride of an alkaline earth, resulting in the formation of a solution of nickel chloride and a precipitate of an insoluble sulphate of the alkaline earth.

882,089. Electrical Signaling Apparatus. Benjamin F. Wooding, Denver, Colo. Application filed January 4, 1907.

Signaling apparatus on the train is connected to line conductors adjoining the track by a special contact device carried on the train.

882,095. Wire Tie for Insulators. Waldo E. Callane, Flora, Ind. Application filed November 19, 1906.

The tie consists of an insulator-engaging element, a wire-engaging element located at one side of the same, and a spring connection between these elements disposed transversely of the former one for urging the elements toward each other.

882,096. Lightning Arrester. Franklin P. Cauble, Lincolnton, N. C. Application filed May 3, 1906.

This arrester comprises an insulating spool having an axial bore and slots extending radially from the bore to the outside of the spool; a grounded core in the bore having radial ribs extending into the slots with their outer edges spaced from the outside of the spool, and a coil connected to the line and wound on the spool out of contact with the ribs.

882,110. Anode. Albert M. Hill, New Haven, Conn., assignor to C. Upham Ely, Brooklyn, N. Y. Application filed April 15, 1907.

The anode plate has a head with a wedge-shaped interlocking socket that engages a supporting hook.

882,118. Annunciator. John T. Needham, Bayonne, N. J., assignor of one-half to the Postal Telegraph-cable Company, New York, N. Y. Application filed May 27, 1907.

In this annunciator there is a semaphore, a rotatable support therefor, an electromagnet controlling the support, a pair of spring jacks opening upon different sides, and means whereby the insertion of a jack plug in either opening restores the semaphore.

882,139. Restoring Attachment to Trolley Wheels and Electric Signal for the Same. George H. Brooks, Louisville, Ky., assignor to Grauman, Beckman & Brooks, Louisville, Ky. Application filed June 17, 1907.

A trolley finder and replacer has a replacer roller mounted in the upper part of a bell crank. This roller first contacts with the wire and guides the trolley wheel

[illegible]

882,131. [illegible] June 20, 1906.

[illegible]

882,143. Block Signal System. William Dave, Bloomington, Ill., assignor to the Interstate Signal Company, Camden, N. J. Application filed December 23, 1907.

[illegible]

882,144. Storage-battery Electrode. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed March 30, 1905.

A support for the active material of an alkaline battery consists of a multitude of conducting metallic particles welded together to form a cellular integral structure composed wholly or in part of metallic cobalt. (See cut.)

882,153. Trolley Head. James Lennox, Brackenridge, Pa. Application filed July 24, 1907.

A yoke with spaced arms has disks with central bearing openings therein secured in parallel relation against the inner faces of the arms, with the arms in position to close the outer portions of the openings. The trolley wheel has trunnions engaged in the bearing openings.

882,157. Safety Appliance for Railway Trains. Robley C. Millard, Atlanta, Ga. Application filed July 17, 1907.

A valve for venting the main pipe line controlling the brake mechanism is governed by electric controllers, the one for opening the valve to vent the main pipe line to effect a setting of the brakes and the other to close the valve to release the brakes.

882,158. Magnetic Ore Separator. Richard R. Moffatt, New York, N. Y., assignor to the Imperial Ore Separator Company. Application filed May 6, 1905.

A feed conveyer passes between pairs of upper and lower poles. Means are provided for removing the material attracted by the upper pole and also means extending through the lower poles for agitating the feed conveyer.

882,169. Electrode. Marcus Ruthenburg, Philadelphia, Pa. Application filed September 20, 1901.

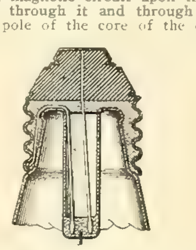
The electrode consists of a solid mass of uniform non-ferruginous composition, comprising silicon and carbon, capable of resisting the action of free chlorine, chlorous acid and nitric acid; the electrode is characterized by its capacity to conduct electricity through its mass.

882,186. Secondary Electric Clock. George B. Bowell, Westminster, London, England. Application filed December 14, 1905.

A rotary step-by-step operating device comprises an electromagnet, a double cam-shaped disk mounted to rotate in the field of the magnet and actuated by the magnet when energized, means for locking the disk against actuation, means for unlocking the locking means and adapted to bring the disk into starting position.

882,198. Induction Coil. John O. Heinze, Jr., Lowell, Mass. Application filed September 13, 1907.

This spark coil has an electromagnet and one or more members of magnetic material, independent of the electromagnet, but mounted adjacent to its core. An iron mass forms part of a magnetic circuit upon the pole adjacent to the member, through it and through the iron mass, to the opposite pole of the core of the electromagnet.



NO. 882,258.—LAMP BASE.

882,218. Electric-discharge Apparatus. Percy H. Thomas, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 6, 1903.

This device consists of a block or plate having comparatively high resistance particles so disposed as to provide discharge paths between them and having a large face area presented to the discharge as compared with its thickness.

882,224. Ice-making Apparatus. Edward T. Williams, New York, N. Y. Application filed July 28, 1906.

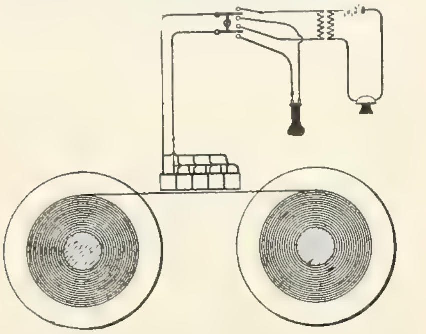
In this apparatus there is a freezing member including means for the circulation of a refrigerant and means for passing an electrical current through a portion of the member to thereby heat the same and detach the ice without stopping the flow of the refrigerant.

882,225. Flush Receptacle. Frank T. Wheeler, Plainville, Conn., assignor to the Trumbull Electric Manufacturing Company, Plainville, Conn. Application filed January 29, 1907.

The body, which is of insulating material, carries central stud and threaded sleeve contacts. The face plate rests upon and is secured to raised bosses.

882,242. Cross Connection for Dynamo-electric Machines. William H. Foot, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 28, 1906.

In combination with a cylindrical core and the windings are concentrically mounted cross-connecting rings for the winding, insulating strips between the cross-connecting rings, insulating rings and plates surrounding these rings and means for clamping the parts together and to the core. (See cut on page 259.)



NO. 882,328.—AMPLIFYING MAGNETS FOR TELEGRAPHONES.

882,250. Fire-alarm Box. Maynard W. Hamblin, Milwaukee, Wis., assignor to the American District Telegraph Company, New York, N. Y. Application filed February 27, 1902.

The box contains a make-and-break device for sending a signal over the main circuit.

882,253. Coil-winding Machine. Fred R. Kunkel, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 12, 1905.

A rotatable member comprises two bearings, the axes of which are in alinement and are perpendicular to the axis of rotation of the member, and two segmental guide plates, one of which is a part of the member, while the other is rotatably mounted upon a separate base.

882,257. Incandescent Lamp. Matthew M. Merritt, Middleton, Mass., assignor to the National Electric Lamp Company, Cleveland, Ohio. Application filed February 11, 1907.

The base of the lamp has a thin metallic shell terminal electrolytically deposited on a coating cemented to the neck of the bulb. To the bottom of the shell and coating is secured an insulating body carrying the central stud terminal.

882,258. Process for the Manufacture of Incandescent-lamp Bases. Matthew M. Merritt, Middleton, Mass., assignor to the National Electric Lamp Company, Cleveland, Ohio. Original application filed February 11, 1907. Divided and this application filed May 27, 1907.

The process of making the base referred to in the previous patent is described in detail. (See cut on page 259.)

882,260. Spark-plug Clip. Charles A. Mezger, New York, N. Y., assignor to C. A. Mezger, Inc., New York, N. Y. Application filed September 6, 1906.

The clip has two separate opposing members spaced from each other and adapted to receive part of the plug between them, each of the members being slotted and adapted to receive a part of the plug in the slot. Pliable fingers on one member engage the other member.

882,265. Lightning Arrester. Newitt J. Neall, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 24, 1906.

A discharge block has conducting plates secured to its faces and an apertured sheet of insulating material secured to one of the conducting plates. A terminal piece has a boss located directly opposite the aperture in the sheet. Insulating blocks are arranged for supporting the discharge block and for securing the terminal plate in position.

882,275. Railway Signaling Apparatus. John D. Taylor, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 4, 1908.

In a signaling system for a single-phase railway there [illegible] a transformer having a primary coil connected [illegible] with the return rail for the propulsion current and having its secondary in the signaling circuit.

882,276. Electric Signaling System. John D. Taylor, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 30, 1908.

[illegible]

[illegible] William S. Brown, New York, N. Y. Application filed August 21, 1907.

[illegible]

[illegible] Call Clock. Augusta Y. Jansen, Chicago, Ill. [illegible]

[illegible]

signor to the American Telegraphone Company. Application filed March 25, 1907.

In this apparatus for magnetically recording and reproducing sound there are provided a recording and an obliterating magnet and a switch for throwing in either the recording or the obliterating circuit.

882,328. Amplifying-magnet System for Telegraphones. John A. Lieb, New York, N. Y., assignor to the American Telegraphone Company. Application filed March 25, 1907.

The method of recording and reproducing sounds by this system consists in transforming the sound into telephonic currents, dividing the energy thereof among several separate magnets, moving a single steel medium past all the magnets so that different paths are traced thereon by the poles of the magnets, the medium moving at a comparatively slow speed and finally reproducing the sound by repeating the operation with the magnets in a single receiver circuit. (See cut.)

882,329. Telegraphone. John A. Lieb, New York, N. Y., assignor to the American Telegraphone Company. Application filed March 25, 1907.

In this apparatus a hollow drum has a steel plate sprung into the drum and retained therein by its own resiliency.

882,337. Junction Box for Electrical Conduits. Adnah McMurtrie, New York, N. Y., assignor to Thomas & Betts, New York, N. Y. Application filed August 29, 1901.

The curb for this box has a cylindrical member of sheet metal turned outwardly at one mouth to form an exterior plaster-retaining lip and curved at the inner mouth to form a non-abrasive shoulder.

882,340. Electrically Controlled Switch Mechanism. Granville E. Palmer, Boston, Mass., assignor of one-fourth to Charles B. Price and one-fourth to Frank S. Price, Salem, Mass. Application filed May 5, 1906.

The mechanism comprises a base with fixed contacts, a vertically moving frame carrying switch contacts, two electromagnets, a vertically moving solenoid core common to both, and a toggle lever mechanism connecting the core with the switch frame, whereby the latter and the core rise and fall together.

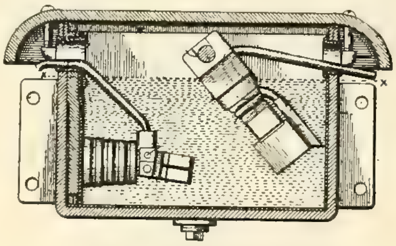
882,347. Composite Signaling and Telephone System. Harry O. Rugh, Sandwich, Ill. Application filed June 14, 1906.

A combined telegraph and telephone system has a quadrilateral of connections at each station, the telephone receiver circuit being connected to opposite points of the bridge so formed, and the telegraph apparatus being connected in series with the line.

882,385. Machine for the Manufacture of Coiled Springs. Noah S. Harter, Waukegan, Ill., assignor to the American Steel and Wire Company, Chicago, Ill. Application filed December 2, 1907.

A machine for forming coil springs has coiling means, an electrically controlled clutch for operating the same, a cutting mechanism, an electrically controlled clutch for operating this and means actuated by the movement of the coil for the purpose of stopping the coiling mechanism and tripping the cutting mechanism.

882,388. Electric Oil Switch. John D. Hilliard, Jr., and Charles E. Parsons, Glens Falls, N. Y. Application filed January 29, 1906.



NO. 882,388. —OIL SWITCH.

This oil switch consists of a fixed contact and a cooperating movable contact, oil surrounding the contacts, and insulating means carried by the movable contact adapted to confine the arc and to direct a jet of oil into the path of the same so as to extinguish it. (See cut.)

882,394. Contact Apparatus for Electric Igniters. Johann Krannichfeldt, Cologne, Germany. Application filed December 16, 1905.

Magnetic induction apparatus for electric blasting comprises a rotary disk, a centrifugal piece pivoted thereto, a contact disposed in proximity to this piece and adapted to close the circuit when the piece has attained a certain speed and a rack adapted to drive the disk.

882,417. Process of Producing Ferrosilicon. Edgar F. Price, Niagara Falls, N. Y., assignor to the Central Trust Company of New York. Application filed November 14, 1905.

This continuous process consists in smelting a charge containing a silicon compound, carbon and a source of iron by sending a current through the charge which acts as an electrically heated resistance conductor, withdrawing the molten product from the furnace and supplying fresh charge mixture as required.

882,418. Process of Producing Silicospiegel. Edgar F. Price, Niagara Falls, N. Y., assignor to the Central Trust Company of New York. Application filed November 14, 1905.

[illegible]

882,424. Insulator Pin. William Scharfhausen, Payette, Idaho, assignor to the Payette Insulator Pin Company, Limited, Payette, Idaho. Application filed June 10, 1907.

[illegible]

around the lower part of the threaded portion. A locking wire is fitted into these slots.

882,495. Trolley-car-pole Attachment. George R. Dunn, San Diego, Cal., assignor of one-half to Solan Bryan, San Diego, Cal. Application filed August 30, 1906.

The attachment consists of a bifurcated frame, the harp journaled therein and adapted to swing laterally, the trolley wheel arranged in the harp in a plane parallel to the frame, and a spring chain connecting the shank of the harp with the frame and arranged between its forks.

882,498. Protective Appliance for Electric Circuits and Apparatus. Harry H. Hornsby and Edward W. Anger, Jr., Chicago, Ill. Application filed December 19, 1901.

An enclosed fuse has an indicating device to show when the fuse has blown, which consists of a spring plunger that protrudes beyond the end of the sheath when released by the fuse wire.

882,508. Static-influence Electric Machine. Heinrich Wommelsdorf, Charlottenburg, Germany. Application filed April 27, 1906.

In this machine there is a disk consisting of a number of insulating plates arranged one above the other, and conducting sectors following one upon the other in a circle, two successive sectors being situated between different insulating plates.

882,509. Apparatus for Producing Ozone. Albert C. Wood, Philadelphia, Pa. Application filed October 18, 1904.

A tubular electrode has a rod extending through it, insulators secured to the rod and movable in the electrode for alineing the rod and electrically separating it from the electrode, means for passing oxygen through the electrode and means for effecting an electrical discharge between the rod and electrode.

882,510. Apparatus for Producing Ozone. Albert C. Wood, Philadelphia, Pa. Original application filed October 18, 1904. Divided and this application filed May 12, 1906.

This is a modified form of the above.

882,514. Connection for Electric Conductors. Frederick O. Ball, Plainfield, N. J., assignor of one-half to F. H. Ball, Plainfield, N. J. Application filed January 31, 1906.

A thin plate has an opening therein, the edge of which is adapted to form electrical contact. A contact piece opposes the thin plates. A spring is arranged to exert pressure on the thin plate and contact pieces to press the contact surfaces thereon toward each other.

882,523. Block-signal System. Frank E. Kinsman, Plainfield, N. J. Original application filed December 8, 1903. Divided and this application filed November 29, 1904.

This system for electric railways has a normally closed signal-controlling circuit fed by current from the power circuit.

882,531. Rotary Converter. John L. Murdock, Boundbrook, N. J. Application filed March 28, 1906.

In a three-phase rotary converter there are in combination a stationary field, an armature provided with three windings, two sectors connected with each winding, each of the sectors representing approximately 120 degrees of a circle, and two brushes, each having a contact length representing approximately 60 degrees of a circle and being adapted to rest throughout the contact length upon one or more of the sectors.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 24, 1908:

448,653. Electric Railway. R. M. Hunter, Philadelphia, Pa.
448,666. Dynamo-electric Machine. S. E. Nutting, Chicago, Ill.
448,669. Electric-contact Device. F. A. Perret, Brooklyn, N. Y.
448,676 and 448,677. Meter for Alternating Electric Currents. O. B. Schallenberger, Rochester, N. Y.
448,679. Waterproof Combined Coupling and Cut-out for Electric Circuits. F. Shlaudeman, Decatur, Ill.
448,680. Connector for Electric Wires. F. Schlaudeman, Decatur, Ill.
448,681. Speed Regulator for Electric Motors. S. H. Short, Cleveland, Ohio.
448,682. Adjustable Rheostat. S. H. Short, Cleveland, Ohio.
448,684. Fire-alarm Signal Box. W. F. Singer, Carthage, N. Y.
448,698. Electric Switch. D. B. Turner, Chicago, Ill.
448,703. Support for Electric Line Wires. H. C. Wirt, Boston, Mass.
448,711. Overhead-crossing Appliance for Electric Railways. I. H. Farnham, Wellesley, Mass.
448,712. Electric Time Alarm. J. J. Gallagher, St. Louis, Mo.
448,778. Electric Railway. T. A. Edison, Menlo Park, N. J.
448,779. Telegraph. T. A. Edison, Menlo Park, N. J.
448,78[illegible]. Electric Lighting. R. M. Hunter, Philadelphia, Pa.
448,796. Perpetual Calendar. A. Hadlock, Kalamazoo, Mich.
448,831. Trolley for Electric Railways. R. Eickemeyer, Yonkers, N. Y.
448,838. Insulator for Electrical Conductors for Mines. F. A. Pocock, Scranton, Pa.
448,847. Clamp for Electric Battery Zincs. J. H. Leakin, Baltimore, Md.
448,856. Electric Signaling Apparatus for Railways. E. D. Graff, New York, N. Y.
448,894. Electric Meter. E. Thompson, Swampscott, Mass.
448,91[illegible]. Electric Street-car Driving Gear. C. M. Conradson, Madison, Wis.
448,914, 448,915 and 448,916. Filaments for Incandescent Electric Lamps. G. Edwen, Berlin, Germany.
448,92[illegible]. Filament for Incandescent Electric Lamps. F. G. A. Heller, Berlin, Germany.
[illegible]. Secondary Electric Clock. W. S. Scales, [illegible], Mass.
449,0[illegible]. Method of Measuring Alternating Electric Currents. O. B. Schallenberger, Rochester, N. Y.
449,0[illegible] and 449,0[illegible]. Meter for Alternating Electric Currents. O. B. Schallenberger, Rochester, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLII. CHICAGO, APRIL 4, 1908 [illegible]

Chicago Municipality Begins the Use of Drainage Canal Power.

Street arc lights in Chicago received current from the Drainage Canal hydro-electric power plant for the first time on March 23d. Only a comparatively small number of arc lights in the street-lighting service are as yet on the new circuits, but enough has already been accomplished to warrant the present outline account of the plans, which contemplate the lighting of practically all the streets of the city with current generated at the new Lockport plant of the Sanitary District of Chicago.

The Drainage Canal, as readers of the Western Electrician know, was built at great expense as a means of affording sanitary relief to the city of Chicago. At the close of the year 1907 the project, which has satisfactorily accomplished the purpose intended, had reached a cost of $56,616,014. As the work neared completion the trustees of the Sanitary District of Chicago, which is the official body which built and controls the canal and its property, began to see the possibility of power development afforded by the large flow of water through the channel, and they at once began to carry out the work.

The fine hydro-electric power plant at Lockport, designed for an ultimate capacity of 40,000 horsepower and with 20,000 horsepower available at present, was the result. This plant, with its high-tension transmission line and sub-station in Chicago, has been fully described in the Western Electrician. The plant is modern in design and well built, generating three-phase, 60-cycle, alternating current at 6,600 volts, from which it is stepped up to 44,000 volts for transmission to the Chicago sub-station at Western Avenue and the canal.

At the Western Avenue sub-station the current is transformed to 12,000 volts. The present article will deal with the plans of the Department of Electricity of the City of Chicago for distributing this 12,000-volt current to various points of use throughout the city.

In the municipal lighting system there are four steam generating plants, three direct current and one alternating current. Two of these, the one at Rice and Lincoln streets and the plant at Halsted and Harrison, have been equipped to utilize the canal power. The new Horatio N. May alternating-current plant on the North Side and the Wentworth Avenue direct-current plant on the South Side are now being fitted up. Besides, the city is building numerous small transformer stations in various localities, from which lighting circuits will be run.

To utilize the canal power required a considerable outlay by the city and much work by the Department of Electricity. Transmission lines from the Western Avenue sub-station to the several power houses were built by the city. These are for the most part underground and represent an outlay, including conduit, three tunnels and cable, of $210,000. The new apparatus and alterations necessary in the power houses will require $114,464. Thus $324,464 has been expended, not including the transformer sub-stations which are to be built along the distribution lines until the capacity of the cables, about 4,000 kilowatts, is exhausted.

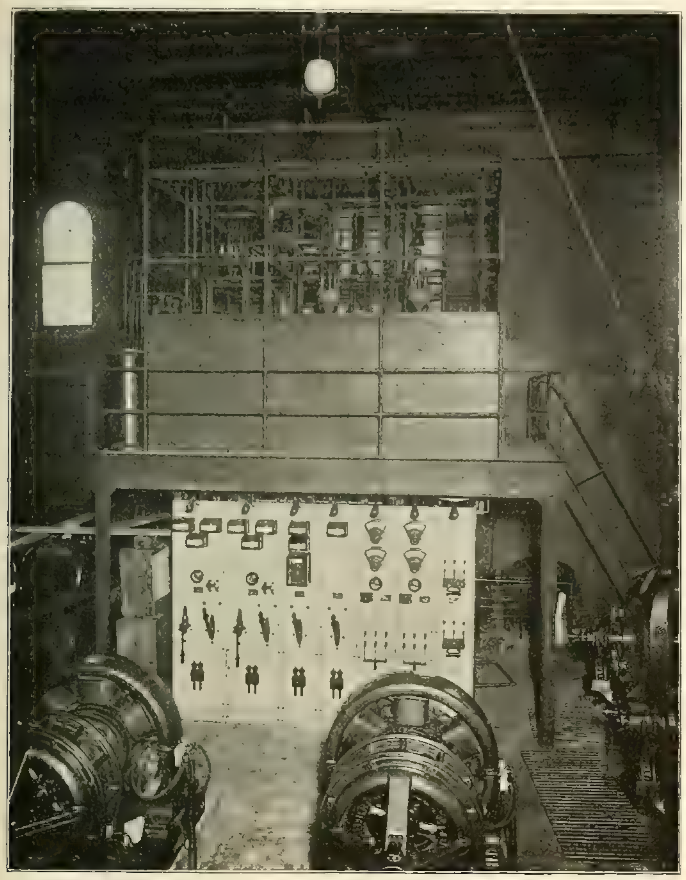
The only alternating-current city plant is the new Horatio N. May station on the North Side. From this plant, which is the largest of the four owned by the city, 2,821 arc lights are operated. The plant has three 750-kilowatt engine units, which will soon be used only for emergency. A standard outfit of step-down transformers, with the necessary switchboard and apparatus, is being installed to reduce the 12,000-volt current received from the sub-station to 6,600 volts for the arc-light circuits.

One feature of interest in the H. N. May plant is the use to be made of the 750-kilowatt engine units. Two of these will be kept in readiness to operate the lights in that territory in case of accident to the canal power. The third unit, when needed, will deliver its 6,600-volt current to transformers which will raise it to the line voltage of 12,000 volts. This arrangement has been planned to help out any of the other three plants whenever necessary.

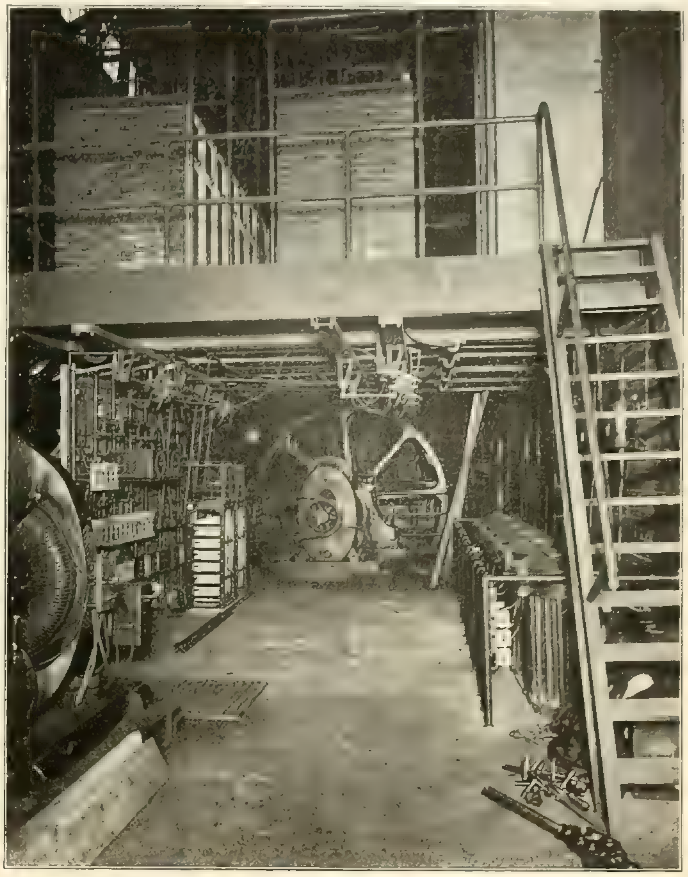
In the three direct-current plants the new equipment is identical in character. The Halsted Street plant and the one at Rice and Lincoln streets are nearly completed and [illegible] equipment installed for utilizing the canal power [illegible] paratus, and exciters.

[illegible] side view of the new switchboard in the Halsted Street plant, which is the largest of the direct-current stations. The plant has [illegible] arc dynamos supplying current to as many arc-light circuits. Three steam engines, one for reserve, drive a shaft extending the full length of the building to which the generators are belt-connected.

For the new power [illegible] been installed in the Halsted Street plant, arranged to drive the shaft by friction clutches. An accompanying illustration shows the motor and clutch arrangement. This picture was taken in the Rice and Lincoln Street plant, and is typical of all the others.



Switchboard in Halsted Street Power House, with Exciter Sets for Synchronous Motors in Foreground.



Oil Switches, Lightning Arresters, Rear of Switchboard and Transformers in Halsted Street Power House.

THE USE OF DRAINAGE CANAL POWER FOR CHICAGO STREET LIGHTING.

The motors take the full 12,000-volt current, starting compensators giving one-half the impressed voltage being used in starting. The starting compensators are shown to the left of the high-tension equipment in the front view of the switchboard. Some difficulty was experienced at first in starting and bringing the apparatus up to speed, but this is now accomplished satisfactorily by a unique method which has been termed by the city engineers "kicking up." The current is turned on and the motors are got up to speed with no load. Then the clutch is thrown on and allowed to remain for a few seconds, and again thrown off. This is repeated three or four times, when the shaft is also up to full speed. The generators are then thrown on one at a time.

The Rice and Lincoln plant contains eight generators belt-connected to a shaft. There are two steam engines which are replaced by the 1,200-horsepower motor shown. From this plant 1,294 arc lights are operated. The R. A. Waller plant on the South Side, now being re-equipped, supplies current for 1,373 arc lights.

The switchboards, of which the one shown is typical, are of the standard General Electric type. The exciters for the motors are shown in front

on the switchboard. The back of the board and the exciter transformers are shown in the side view. The high-tension apparatus, oil switches and lightning arresters are located above.

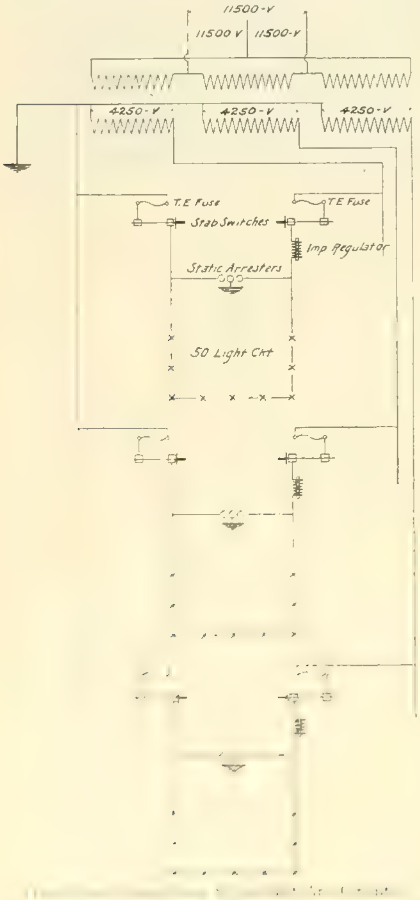
Of considerable interest in the new canal power lighting service is a series of transformer sub-stations which are planned and being built in various parts of the city. One of these is completed and the apparatus is being installed. It is located in the rear of a city building on Emerald Avenue,

USE OF DRAINAGE CANAL POWER FOR CHICAGO STREET LIGHTING.—A TRANSFORMER SUB-STATION.

near Thirty-fourth Street, and is shown in an accompanying picture. Three of this type are now being built, but for the future ones lots will be purchased and more pretentious buildings constructed.

The transformer sub-stations will each be equipped with three 250-kilovolt-ampere, 11,500/4,250-volt, single-phase transformers, together with switchboard, regulators, etc. The primary will be connected in delta and the secondary in Y, with eight 50-light circuits in multiple from each leg of the Y. The buildings are of brick and reinforced concrete throughout.

The city is now prepared to use 2,700 horsepower from the Sanitary District, for which it pays $15 a horsepower a year on a basis of an average use of 11 hours a day. It operates 7,935 arc lights from the four plants, rents 625 lamps and buys current for 213. It is planned to add many thousands of arc lamps during the next few years and do away with all gas and gasoline lamps. The new work has been done in a thorough manner and has been under the supervision of William Carroll, city electrician.



Canadian Waterpower Development.

At the Charter Day exercises at Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., on March 14th, Cecil B. Smith of Toronto, an engineer who has given much attention to hydro-electric development, delivered the address. He pointed out that the United States has more fully developed its waterpowers than any other country, largely through the diversity of its climate. Canada's waterpowers come next in order, where 400,000 horsepower has been developed; and next to that stands Italy. Mr. Smith had the pleasure of examining the waterpowers of Italy a few years ago, and brought back the highest regard for the Italian engineers. He said that he came back to Canada very much humbled, as it were, after seeing the wonderful progress that foreign engineers had made in developing waterpowers for manufacturing purposes.

Some of the developments which have been made in Canada were described in an interesting manner. Canada is a country stretching from ocean to ocean, and to the North Pole. On the two seaboards there is an abundance of coal. Nova Scotia and Cape Breton supply the New England States, and in turn Pennsylvania supplies Ottawa. In the far West, British Columbia supplies San Francisco; and all through the Canadian mountain ranges coal is to be found in enormous quantities. Geologists have scarcely formed as yet any conception of the natural resources of Canada. Unfortunately, however, between these two extremes and in the most populous parts of Canada no coal is to be found. Therefore, dependence must be placed upon shipments by rail of coal from distant points, whether in the United States or Canada, for fuel, and for heating and power purposes. It will easily be seen that in the lower central and lake provinces every effort should be put forth to make the most of the natural resources there abounding, namely, the almost unlimited waterpowers.

At the Long Sault, for instance, near Massena, N. Y., there are developments projected something like 700,000 horsepower. Although Mr. Smith would hesitate to say that a dam would ever be built across the St. Lawrence River, nevertheless, to do so would result in untold benefits to both Canada and the United States. If it should be the case that the International Conference gives permission to place a dam across the Long Sault, thereby making it necessary for all the lake shipping vessels on their way to the sea to go through canals, there would be one of the greatest hydro-electric developments in the world at our doors, as great, in fact, as Niagara Falls, because the respective governments have already limited the amount of water to be taken out for power purposes at Niagara.

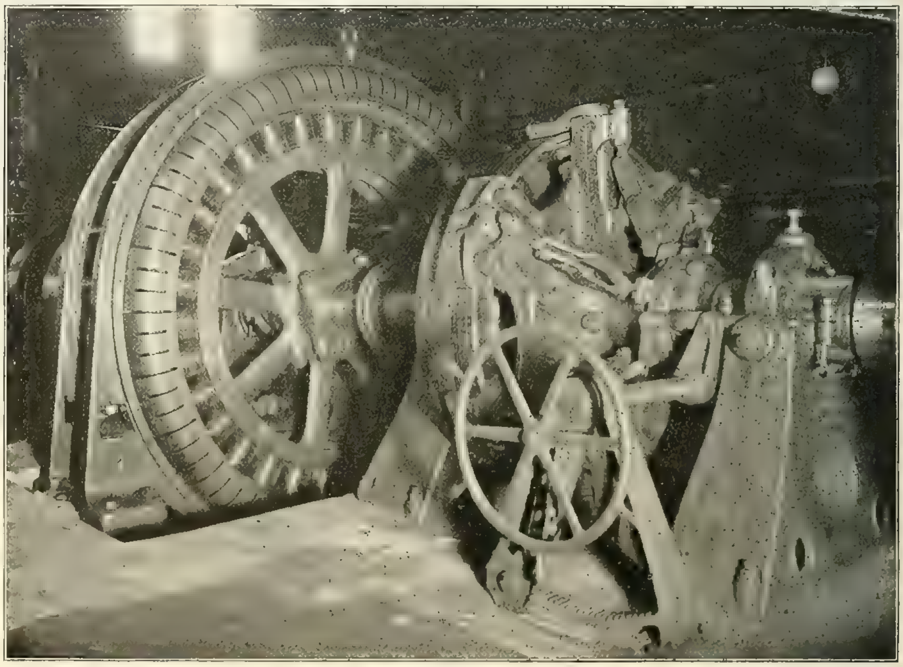
Location of Faults on High-tension Transmission Lines.

High-tension transmission lines of great length frequently develop faults of such a nature, as, for example, the development of a defective insulator, as to put the system out of commission until the fault is repaired. It is of the utmost importance that the fault shall be located with reasonable closeness in as short a time as possible and that any test made for the purpose of locating the fault should be conducted with rapidity and without producing destructive effects. At the same time these faults, which usually take the form of the partial grounding of one of the conductors at an insulator are frequently of such a nature as to require the full normal voltage of the line in order that they may be developed. When such a fault has been developed by this high potential a large current will flow through an arc to ground.

Considerable study of the subject has led to the invention of a simple method of locating such faults by Lloyd C. Nicholson of Buffalo, N. Y., and the means employed by him were recently patented in this country. This method, which has been employed by him extensively, will be illustrated and described in connection with a three-phase transmission line in which the secondaries of the step-up transformers used at the generating station are star-connected, the neutral point being connected to ground. The method, however, is applicable to other arrangements and connections with some minor changes. This method involves the provision of apparatus by which the fault can be rapidly located without a continued flow of a destructive current and without requiring adjustment of the testing apparatus during the continuance of the test.

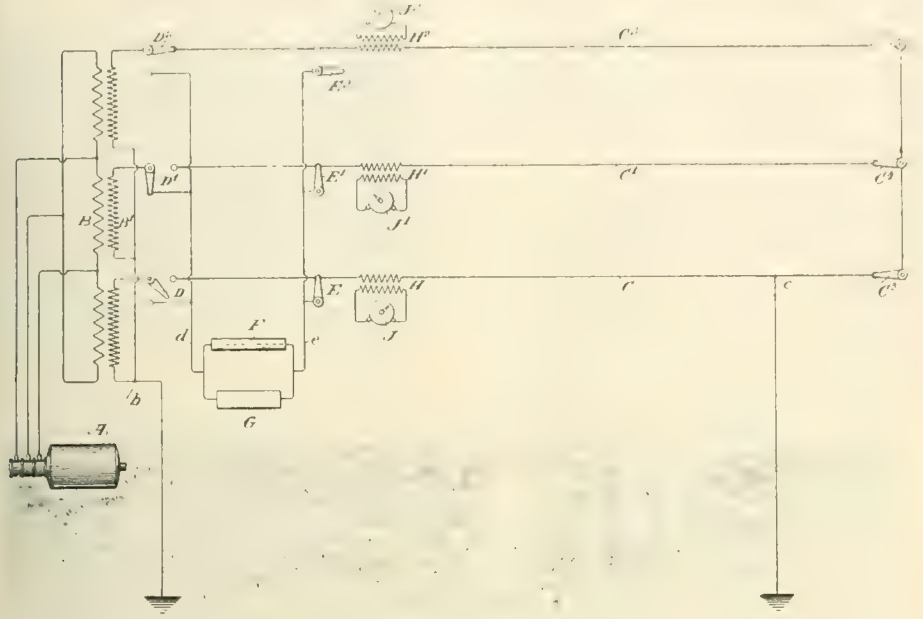
The conductors of the transmission system are connected in a loop which contains the faulty conductor, and this loop is connected to one terminal of a suitable source of power, which is indicated in the diagram herewith as the usual power transformer of the generating station. The location of the fault is determined by comparing the measurements of two measuring instruments so connected as to indicate by their relative readings the relative impedances of the two branches of the loop from the source of power to the fault. These two instruments are in the present instance connected respectively to the secondaries of two series transformers whose primaries are placed in the two branches of the loop. By determining the fault in accordance with the indications of these two instruments the fault may be located without the necessity of adjusting any apparatus during the progress of the test, and the results can be arrived at almost instantaneously, thus obviating the necessity of injuring the conductor by a continued arc at the fault.

A further feature of this method involves the provision of a sufficiently high voltage applied to the fault to insure the development of the same for the purpose of the test, and the provision of



SYNCHRONOUS MOTOR DRIVING LINE SHAFT IN CHICAGO STREET-LIGHTING POWER HOUSE, SHOWING FRICTION CLUTCH.

means that will reduce [illegible] current in the circuit so as to reduce the destructive effect of the arc and keep the power consumed during the test within the capacity of the generator and within the range of the measuring instrument. It was found that good results may be obtained by providing an impedance in series with the source of power and the loop and shunting this impedance with an enclosed fuse. This enables one to raise the voltage of the circuit to a point at which the arc to ground will develop while the enclosed fuse will



CIRCUITS FOR FAULT-LOCATING APPARATUS.

be burned by the current flowing after the arc has been developed, thus throwing the impedance into circuit and permitting but a relatively small current to pass through the circuit. The same general result may also be attained by employing, as the impedance, an inductance of proper value to offset the condensance or capacity of the line, as hereinafter explained, in which a fuse, or its equivalent, need not necessarily be employed.

In the diagram (A) indicates a three-phase generator which may be considered as representing one or more main generators of a high-tension generating station. (B) (B′) indicate, respectively, the primaries and secondaries of step-up transformers through which the high-tension current is fed to the transmission line comprising the conductors (C), (C′), (C²). The particular transformers illustrated have their primaries delta connected, while their secondaries are star connected, the neutral point (b) being normally connected to ground, as indicated. These transmission lines may be of great length, the particular line upon which many of these tests have been made being over 100 miles in length. At (c) is indicated a fault upon the conductor (C) by a connection from that conductor to ground. During the normal operation of the system after such a fault develops it will readily be noted at the power house, and the particular conductor in which it is, is known by the indications of the measuring instruments. These are not illustrated here nor their connections described, as they are well known.

Switches (D), (D′), (D²) are connected to the conductors from the secondaries and are arranged as indicated to connect the secondaries either with the main lines or with the conductor (d), or to open the circuit from its secondary. Switches (E), (E′), (E²) are arranged to connect or disconnect any of the main conductors with the conductor (e) as indicated. Between the conductors (d) and (e) is an enclosed fuse (F) shunting an impedance (G), which may be either a non-inductive or an inductive impedance, it being not essential what character of impedance is employed.

(H), (H′), (H²) indicate series transformers whose primaries are connected in the main conductors. The secondaries of these transformers are connected to electrical measuring instruments which give a registration determinative of the currents flowing in the respective conductors. These instruments may be indicating, integrating or recording instruments. Except where the fault is of such a character as to cause extremely rapid fluctuations of the currents flowing, indicating instruments are sufficiently satisfactory, although they have the dis-

[illegible] referred to [illegible]

When the station attendant observes that there is a fault such as indicated on the conductor (C) and desires to locate that fault, he gives telephonic instructions to an attendant at the other end of the transmission line to disconnect the receiving apparatus from the line and connect the faulty conductor with one of the other conductors as by switch (C³). The station attendant at the generating end then manipulates such of the switches (D), (D′), (E), (E′), as may be necessary to connect the faulty conductor to the conductor which has been connected at the other end, this being effected by connecting these conductors to the conductor (e) by the switches (E), (E′). Switch (D) is opened to disconnect conductor (C) from the secondary of the power transformers, while switch (D′) is thrown to connect a secondary of the power transformers with the conductors (d).

These connections in this manner cause a circuit to be established from one of the secondaries of the power transformers through the impedance (G) and fuse (F) in shunt therewith, then through the conductor (e), and thence to the fault through parallel branches of the loop formed by the conductors (C), (C′), switches (C³) and (C⁴) and switches (E) and (E′), the circuit from the fault being completed through the ground to the point (b) of the power transformers.

The fuse is provided to enable a sufficient voltage to be applied at the fault to enable the arc to develop thereat, even though the fault be only a partial one, otherwise a substantial amount of current will be required in the conductors at the voltage necessary to cause the arc to develop because of the electrostatic capacity of the conductors, which would require an increased voltage at the generating station, due to the fact that the impedance (unless designed to have a suitably proportioned high inductance) will, at the current required by the conductors, absorb a great proportion of the voltage. On the other hand, the impedance has been provided in order to reduce or limit the current after the fault has developed to a safe and desirable value. A sufficiently high voltage, therefore, is applied to the fault to develop an arc. If this is followed by a rush of current of a greater value than that for which the fuse is designed, the fuse will burn out and place the impedance in series with the loop. This reduces the current to a desirable value and one that can be readily measured by the instruments (J), (J′), the transformer (H²) and instrument (J²) not being in use at the particular test assumed.

The currents indicated by these instruments are inversely proportional to the impedance of the respective branches of the loop to the fault. From the relative measurements the impedances of the two branches of the loop may be readily calculated since the electrical constants of the circuit are known. It has been found in practice that the simplest and most accurate method of determining the exact location is to divide the difference between the readings of the two instruments in the two branches of the loop by the sum of the readings,

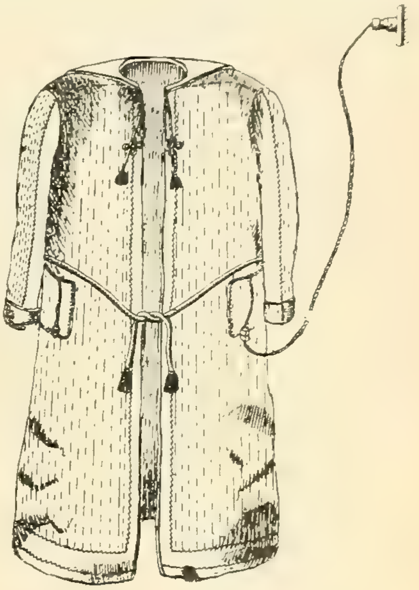
[illegible]

It is evident [illegible] ductors, and that either or both of the conductors may be [illegible] conductors. It is obvious that the method is equally applicable to [illegible]

It is possible to place an inductive impedance in the same position in the circuit as the impedance (G) (inductive or non-inductive), but which shall not be shunted by the fuse, and therefore be permanently in the testing circuit. If this inductance is of such value as to substantially offset the condensance of the transmission line so that a sufficiently high voltage may be applied to the fault while the inductance is in circuit to develop that fault, then it will not be necessary to employ a fuse or an equivalent for the fuse. This is true, because under these conditions, despite the presence of the impedance, the fault will develop while such impedance will limit the flow of current after the fault has developed. It is, of course, well known that an inductance and a condensance in series neutralize each other's effects partially or wholly according to the relative values of the two.

An Electrically Heated Bath-robe.

A novelty in the electric heating line is the invention of Burton R. Charles of Portland, Ore., who has just been granted a patent on what he calls an electrothermal garment. This garment is in the form of a bath-robe and is lined throughout. The outer surface is made of heat-retaining material



ELECTRICALLY HEATED BATH-ROBE.

and between this and the lining is a mesh of electrically heated wires. These wires are securely fastened at their ends in one pocket, where they connect with a cord and plug, by means of which connection is made with a lamp socket or other electrical outlet, or with a battery. The attachment plug and cord can be conveniently carried in the pocket when the electric heat is not desired; when these are so concealed the garment looks just like an ordinary lounging robe or bath-robe. The other pocket holds a snapswitch in circuit with the heating wires to enable the current to be conveniently turned on or off. The material of the garment is practically fireproof to eliminate danger of fire in case any of the wires should be broken and the ends come together again.

Under date of March 17th the Paris correspondent of the Western Electrician writes: "The former prohibition of importing electric material into Turkey has now been abolished, and there will be an excellent field for introducing apparatus in that country, as in the large cities, such as Damascus, Smyrna, Mecca and others, the inhabitants are quite in favor of using current."

Central Electric Railway Association.

The second bi-monthly meeting of the Central Electric Railway Association was held in the Claypool Hotel, Indianapolis, on March 26th. The attendance was very good; over one hundred members present represented 164 electric lines in Ohio, Indiana, Michigan and Kentucky.

W. S. Whitney, chairman of the committee on traffic association, presented a report to the effect that a permanent traffic association had been formed and that A. L. Neeramer of Delaware, Ohio, had been selected as permanent chairman for the Central Electric Traffic Association, also to act as permanent secretary of the Central Electric Railway Association. The amount of $7,000 was determined necessary to defray the expenses of salary, traveling, office expenses, etc., for the year 1908, and this amount is to be raised by a monthly tax on each road according to the mileage. This report was adopted.

The Interstate Commerce Commission at Washington is considering a method of bookkeeping upon the electric railroads which is believed to be impractical and impossible of carrying out. For this reason every official of the electric lines in Indiana and Ohio was requested to wire the Interstate Commerce Commission for more time to suggest revision and modification of the system proposed so as more nearly to comply with the needs of the electric lines. In discussing this matter, A. W. Brady, president of the Indiana Union Traction Company, said one item of the commission's plan would be sufficient to show its impracticability. The plan requires the companies to show how much current is used for lighting cars, how much for lighting stations, how much for turning the car wheels, etc. This could only be guessed at, said Mr. Brady.

The first paper on the programme was read by Adam Cole of Dayton, Ohio, on "Standardization of Trolley Wheel, Harp and Pole." H. D. Murdock of the Indianapolis and Louisville Traction Company described the 1,200-volt, direct-current system used on that road. Mr. Murdock said that up to date the alternating-current motor has "refused" to be as good a motor as the direct-current, and for that reason the latter is still a favorite. A remarkable development in the direct-current railway motor has recently taken place; the application of the commuting-pole principle has already doubled the usual voltage, and the end is not yet. This improvement in voltage capacity is a great advance in the art, when the fact is considered that the voltage of railway motors has been raised only 150 volts in 20 years. The speaker concluded by saying that the application of 1,200 volts direct current to electric traction has placed in the hands of the electrical engineer another system to select from, which should enable him to solve some of the perplexing problems in electric traction more economically than heretofore.

The next paper on the programme was read by A. C. Vau Clain of Philadelphia, on "Electric Motor and Trailer Trucks." Mr. Vau Clain illustrated his paper with lantern slides, showing and describing the development that has been brought about in the last few years in order to secure a satisfactory motor truck for electric cars.

President F. D. Carpenter said that it was particularly fortunate that W. D. Deppe of Nova Scotia was present and would read a paper on electric-railway development. Mr. Deppe said the real needs were more liberal rather than drastic legislation in the interest of electric railways.

The convention adjourned to take a car at five o'clock for a trip over the Indianapolis and Louisville Traction Company's line, on the invitation of A. A. Anderson, general superintendent. The next meeting will be held on the fourth Thursday in May, probably at Toledo, Ohio.

B. E. Sunny Becomes Vice-president of the Bell Telephone Interests.

Bernard E. Sunny of Chicago has resigned as vice-president of the General Electric Company to become vice-president of the American Telephone and Telegraph Company. Mr. Sunny is one of the best known and best liked electrical men of the West, and the announcement of this change will be received with the greatest interest. Here is Mr. [illegible] statement, dated March 31st:

"I have resigned my position with the General Electric Company as one of its vice-presidents, but will continue for an indefinite period to be connected with its affairs, although not actively.

"I have accepted the appointment as one of the [illegible] of the American Telephone and [illegible] of New York.

[illegible] has a large ownership in Bell telephone plants in the United States, a considerable portion of which is in the West. These [illegible] regard and continue [illegible] that they will [illegible]

[illegible] telephone station [illegible] United States has increased from 2,000,000 to 3,900,000, and there is [illegible] of population.

[illegible] the number of telephone subscribers all over the country has of course increased the number and the character of the questions of policy and practice, and the American company is increasing its executive staff by the addition of myself better to meet this demand.

"I was superintendent of the Chicago Telephone Company for about 10 years, up to 1888, and am therefore familiar with the telephone work."

The change will be made on May 1st. As vice-president of the American Telephone and Telegraph Company Mr. Sunny will succeed Thomas Sherwin, retired.

Succeeding Mr. Sunny, Mr. James W. Johnson will be manager of the Chicago office of the General Electric Company. For several years Mr. Johnson has been assistant manager of the office, and he is exceptionally well qualified in ability and experience to discharge the new responsibilities which are about to be bestowed upon him.

It is a great gratification to Mr. Sunny's western friends that he will probably continue to reside in Chicago.

Promotion of Safety on Railroads.

An administrative ruling and opinion on the act intended to promote the safety of employes and travelers on railroads by limiting the hours of service thereon has been issued by the Interstate Commerce Commission, which has power to enforce the provisions. It is noted that the act does not specify the classes of employes that are subject to its terms. All employes engaged in or connected with the movement of any train are within its scope. Train dispatchers, conductors, engineers, telegraphers, firemen, brakemen, train baggagemen, who, by rules of carriers, are required to perform any duty in connection with the movement of trains, yardmen, switch tenders, tower men, block-signal operators, etc., come within the provisions of the statute.

The proviso in section 2 covers every employe who, by the use of the telegraph or telephone, handles orders pertaining to or affecting train movements. In order to preserve the obvious intent of the law this provision must be construed to include all employes who, by the use of an electrical current, handle train orders, or signals which control movements of trains.

The prime purpose of this law is to secure additional safety by preventing employes from working longer hours than those specified in the act. Therefore a telegraph or telephone operator who is employed in a night and day office may not be required to perform duty in any capacity or of any kind beyond nine hours of total service in any 24-hour period.

The commission interprets the phrase "continuously operated night and day" as applying to all offices, places and stations operated during a portion of the day and a portion of the night, a total of more than 13 hours. The phrase "operated only during the daytime" refers to stations which are operated not to exceed 13 hours in a 24-hour period, and is not considered as meaning that the operator thereat may be employed only during the daytime.

The act provides that operators employed at night and day stations or at daytime stations may, in case of emergency, be required to work four additional hours on not exceeding three days in any week. Manifestly, the emergency must be real and one against which the carrier cannot guard.

Electrical Show at the University of Illinois.

The second electrical show given by the students in electrical engineering and railway engineering in the University of Illinois, at Urbana, Ill., was held on March 26th to 28th. The show was successful to a degree, and the management and faculty are well pleased with the results achieved. In point of attendance, in the interest aroused, and in the opportunities afforded the students to try their hand at doing something practical, the show proved its value.

As compared with last year's exhibition, the affair of this year was both larger and more elaborate. Much more floor space was covered, more power used, and the schemes of decoration and lighting were more extensive. The entire electrical engineereing laboratory of the university was given over to the exhibition, and the power plant was taxed to its capacity to supply the necessary "juice." An attractive scheme of booth construction was followed out, and the lighting was so planned as to illuminate the exhibits without glare or unpleasant intensity at any one point. The main floor of the laboratory was taken up by booths housing the smaller exhibits, while the basement and the upper floor were used for special features requiring too much room for the booths. The electric and dynamometer test cars belonging to the university were placed on a siding at the rear of the building, and visitors were conducted through these after leaving the laboratory.

GENERAL VIEW OF MAIN EXHIBIT AT UNIVERSITY OF ILLINOIS ELECTRICAL SHOW

Situated at a distance from any large center, as the show was, the management found it necessary to plan the exhibits so that not only men of technical training and those interested in electrical affairs, but also laymen, should find features of interest. Accordingly two distinct classes of exhibits were arranged for, those embodying recent advances in the applications of electricity, and those for the entertainment and amusement of non-technical visitors. Among the more noteworthy of those belonging to the first class, were the wireless telegraph, the high-frequency demonstration, the Thordarson transformer, the singing arc, electric welding, the recording apparatus on the two test cars, the electric safe drilling, and the static and high-tension phenomena, shown by the physics department of the university.

Among the exhibits designed to instruct as well as amuse may be mentioned the miniature electric railway, the sub-station equipment, the artificial lightning, the comparison of various forms of electric illuminating appliances, the model gasoline-electric isolated plant, Bell and automatic telephone exchanges, the military telegraph conducted by members of the Signal Corps of the University, the museum of old forms of electrical machinery, and the demonstration of electric cooking carried on by univrsity girls in the Household Science Department.

Those exhibits which may be called purely amusing or purely entertaining were the electric fountain, the electric telescope, the electric incubators, plant growth by electricity, the freak room, known as

"The House of a Thousand [illegible]" [illegible] "perpetual motion" machine. The university blue printing department moved a complete arc light printing outfit into the laboratory and made [illegible] your blue prints, and "shadowgraph" postals were made "while you wait" in another booth.

The work of installing the show was done entirely by students, and all exhibits were also in their charge. In order that the show should interfere as little as possible with the regular classroom and laboratory work all that could be accomplished in the way of preparation was done outside,

ELECTRICAL BUILDING, UNIVERSITY OF ILLINOIS, WHERE SHOW WAS HELD

and only a few days before the opening was the actual work of installation begun.

The booths were built up and assembled from sections convenient to handle, while lights were strung on wires, and exhibits prepared in readiness for the time when the floor should be free. From 40 to 80 men were then put at work setting up exhibits and assembling machinery, and in the four days' time during which the men attended classes as usual, the show was made ready for the opening night.

All circuits were carefully inspected by members of the faculty as soon as completed, and all wiring was done strictly according to the Underwriters' rules. Lack of time was a great handicap, and the fact that men could work only between classes made the supervision much more difficult. As soon as the show was closed on Saturday night the work of dismantling was begun, and before midnight the natural order of things had been restored to such an extent that regular laboratory work was resumed Monday afternoon without the necessity of Sunday work.

Besides the regular paid advertisements and daily news "stories" in the local papers, several novel

RADIO-TELEGRAPH EXHIBIT AND ONE OF THE SWITCHBOARDS AT UNIVERSITY OF ILLINOIS ELECTRICAL SHOW.

schemes were adopted to draw public attention to the show. Men were sent out along the interurban roads with advertising matter, and people were thus kept informed as to the plans of the management and the progress being made. A special paper was published and sold in town and on the university campus, which undertook to set forth, in an attractive manner, the full particulars of each exhibit. A powerful searchlight operated from the top of University Hall attracted a good deal of attention, while the lighting of the stately library tower drew favorable comment from evening pedestrians on the campus. During the show a huge electric serpentine 30 feet in length, mounted on the military flagstaff, seemed to be making ineffectual attempts to climb skyward.

Every precaution was taken to insure the safety of the visiting public. Special fire-escapes were erected at convenient points to minimize the danger of crowded stairways in case of an alarm of fire. [illegible] the power could be cut off immediately and still there would be [illegible].

[illegible] laying out of the circuits and the care with which [illegible] with no training in handling of electric circuits, and that the [illegible] utmost [illegible].

The success of the show may be attributed largely to the plan of organization adopted. By the creation of distinct departments with clearly defined duties, the management was able to distribute the work among several responsible heads. The active management of the exhibition was in the hands of a committee of three, composed of F. L. Cook, general manager; G. E. Jaquet, installing engineer, and B. M. Beach, treasurer. Of course, the general supervision was in the hands of the faculty and more particularly lodged in Mr. Morgan Brooks, the professor of electrical engineering.

Governing Device for a Turbo-generator and Storage-battery Installation.

The governing of a turbo-generator set presents a problem that has been attacked by many inventors with more or less success. A device in this line has been recently devised by Max Grob of Winterthur, Switzerland, and it was patented in this country a few weeks ago. This governing device is said to be applicable to either a hydraulic, steam or gas turbine mechanically connected with a generator used for charging a storage battery from which the lighting or other circuits run.

According to this invention a movable part of an electromagnetic device, for instance of a solenoid arranged in an electric circuit, is connected mechanically on the one hand with a throttle or cut-off for controlling the flow of the driving fluid to the turbine and on the other hand with a switch serving to make the connection between the storage battery and dynamo; consequently when the electromagnet is energized the controlling means for the turbine is simultaneously opened or closed while the switch for closing and breaking the connection between the dynamo and battery is operated. The accompanying diagram illustrates the general principles of the arrangement.

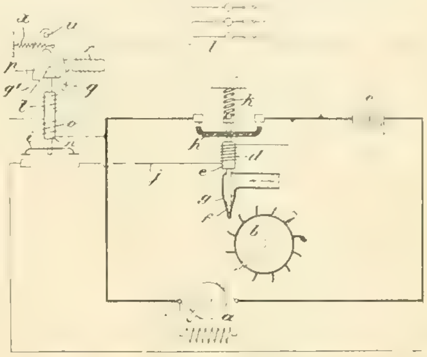
In this diagram (a) indicates a dynamo mechanically coupled with a turbine (b) and arranged in circuit with a storage battery (c); (d) is a solenoid, the movable core (e) of which is mechanically connected on the one hand with the cut-off valve (f) in the supply nozzle (g) for the turbine, and on the other hand with the bridge piece (h) of a main switch for breaking and closing the electric circuit above mentioned. The winding of this electromagnet is arranged in a shunt circuit (j) across the terminals of the battery (c), this shunt containing a cuit-out or secondary switch (i); (k) is a spring which, when no current is flowing through the solenoid, causes the switch (h) to be opened and at the same time closes the cut-off valve (f) of the turbine.

With the parts in the position shown, if the cut-out switch (i) in the shunt circuit (j) is automatically closed by means of a device hereinafter referred to, current flows from the charged battery through the winding of the electromagnet (d) whereby this latter is energized and the valve (f) is opened while simultaneously the switch (h) is closed. The consequence of this is that the turbine is set in action by the driving fluid allowed to pass through the open nozzle and at the same time, in consequence of the closing of the switch (h), the electric connection between the dynamo and the battery is closed. The dynamo is then in a position to supply current to the battery to an extent corresponding to the power of the turbine, and as long as the switch (i) is closed. When this switch is opened the spring (k) opens the switch (h), thus cutting off the battery from the dynamo and simultaneously closing the valve, thereby cutting off the supply of working fluid from the turbine.

The plant as represented in the diagram serves for supplying an electric-lighting circuit (l), and the arrangement hereby is such that, when single lamps are switched on, the turbine is stopped even if the battery has not been fully charged, or that the turbine remains out of action if it was already idle, owing to the battery having been completely charged [illegible] lighting circuit (l) and which acts in the same [illegible] which has its coil arranged in the lamp circuit, in [illegible].

This arrangement operates in the following manner: Assuming that the cut-off valve is opened, the switch (h) is closed and the lamp circuit is opened, the battery will be charged preferably, as is usual, with a compensating resistance (not shown) connected in circuit therewith. By this means the controlling solenoid (o) is influenced in such a way that at a certain potential which corresponds to that of the full load of the battery, the core (n) is drawn in and the cut-out or secondary switch (i) is opened. The shunt circuit (j) is thus broken so that the valve is closed under the action of the spring (k) and the main switch (h) is opened, the battery being thus charged and the turbine thrown out of action.

If now the separate lamps are switched on after the charging of the battery and the throwing out of



GOVERNING DEVICE FOR A TURBO-GENERATOR AND STORAGE BATTERY.

action of the turbine, the compensating resistance above referred to being cut off, the lighting current flows through the releasing solenoid (r), the consequence of which is that the pawl (q) is released from the catch-head (p) and the core (n) is released so that it can fall under its own weight until it is stopped by the pawl (q^1), which is brought into position to engage its catch-head. When all the lamps are switched off the current ceases to flow through the solenoid (r) so that the pawls can move back under the tension of the spring (x) into the position shown, whereby the catch-head and the core are completely freed, allowing the cut-out switch (i) to close. Thus the electromagnet (d) is energized, the cut-off valve for the turbine is opened and simultaneously the switch (h) is closed for connecting the battery to the dynamo.

If lamps are switched in while the battery is being loaded the magnetic actions of the two solenoids (o) and (t) are added together so that the core (n) is drawn up, the circuit of the electromagnet coil (d) is broken and the turbine is thrown out of action. The core is then held fast by means of the pawl (q^1) engaging with the catch-head (the solenoid (r) being still energized), and the parts continue in this position until all the lamps are switched off, whereupon the core is released in consequence of the de-energizing of solenoid (r), and the switch (i) is closed so that the valve for the turbine is opened and the switch (h) is closed to connect the battery with the dynamo.

If all the separate lamp circuits are simultaneously opened and if the battery charged by the dynamo has reached its full-load potential the core may be raised again by the action of the solenoid (o) so that its head may be engaged by the pawl (q), which is then hanging free.

The inventor has worked out a number of modifications of this control system which differ only in details, the main principle being as here described.

With the proceeds from the sale of $300,000 bonds the Hattiesburg Traction Company of Hattiesburg, Miss., will build a power plant to provide for the operation of the street-railway system. The plant, for which plans have been prepared, will have sufficient capacity to light the entire city.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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WILLIAM AINSLEY KREIDLER, who established the Western Electrician and who conducted it as long as he lived, is dead; but his work will live after him. That work was represented by this journal, which was his creation. He planned it and directed it from its first issue of July 2, 1887, until he was stricken with his fatal illness on March 25, 1908. He made the paper what it is.

But the actual work of preparing the successive issues of the Western Electrician and laying them before the readers was in other hands, to which Mr. Kreidler entrusted the task. The paper was and is owned by the Electrician Publishing Company, in which Mr. Kreidler held a controlling interest. But he was a man of broad, vigorous, comprehensive intellect, with no liking for detail. Moreover, he had the admirable trait of reposing complete trust in his subordinates, once they had gained his confidence. He seldom made changes in the staff, rarely interfered in the details of their work. He built up an organization, with various departments, to do the work in hand, and then looked to that organization to produce the paper and to attend to all the various ramifications of its business.

Pursuing this policy, Mr. Kreidler surrounded himself with a staff of capable editorial, business and office men, competent to make the paper without his immediate attention. From this staff he expected results. This organization is composed of men of many years' experience on the paper, several having been with it for 15 years or more—men accustomed to work together, and thoroughly familiar in all details with the aims, purpose and policy of the publication. This organization will continue to devote its trained and specialized efforts for the benefit of the subscribers and advertisers of this journal.

The Western Electrician is W. A. Kreidler's monument. No changes of editorial or business policy or in the personnel of the staff are contemplated. This statement, which is authoritative, does not mean, of course, that the paper may not be improved where possible as time goes on. But it does mean that the owners and staff of the paper are determined that it shall not deteriorate; that it shall go on to even better things as one expression of the true regard and of the sorrowful remembrance entertained by every man and woman employed on the Western Electrician toward its late conductor.

William Ainsley Kreidler

Born August 20, 1858 **Died March 26, 1908**

William A. Kreidler, founder and principal proprietor of the Western Electrician, and president of the Electrician Publishing Company of Chicago which is the owner of the paper, died at Augusta, Ga., at 3 p. m. on March 26th, after a brief illness.

Death was due to an attack of apoplexy, and the stricken man was unconscious for 32 hours preceding dissolution. Mr. Kreidler, with Mrs. Kreidler, had been spending some time in the South, where he went last January for rest and recreation. In Augusta he played golf almost daily and sought a release from business cares. But the climate proved enervating to him, and he did not enjoy his holiday as he had hoped. His death was, however, entirely unexpected and a great shock. On the very day of the receipt of the telegram announcing his dangerous illness a note was received in the Western Electrician office, dated March 23d, and written in his own hand, announcing his return the next week. This was prophetic, but alas! in a different sense than the writer had intended. On March 25th on arising from bed Mr. Kreidler was stricken with the fatal seizure, and although everything was done for him that the love of a devoted wife and the skill of physicians could suggest, he passed away on the following day. The body was brought to Chicago on March 29th.

The funeral took place from Mr. Kreidler's Lake Bluff residence at 2:30 p. m. on Monday, March 30th. Lake Bluff is 30 miles from the center of Chicago, and the large attendance of electrical men and other friends, which taxed the capacity of the house to the utmost, was a fine tribute to the esteem in which Mr. Kreidler was held. The floral remembrances were numerous and very beautiful. A short but impressive service was conducted by Rev. J. H. Edwards, rector of the Church of Our Saviour, assisted by Rev. A. G. Richards, rector of the Church of the Holy Spirit in Lake Forest. There was singing of the hymns "Lead, Kindly Light" and "Angels Ever Bright and Fair" by a boy singer from a North Side church. The burial was in Lake Forest Cemetery, and a long line of carriages wound through the picturesque scenery between the two North Shore suburbs.

The list of honorary bearers includes the names of many men prominent in business and social life in Chicago. It is as follows:

Bion J. Arnold.	A. S. Hibbard.
Francis B. Badt.	J. D. Hood.
Foree Bain.	Samuel Insull.
Enos M. Barton.	James McCrae.
B. F. Bremner.	Francis W. Parker.
Charles A. Brown.	Thomas Rankin.
T. R. Butman.	A. H. Reece.
M. P. Carroll.	H. A. Ritter.
W. F. Cochran.	Louis Spohn.
F. W. Cornish.	B. E. Sunny.
F. W. Cushing.	A. Vanderkloot.
L. A. Ferguson.	F. A. Waidner.
C. A. Flanders.	Prof. F. M. Woodruff.
T. P. Gaylord.	

The active bearers were eight members of the Western Electrician staff: C. W. Forbrich, Frank L. Perry, William E. Keily, E. R. Ford, J. D. Downer, W. F. Forbrich and N. F. Obright of Chicago and Elmer E. Wood of New York.

Mr. Kreidler's life work was the establishment and direction of the Western Electrician—a work which will live after him and be his greatest monument. In doing so he was successful also in a business sense, and as time passed on he became interested in outside commercial ventures of a nonelectrical character, but always the first place in his heart, after his family and friends (for he was very domestic in his tastes), was the paper he founded and conducted until it became one of the leading technical journals of the country, and was enabled to celebrate its twentieth anniversary, as it did last year.

William Ainsley Kreidler was born in South Dansville, N. Y., August 20, 1858. He was the son of Peter and Ellen (Allen) Kreidler. His father,

MR. KREIDLER AT THE AGE OF THIRTY-EIGHT

who died in 1905 at the age of 76, was himself a native of New York state and lived all his life practically in Steuben County, where he was a prosperous farmer and stock raiser, well known and highly respected. His mother, equally esteemed, survives. The oldest son of these parents, William, was educated at Rogersville Union Seminary, South Dansville; Dansville Seminary, Dansville, and at the University of Rochester, where he was a member of the class of '84, and also of the Delta Kappa Epsilon fraternity.

Eager to be at the work of making his way in the world, young Kreidler did not finish his college course, but in 1882 removed to Chicago and entered the employment of the Western Electric Company in the office of Mr. Enos M. Barton, then as now president of the company. He remained here over two years, but even in college he was interested in journalistic pursuits, and he left his first employment to establish the Chicago office of an eastern electrical journal. This was congenial work, for which he was well adapted, and he was successful at it.

Mr. Kreidler saw that there was an opportunity

MR. KREIDLER AT FORTY-NINE. (PICTURE TAKEN NEAR HIS HOME IN LAKE BLUFF, ILL.)

[illegible] enterprising in collecting electrical news; it intro- [illegible] handsomely printed and illustrated; it rose to im- [illegible] themselves. Subscribers and advertisers soon came to have confidence in it and gave it their support.

All [illegible] without assistance. The work of the paper required a staff of considerable size. The editor and publisher of the Western Electrician was not a man to spend his time on routine work, and he surrounded himself with capable men in the various departments and trusted them. But through it all W. A. Kreidler was the guiding spirit, the master mind. He made the paper what it is, and no one can recognize that fact more unerringly than the men who were associated with him. The career of the paper has been honorable and successful. It was detailed in the article "The Western Electrician—Twenty Years in Retrospect," in the Twentieth Anniversary Number of September 28, 1907, and on the present sad occasion, so near that one of triumph, the story need not be retold. The readers of the Western Electrician, never so numerous as at present, are themselves the best judges of what Mr. Kreidler brought to pass.

While Mr. Kreidler always gave the greater part of his time to the Western Electrician, he also became interested in outside business ventures, as has been stated, and in these he was generally successful. He erected the apartment building known as The Belden, and here, at 295 Belden Avenue, he made his home for a number of years. He had a country house in Lake Bluff and spent much of his time there. He was a home man and a clean-minded man. He was a true, devoted husband, a good son, a good brother. He was fond of his friends and his books and fond of animals. But he was also a member of several clubs and societies. He was one of the organizers of the old Chicago Electric Club and was for several years its secretary. He was a member of the Union League Club, Exmoor Country Club, Northwestern Alumni Association of the D. K. E., National Geographic Society, Chicago Academy of Sciences and an associate of the American Institute of Electrical Engineers. His business ability was of a high order, but he was also a student of literature and of the natural sciences. He possessed some inventive ability, and one or more patents have been taken out in his name.

Mr. Kreidler was married in 1893 to Miss Netta Ophelia Preston, who survives him. Mrs. Kreidler was a true helpmate to her husband, who found in her not only a tender companion but one whose judgment he valued in the larger affairs of life. The other surviving relatives are Mrs. Ellen R. Kreidler (mother), Allen S. and Woolsey Lynn Kreidler (brothers), and Mrs. Grace B. Carney (sister), all of Olean, N. Y.

Few portraits were taken of Mr. Kreidler, for he was a man who did not court publicity. The upper one on this page was taken in 1896, and the expression is perhaps a trifle too aggressive, although the subject of the picture was a man of forceful personality. The lower picture—an easy, informal "snapshot," taken near his Lake Bluff home last year—is an excellent likeness and shows the benignity of more ripened years. In lieu of a more formal portrait, lately taken, this pleasing, if somewhat unconventional, picture is given.

A man of generous impulses, loyal to his friends, vigorous in intellect, sound in counsel, leading a clean, upright, honorable life, with a large measure of honestly won success—such a man has passed away in William A. Kreidler. Every man and woman employed on the Western Electrician feels a sense of sadness, of personal loss at his death, and wishes to extend to the immediate family such poor comfort as words can give.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker

Part I.

The Meter Installation.

Capacity of the Meter. The appropriate capacity of meter to install on any given load is determined by the character as well as the size of the load; and the life of the jewel bearing, and of the commutator and brushes in direct-current meters, and in general the accuracy of registration that may be maintained by the meter, depend upon the care with which these factors are estimated. If poor judgment is shown in estimating the actual and prospective conditions under which the meter is to operate, the loss of revenue from inaccuracy, and the expense of repeated special inspections, may aggregate a considerable amount.

It is the general practice to consider the meter requirements of each large or special consumer's installation separately. The size of the load may be a variable; and the character of the load is affected by the nature of the customer's business and the hours during which it is conducted, summer and winter, or, if the installation is at a residence, the scale on which the customer lives; by the probable frequency and amount of a maximum demand greatly exceeding his average demand, and by the size and nature of his light load. These things are all factors in the proposition. In some companies, data of this kind are collected by connecting to the consumer's installation, for a certain period, a maximum-demand indicator or a recording wattmeter of the Bristol type.

The greater part of the lighting load of a city central-station system is distributed among consumers' loads of a few general types, and these are usually metered in accordance with the character of each, as follows:

In very large installations, such as factories and department stores, it is considered advisable by many companies to install a number of small meters, each controlling the supply of a separate department; for while the investment costs and potential losses of several small meters are greater than for one or two large meters, the liability of losses due to under-registration on light load, or to the meters becoming inoperative by reason of defects that may develop, is very largely reduced. Furthermore, the small meters can be tested more easily; and the cause of any abnormal fluctuations in the bills can more readily be located, and remedied.

In theaters, churches and halls it is sometimes impossible to install a meter that will accurately measure the maximum load, consisting of the entire installation of lamps, and yet start on the low minimum load consisting of the small percentage of lamps that are in use during the day and while the building is being cleaned. To endeavor to measure a light load so out of proportion to the full load with a meter of large enough capacity to register accurately the full load would be inadvisable; so here again losses may be reduced by using two or more meters on separate circuits.

In those small stores, saloons, etc., where all of the lamps connected are usually burned at one time, a meter may be installed having a capacity about equal to the connected load. However, in a 40-light installation of this character, where all the lamps are burned for only an hour or two each evening, and during the remainder of the time only a very few lamps ("night lights") are used, it would be considered preferable to install a 15-ampere, two-wire meter rather than a 25-ampere, two-wire meter. For such installations the liability of loss due to overload in the one case must be balanced against the liability of loss on light load in the other, and the capacity of the meter selected accordingly.

In residences the experience of many companies has shown that seldom more than 50 per cent of the lamps installed are used at any one time, and [illegible] per cent. It is, therefore, [illegible] to install meters of capacities of 50 [illegible] connected load. The fact that occasionally, during social gatherings, etc., the meter must withstand a large overload, with cor[illegible] during the overload, [illegible] by the greater accuracy obtained on the light loads, especially as [illegible] duration.

[illegible]

[illegible]

motors, except that the meters installed should have a capacity 25 to 50 per cent. greater than the nominal horsepower of the motors. In some of the larger installations of this character the maximum and minimum load used is determined, and the meter most suitable to the requirements is then installed on polyphase light and power circuits. Many companies install a single polyphase meter, rather than two single-phase meters.

This discussion of the different types of variable loads usually found in city central-station systems may be summarized in the following recommendations:

1. Separate meters for light and power circuits.
2. Separate meters for incandescent and incandescent arc lighting, where the combined load requires a meter larger than one that will start safely on a single 16-candlepower lamp.
3. Separate meters for signs, photographic arcs, battery-charging sets, or other constant or definite loads which are large enough to warrant the investment in an additional meter.
4. It is advisable to under-meter connected variable loads by a margin greater or smaller, according to local conditions—a conclusion which is confirmed by the practice of most lighting companies.

An intelligent study of each installation will generally indicate a way of metering that will insure registration of the minimum load, without risk of overloads dangerous to the meters on the one hand, and, on the other hand, without installing so many separate meters as to entail an unduly large investment of capital.

Experience has unquestionably shown that it is never advisable to install a meter of greater capacity than is necessary to register accurately and economically the average full load.

Installing.—The meter should be carefully transported so as to avoid injury, and should be installed in a place that is readily accessible for reading and testing, and free from vibration, dust, moisture, etc., all of which tend to cause inaccurate registration and shorten the life of the meter, and cause sparking at the brushes in a commutator meter. The location for the meter should be carefully selected with a view to meeting the requirements of the metering service.

As the meter registers the income of the company, and the meter board is in many cases a distributing point where fuses and switches are located, it is to the common interest of the company and the consumer to secure a location for the meter which is entirely suitable.

The ideal location is one that is perfectly free from vibration, perfectly dry, and well lighted by daylight, away from proximity to gas, water and steam pipes, which are liable to cause trouble by variations of temperature, leaks and precipitation of moisture; reasonably free from opportunities for grounds when testing and readily accessible, with plenty of room for inspection, reading or testing. It is not usually possible to find a place that fills all these conditions, but it is usually possible to obtain a substantial vertical support, such as an outside wall of the building, allowing the meter to be placed five or six feet from the floor and with sufficient free space all around. Freedom from vibration is very important, and meters should not be mounted on any light structures, which readily take up any vibrations of heavy machinery in the building or passing trucks or trains nearby. Wooden partitions which have doors that are liable to be closed violently are especially to be avoided. Pieces or washers of soft rubber may be employed to absorb vibration. In residence installations meters should not be installed in places where the meter reader or tester would be interfered with or the customer disturbed by his presence—such as bedrooms, bathrooms, small closets, etc.

It is important to be guided by favorable conditions of installation rather than arbitrarily to place the meter at the point where the service wires enter the building. The meter is, however, usually placed at the entrance to the building—so that the customer pays for about one per cent. more energy than is actually consumed in his translating devices.

If the meter is carried to its place of installation in its packing box, it should be cleaned off carefully to remove all excelsior and dirt before taking off the cover, especially bits of excelsior that may adhere to the felt strip that project around the base in some meters.

The meter should be securely mounted on a firm support or backboard of well seasoned wood, put together and secured to the wall or other main support, and should be cut in on the consumer's wiring in a neat and workmanlike manner. Great care should be taken to follow the diagram of connections proper to the meter, and particularly to get the positive service main into the positive binding post of the meter, to insure sensitive and accurate operation on light loads.

All contacts should be firm and good, to avoid future trouble or error from local resistance.

The importance of setting up meter binding posts sufficiently tight is perhaps not realized by many meter men. Vibration and corrosion have often developed a high resistance at poor binding-post contacts, resulting in local heating which chars the bushings and support of the binding posts and may even set fire to the insulation of the wire.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Load Factor of a Station.

W. N. G., Olney, Ill.: Please tell me whether, in figuring the load factor of a station, it is the custom to figure the average output per hour against the highest peak during a period or against the average peak during the period. Also whether it is customary to figure on the actual hours run per day or on 24 hours.

Answer.

The term "load factor" is used in a number of distinct ways, depending on what ratio is desired. The value most commonly referred to is the ratio of the average load for a full day or year, as desired, to the maximum peak load in that period. Sometimes the average load is figured against the average peak; if this is meant, it should be so defined. Very frequently the ratio of the average load to the total capacity of the station is referred to; in this case the term "station factor" is sometimes used.

High-efficiency Lamps on 25-cycle Circuits.

A. L. R., Leetonia, Ohio: Will any ordinary 110 or 125-volt high-efficiency incandescent lamp operate satisfactorily on a frequency of 25 cycles?

Answer.

What are commonly known as Gem, metallized filament, or high-efficiency lamps will operate practically as well on a 25-cycle alternating current as on 60 cycles. This type of lamp is affected less by voltage fluctuations than the old carbon-filament lamps because they have a positive temperature coefficient, i. e., as the temperature increases so does the resistance. Therefore these lamps are less subject to flickering or "winking" than the old-style lamps. Tantalum and tungsten lamps are even less subject to this effect on low frequencies than the metallized filament lamps.

Use of Large Cables.

E. H. Noyes, Chicago: I have just noticed in your paper of February 29th, under "Questions and Answers," the question of "F. J. T.," asking if anyone is using cables larger than 2,000,000 circular mils. It may be of interest to F. J. T. to learn that the South Side Elevated Railroad Company of Chicago has several hundred thousand pounds of 2,385,000-circular-mil aluminum cable on its new extensions to the Stock Yards and Englewood.

The Electric Club.

On account of the fire at the Grand Pacific Hotel the Electric Club of Chicago held its weekly meeting on Wednesday of last week at the Automobile Club. The speaker for the day was George P. Nichols of G. P. Nichols & Bro., who spoke about the early days of the electric business and how different things were at the present time.

The first smoker given by the club is scheduled for Friday evening of this week in the main dining-room of the Grand Pacific Hotel.

The growth of the club has been remarkable, starting as it did a few weeks ago with a very few members. The rapid growth indicates the need of permanent quarters, and the house committee is in search for quarters more in keeping with the club's needs.

The yearly dues were nominal until such a time as the membership reached 200. As this figure has been reached the dues are to be immediately increased. As the membership is composed of some of the most representative men in the electrical business, and the objects comprise a happy combination of educational, entertaining and social features with three-fourths of the time devoted to educational features, the success of the club is apparently assured.

Meeting of the Underwriters' National Electric Association.

The sixteenth annual meeting of the Underwriters' National Electric Association was held in the rooms of the New York Board of Fire Underwriters, New York city, on March 25th and 26th. This meeting is the occasion for the annual discussion of the rules and requirements of the National Electrical Code and attracted this year, as always, a large attendance of inspectors, manufacturers, contractors and representatives of all the associations by whose allied efforts the Code is devised and revised. As before, the proposed changes in rules were considered by the electrical committee of the Underwriters' Association at preliminary meetings, the recommendations of the committee being presented at the general meeting for acceptance or rejection after full discussion.

It is much to the credit of the Underwriters' committee that its recommendations so generally find acceptance by the meeting, although it is of course true that there will always be those who will complain of the results attained either on account of too great stringency or too great laxity.

The sessions are always characterized by spirited discussions, but the meetings this year were free from any acrimonious spirit, and a very fair amount of useful work was accomplished. There were, however, no very radical new rules to be debated.

Grounding Low-potential Circuits.

Perhaps the one matter of most general interest and importance to the electric-light fraternity was the discussion of the question of grounding low-potential systems. It is now permitted under Code Rule 13A to ground such circuits under certain specified cases and in a manner partially prescribed. At the meeting a year ago the matter was referred to a joint committee representing the Underwriters, the National Electric Light Association, the American Institute of Electrical Engineers and the National Electrical Inspectors' Association. Secretary Goddard explained that the rules set forth in the advance bulletin represented the suggestions of only a portion of these societies and had not been received by the Underwriters' committee in time to receive full consideration.

Inasmuch as it was now proposed to make it mandatory to ground low-potential circuits instead of merely permitting it, it was necessary that the greatest opportunity be allowed for full consideration and a careful working out of all details. The discussion in the meeting further showed that there was not full unanimity as to the limiting voltage for which grounding was to be required, and as to the most reliable means of securing good and permanent earth connections.

It was pointed out that the Underwriters are not very directly concerned in this matter of grounding, which is of importance from the point of view of the protection to life. Therefore, it was desired that there be as complete agreement as possible among other interests affected before the Code should make compulsory a practice not immediately a matter of fire hazard inasmuch that when such a rule is actually passed the insurance interests through inspection departments will be the ones upon whom will fall the burden of enforcing the rule. The whole matter, together with other kindred matters, such as the grounding of fixtures, was finally referred back to the subcommittee for further consideration and report.

Rearrangement of the Code.

The committee appointed last year to consider the necessity, feasibility and desirability of rearranging and recodifying the National Electrical Code presented a report which was welcomed as leading to a very desirable improvement. Users of the National Electrical Code have very often found fault with it as ambiguous and as so arranged that it was difficult to find readily all the rulings on any given topic. While such criticism is in part deserved, it is still true that no such sweeping revision or rearrangement as some have advocated is either possible or to be desired. The report of the committee has been summarized in a previous issue of the Western Electrician (issue of March 21st, page 230). It was adopted and the committee was continued, with instructions to report at the meeting in March, 1909. The revision will not change Code requirements, but simply the arrangement.

Transformers.

The report of the committee on transformers was adopted in a form which now permits oil-cooled transformers to be installed inside buildings other than central stations and sub-stations only by special permission of the inspection department having jurisdiction, but permits air-cooled transformers having neither primary nor secondary voltage over 550 to be installed with- [illegible]

[illegible]

[illegible] pings, shall be confined within the rheostat; or [illegible] droppings.

[illegible] constructed that if the resistive conductor be fused the arc or any attendant flame or molten droppings shall be confined within the rheostat; or they shall be constructed with such capacity that if subjected to a current flow throughout the entire rheostat, 25 per cent. in excess of that at which they are rated, for a period of two hours, there shall be no resultant flaming or molten droppings.

Special rules needed to cover construction and installation of automatic apparatus were referred back for further investigation by a sub-committee. A sub-committee will also be appointed to draw up rules for the construction and installation of autostarters for alternating-current motors.

Wiring of Electric Cranes.

Rules for wiring of electric cranes were adopted upon recommendation of a special committee. These rules, entirely new, are as follows:

All wiring, apparatus, etc., not specifically covered by special rules herein given, must conform to the Standard Rules and Requirements of the National Electrical Code, except that the switch required by Rule 8-c may be omitted.

(a) *Wiring.*—

1. All wires except bare collector wires, those between resistances and contact plates of rheostats and those subjected to severe external heat, must be approved, rubber-covered and not smaller in size than No. 12 B. & S. Wires between resistances and contact plates of rheostats must conform to No. 4-c, unless the wires are exposed to moisture, in which case the insulation must also be rubber. Wires subjected to severe external heat must have approved slow-burning insulation.

2. All wires excepting collector wires and those run in metal conduit or approved armored cable must be supported by knobs or cleats which separate them at least one inch from the surface wired over, but in dry places where space is limited and the distance between wires as required by Rule 24-h cannot be obtained, each wire must be separately encased in approved flexible tubing securely fastened in place.

Collector wires must be supported by approved insulators so mounted that even with the extreme movement permitted the wires will be separated at all times at least 1½ inches from the surface wired over. Collector wires must be held at the ends by approved strain insulators.

3. Main collector wires carried along the runways must be rigidly and securely attached to their insulating supports at least every 20 feet. Where the wires are arranged in a horizontal plane above the crane, they must be supported at least every 20 feet if practicable and separated at least six inches, but if longer spans are necessary the distance between wires must be increased proportionately, the span in no case to exceed 40 feet. If arranged in a vertical plane wires must be separated at least eight inches.

4. Where bridge collector wires are over 80 feet long, insulating supports on which the wires may loosely lie must be provided at least every 50 feet.

Bridge collector wires must be kept at least 2½ inches apart, but a greater spacing should be used whenever it may be obtained.

5. Collector wires must not be smaller in size than specified in the following table for the various spans:

Distance between rigid supports. Feet.	Size wire required. B. & S.
0 to 30	6
31 to 60	4
Over 60	2

(b) *Collectors.*

Must be so designed that sparking will not occur between them and collector wires.

(c) *Switches and Cut outs.*

1. The main collector wires must be protected by a cut-out and the circuit controlled by a switch, cut-out and switch to be so located as to be easy of access from the floor.

2. Cranes operated from cabs must have a cut-out and switch connected into the leads from the main collector wires and so located in the cab as to be readily accessible to the operator.

3. Where there is more than one motor on a single crane, each motor lead must be protected by a cut-out located in the cab if there is one.

(d) *Controllers.*—

Must be installed according to No. 4, except that if the crane is located out doors the wires between resistances and contact plates of rheostats must be rubber-covered. If the crane operates [illegible]

[illegible]

Rules were adopted for [illegible] of the Cooper-Hewitt type and for the Moore tube. These treat chiefly of details of construction and method of installing [illegible] sistances and cabinets.

Conduit Work.

No radical changes were made [illegible] but recommendations favoring galvanized armored cable, switch boxes, outlet boxes and similar fittings were voted. No action was taken regarding enameled conduit, except one to require the thorough cleaning off of the non-conducting enamel at all coupling and box joints.

Circuit-breakers.

The new requirements for circuit-breakers for 550 volts or less elicited a long debate, but rules in the following form were adopted for use by the laboratories pending further investigation, which shall determine more exactly the proper conditions for conducting tests on these devices.

Rules for the Construction of Circuit-breakers for 550 Volts or Less.

Circuit-breakers must be made to comply with the following specifications, except in those few cases where peculiar design allows the breaker to fulfill the general requirements in some other way, and where it can successfully withstand the test of section d. In such cases the breakers should be submitted for special examination before being used.

a. Base.—Must be mounted on non-combustible, non-absorptive, insulating bases, such as slate or marble. Bases with an area of over 25 square inches must have at least four supporting screws. Holes for the supporting screws must be so located or countersunk that there will be at least one-half of an inch space measured over the surface between the head of the screw or washer and the nearest live metal part, and in all cases when between parts of opposite polarity must be countersunk.

b. Mounting.—Pieces carrying contact parts must be screwed to the base by at least two screws, or else made with a square shoulder, dowel pin, or equivalent device, to prevent possible turning, and the nuts or screw heads on the under side of the base of front connected breakers must be countersunk not less than one-eighth inch, and covered with a waterproof compound which will not melt below 150 degrees Fahrenheit (65 degrees Centigrade). Metal work of circuit-breakers must be substantial in construction and must have ample metal for stiffness, and to prevent rise in temperature of any part of over 30 degrees Centigrade at full load. The contact parts shall be arranged so that thoroughly good bearings are obtained. The whole device must be well made mechanically throughout.

c. Connections.—Circuit-breakers for currents of over 30 amperes must be equipped with lugs, firmly screwed or bolted to the terminals and into which the conducting wires shall be soldered. For the smaller size circuit-breakers simple clamps may be employed, provided they are heavy enough to stand considerable hard usage. Bearings and catches must be made of such material or of materials so treated as to insure the breaker working freely and positively at all times under ordinary conditions met with in practice.

d. Test.—

1. Breaking Capacity.—Must successfully operate at ten times its normal capacity in amperes at rated voltage. Tests on multi-pole breakers to be made both on all poles at once, and also on each pole singly.

2. Voltage Test.—Must successfully withstand 2,000 volts A. C. for one minute between live metal and ground, between poles in multi-polar breaker and between terminals with breaker open.

3. Carrying Capacity.—Maximum rise in temperature of any part must not exceed 30 degrees Centigrade when carrying its rated current.

4. Calibration.—Must not have a plus or minus error greater than 10 per cent. at any point of its calibration.

e. Mechanism.—Multiple-pole circuit-breakers must be so arranged that the action of the trip coil or coils will open all poles of the circuit-breaker, and the breaker must have such necessary trip-coils so arranged as to afford complete protection against overloads and short-circuits under all conditions met with in practice. All cir-

cuit-breakers must be provided with an easily accessible means for tripping them by hand without danger to the operator.

f. Marking.—Must be plainly marked where it will be visible when installed with the name of the maker and the current and the voltage for which the device is designed.

The conditions under which circuit-breakers should be used in general practice aside from switchboards under expert supervision were discussed at length and finally referred back to a committee for special consideration of proper arrangements for protection to be secured by fuses and breakers on both direct and alternating motor circuits.

Variable-speed Motors

The committee on variable-speed motors presented a brief report which was ordered printed in the Supplement of the Code as suggestive of a more complete presentation of this difficult question to be hoped for at some future time. The report was as follows:

All varying (or variable) speed alternating-current motors except those used for railway service must be marked with the maximum current which they can safely carry for 30 minutes, starting cold.

Fine print note:—

Varying-speed motors are motors in which the speed varies automatically with the load, decreasing when the load increases, and vice versa. It does not mean motors in which the speed is varied by the use of different windings or groupings of windings, or motors in which the speed is varied by external means, and in which after adjusting to a certain speed, the speed remains practically constant.

The current used in determining the size of the motor leads or branch circuits must be the percentage of the 30-minute current rating of the motor as given for the several classifications of service in the following table:

Classification of Services.	Percentage of current rating of motor.
Operating valves, raising or lowering rolls, tool heads, etc.	200
Hoists, rolls, ore and coal-handling machines	180
Freight elevators, shop cranes	160
Passenger elevators	140
Rolling tables, pumps	120

Outline Wiring.

Somewhat detailed requirements were adopted for outline wiring limiting this to either open or conduit work. Details were given calling for rubber-covered wire for all outline work, for separate switch and cut-out for the outside circuits, for proper spacing and supporting of wires in open work and limiting the energy per cut-out to 1,320 watts with not more than 66 lamps per circuit.

Panel-board Construction.

The following are new rules on panel-board construction, and cabinet construction rules were referred to a committee for later report.

The following specifications are intended to apply to all panel and distributing boards used for the control of light and power circuits, but not to such switchboards in central stations, sub-stations or isolated plants as directly control energy derived from generators or transforming devices.

Add new section as follows:

a. Design.—The specifications for construction of switches and cut-outs (see Rules 51 and 52) must be followed as far as they apply.

In the relative arrangement of fuses and switches, the fuses may be placed between the bus-bars and the switches, or between the switches and the circuits, except in the case of service switches, when Rule 21a must be complied with. When the branch switches are between the fuses and bus-bars, the connections must be so arranged that the blades will be dead when the switches are open.

When there are exposed live metal parts on the back of board, a space of at least one inch must be provided between such live metal parts and cabinet in which board is mounted.

b. Spacings.—The following minimum distance between bare live metal parts (bus-bars, etc.) must be maintained:

[illegible] same surface	[illegible] in air.	Between parts of same polarity At fuses.
[illegible]	[illegible]	[illegible]

Panel boards of special design, in which the in- [illegible] used.

[illegible] ing can be plainly seen when installed, with the [illegible] maximum capacity in amperes and the voltage for [illegible]

[illegible]

motors and dynamos was reported as adopted by the electrical committee.

The use of soft rubber bushings about lead and supply wires in frames of motors or dynamos is permitted except in cases of machines installed where oils, grease, oily vapors or other substances known to have rapid deleterious effect on rubber are present in such quantities and in such proximity with motor or dynamo as may cause such bushings to be liable to rapid destruction. In such cases the use of hardwood properly filled, or preferably porcelain or micanite bushings may be called for.

Other Changes.

The following note was added to the rules on rheostats:

In drum controllers and apparatus of like nature where the controlling mechanism is entirely enclosed in a substantial tight metal case or compartment, hardwood or other suitable material may be used for bases for mounting current-carrying parts or for other parts which cannot readily be made of non-combustible material, provided such combustible material is present only in such amount and so disposed that, even if it be totally destroyed by fire or excessive heat, the effect shall be confined to the interior of the case.

Wood or other suitable material may be used for parts of the casings or covers of drum controllers, providing these parts are properly lined or treated with fire-resisting materials, and so arranged that should the combustible parts within the casing be ignited the fire would be confined within the casing or cover.

Rules for factory tests of transformers already in 1907 edition of the Code were formally ratified. They correspond to those of the Institute.

The rule (24a) forbidding having any bare live metal parts of over 300 volts' difference of potential was revoked for the reason as explained that it was originally enacted to prevent the use of 440-volt, three-wire, lighting-circuit panels and cabinets. As it stood, the rule prevented the enclosing of cut-outs and switches for 440-volt motor work in cabinets which it was not the intent of the rule to do.

Although considerable time was devoted to discussion of requiring instead of recommending the use of boxes at all outlets, the committee refused to recommend or the general meeting to vote such a rule. The same fate befell the proposition to require porcelain sockets "in all places where they will be installed in close proximity to metal work, water pipes, water faucets, radiators and the like, and in basements, and in any location where there is a liability of a person coming in contact with the ground while turning on the light."

The present theater rules were amended in a few details of minor importance.

It was voted that all self-fastening knobs, cleats and supports must be secured with screws. Also that all wires in molding must be in continuous lengths from outlet to outlet, or from fitting to fitting, no joints or taps to be made in molding, and that where branch taps are necessary in molding approved fittings for this purpose must be used.

The large number of miscellaneous suggestions for changes in the rules were rejected, and most of them were not discussed.

A large number of special committees are to be appointed and Chairman Cabot will announce their membership at an early date.

Arrangements for the Southwestern Convention.

The executive committee of the Southwestern Electrical and Gas Association held a recent meeting in the office of Secretary R. B. Stichter, Juniata Building, Dallas, Tex., and made arrangements for the annual convention in El Paso, Tex., May 7th, 8th and 9th. An especially good meeting is promised. The St. Regis Hotel will be the headquarters. A special committee of St. Louis men headed by "Sam" Hobson will meet visitors from eastern points at St. Louis and take them to El Paso. St. Louis supply men have also taken an interest in the exhibit at the meeting. Ample facilities for exhibits are afforded in the hotel. The El Paso Electric Railway Company will furnish 104 or 208-volt, single-phase or two-phase alternating current or 500-volt direct current at five cents a kilowatt-hour.

The programme committee has arranged for a number of papers by leading men of the Southwest, and aside from this there will be a discussion of the general question, "What Policy Should be Pursued by Public-service Corporations in Making Extensions?" Messrs. E. T. Moore, J. A. Myler, Jr., H. S. Cooper and J. E. Farnsworth, representing, respectively, the electric-lighting, gas, street-railway and telephone companies, will lead in the discussion. H. T. Edgar of Fort Worth, Tex., is [illegible]

COMMUNICATION.

Possible Power Development on the Upper Hudson.

To the Editor of the Western Electrician:

According to the state engineer's report (1895) there has been developed on the upper Hudson 4,000,000,000 cubic feet of water storage for log driving. This amount of water is equivalent to about 1,000 cubic feet flowing continually day and night for two months, and the amount of power it represents in falling from North Creek (58 miles north of Saratoga) to Thurman level, 460 feet, equals

$$\frac{460 \times 1{,}000 \times 62\tfrac{1}{2}}{550} = 52{,}000 \text{ horsepower}$$

for two months, which is equivalent to 9,000 horsepower for 12 months. This has a value of $10 per horsepower, making $90,000 per year as a gross revenue. This amount of money, capitalized at five per cent., equals $1,800,000. In other words, this sum could be spent harnessing this power without exceeding commercial conservatism.

According to the above calculation, it therefore costs about $90,000 to drive the logs each year from North Creek to the Thurman level. This amount of power should be conserved, so that it can all be utilized, instead of running away in two months, with, say, only about one-third being used. In other words, by keeping back this water (and it would seem as though this could be done without additional injury to the forests) and letting it down with an equalized flow, we can have practically a continuous 6,000 additional horsepower from North Creek to Thurman. There would, of course, be a correspondingly large increase of useful energy to the mill owners farther down the river. Why should not a more efficient method of log driving be adopted?

No doubt some day this will be brought about, but in the meantime think of the vast amount of lost wealth! Allowing one horsepower per man in manufacturing, this amount of lost power would keep an army of 9,000 men busy day and night, continuously from now to eternity. If this power were turned into electricity at 60 per cent. efficiency, we could have 5,000 electric horsepower, which equals 60,000 incandescent lamps (16-candle-power) burning day and night. With electricity selling at $35 per horsepower, this monetary loss would be something like $175,000 per year. Certainly not a small sum.

Assuming that the run-off of the Upper Hudson is the same per square mile as the Warrensburg water shed (immediately adjacent), even in a low year, it seems that 600 cubic feet per second of water can be depended upon the whole year and 800 additional cubic feet for about five months. The average run-off is somewhat over two second-feet per square mile. (See the state engineer's reports.) This gives an average of 1,600 to 1,700 cubic feet of water per second per square mile.

How is it that no one has taken advantage of this fine power? it being only 30 miles (or less) from a large manufacturing center, where there certainly must be a demand for additional cheap power. This can be transmitted by electricity, at, say, $2 per horsepower (actual line transmission cost), making a selling price at a center of distribution 30 miles away of about $38 per horsepower per year, netting a handsome profit to the supply company. This price is approximate, and is based on the delivery of about 10,000 horsepower. Certainly steam users could afford to utilize a large amount of this power at such an attractive price.

With trolley roads in the immediate vicinity, arc and incandescent lighting and a large number of steam plants, it certainly must be, that at no distant date the power will all be used, and the river from tidewater to the State Park will be a continuous producing property, with practically no lost power, supplying factories, employing an army of men, resulting in a very much increased state and railway revenue.

Who will further a project to utilize this power, and when will this furthering come about? The writer has every reason to believe that when the fast-approaching business revival appears, this project will be among the first to take tangible shape.

The writer is indebted to the reports of the state engineer for much of the above information.

George F. Archer

New York, March 19, 1908.

St. Louis Electrical Business Men Organize.

An organization of the electrical manufacturers and supply dealers of St. Louis was recently effected. The committee on organization embraces W. A. Layman, vice-president of the Wagner Electric Manufacturing Company, chairman, R. V. Scudder, Wesco Supply Company, and Fred B. Adam, Frank Adam Electric Company. The society will probably have no regular time of meeting but will exist for the purpose of bringing the fraternity together to discuss matters of common interest at the call of four or five companies.

Distribution Voltage for Central Stations.[1]

By J. F. [illegible]

Ever since the installation of the first [illegible] Edison station the question of proper distribution voltage has been the subject of more or less animated discussions. It has been declared time and again that the final solution of this problem in defined cases has been given, but the actual employment even today of different voltages in communities where conditions are practically identical seems to contradict the assertion.

Very illustrative in this respect are the two curves here shown (Fig. 1), representing the in-

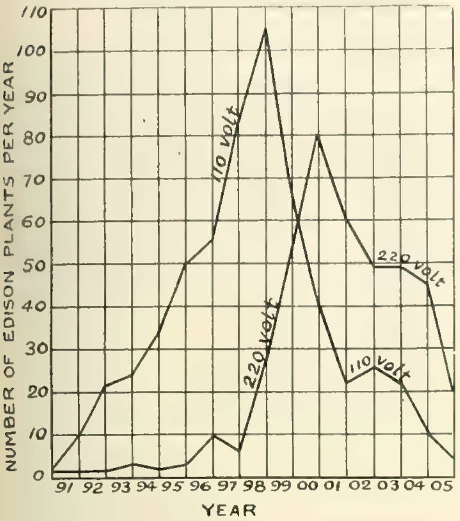


FIG. 1. INCREASE IN NUMBER OF EDISON STATIONS IN GERMANY.

crease in number of Edison stations in Germany for 110 volts and 220 volts between the years 1891 and 1906. It will be seen that up to 1898 110-volt plants were almost exclusively built, but with the arrival of the 220-volt incandescent lamp the number of plants built for this latter voltage increases very rapidly. On this continent we know that the 110-volt plants by far outnumber the 220-volt installations where direct-current is employed. It seems that the efficiency of the incandescent lamp has had most to say in deciding the voltage on this side of the Atlantic. Curiously enough, however, I have been told that since the construction of the high-efficiency lamps, plants for twice 50 volts have been put in operation in England.

It will be the purpose of this paper, then, briefly to see whether the importance ascribed to the incandescent lamps in this respect is warranted. In these days of advocacy of municipal ownership it might be advisable to remember that the point of view is necessarily somewhat different for a municipal plant and for a plant owned and operated by a private concern. The chief interest for the municipality in deciding upon distribution voltage is to deliver the most suitable form of energy to the consumer, whereas the private company must choose the voltage that earns the largest interest on the capital outlay. It would seem that these two considerations should lead to the same result, but as this assumption is by no means axiomatic, it has to be proved before we may treat both propositions in the same way.

Municipal Plants

In our modern community electric energy is used for many different purposes, but for the present purpose it is sufficient to distinguish between—

1. Lighting of stores, public halls and streets.
2. Lighting of residences.
3. Motor drive.

The first class of lighting I shall, in the following, for the sake of brevity, term "commercial lighting" and the second "residence lighting."

Generally, of course, it might be said that the voltage that is most suitable for the most important consumers in a community should be chosen. A city with predominant manufacturing interests must select the current most suitable for motor drive, whereas a residential suburb will pay most attention to residence lighting. In these extreme cases the problem is easily solved, but in general practice the question is more complicated.

The first point to be taken into consideration is that the motor load, broadly speaking, is increasing at a higher rate than the lighting load. From Germany, where the Department of Statistics is doing some excellent work, the curves shown in Fig. 2, illustrating this fact, are obtained. Unfortunately they only go up to the year of 1905. The two upper curves show the total lighting and motor load of all Edison stations in Germany from year to year. The two lower curves give the corresponding rate of growth. It is seen that the motor load always [illegible]

[illegible]

[illegible]

[illegible] well known, [illegible] constant and one variable, the former proportional to the maximum yearly load and the latter again to the number of sold kilowatts. The investment, therefore, earns a better dividend the higher the load factor or the ratio between total kilowatts sold in a year and the maximum load in an hour multiplied by 365 times 24. For motors running with constant load 3,000 hours [illegible] the factor is 0.34, while the average factor for residence lighting is only about 0.14. Principally for this reason the motor energy is sold cheaper than the lighting energy, the ratio varying between 1:1.33 and 1:2.25, and is on an average 1:2, but in spite of this the motor load is generally more profitable, because the constant expenses or fixed charges by far outweigh the variable. I have figured out that the ratio 1:2 is justified in a plant where the fixed charges are about 70 per cent. of the total expenditure for a certain amount of energy. But in a plant driven by waterpower the fixed charges amount to 85 to 90 per cent. of the total expenses; in gas-driven and even in steam-driven plants the percentage often is 75. Similarly, commercial lighting has generally a better load factor than residence lighting, although in odd cases the reverse is observed. These figures should be sufficient to prove that from the central-station point of view attention ought to be given to motor drive in the first place, commercial lighting in the next, and residence lighting in the last, if one voltage is not equally suitable for all these classes.

Let us now look into this latter question.

Motors.

In regard to motors, then, it must be admitted that 110 volts is more suitable for the smallest sizes, although these may safely and successfully be wound also for 220 volts. The medium sizes are equally well adapted to either voltage, but for the larger sizes 220 volts is decidedly preferable. This voltage requires less collector copper and makes therefore cheaper motors, causes smaller brush losses and thus gives better efficiency. Controllers, switches, etc., are cheaper for this voltage on account of the lower current density.

Carbon-filament Lamps

Somewhat different, of course, is the result when considering the incandescent lamps. The carbon-filament lamps of five candlepower are not made for 220 volts, and the difference in economy between a 110-volt and a 220-volt lamp is according to some sources as high as 20 per cent. in favor of the lower

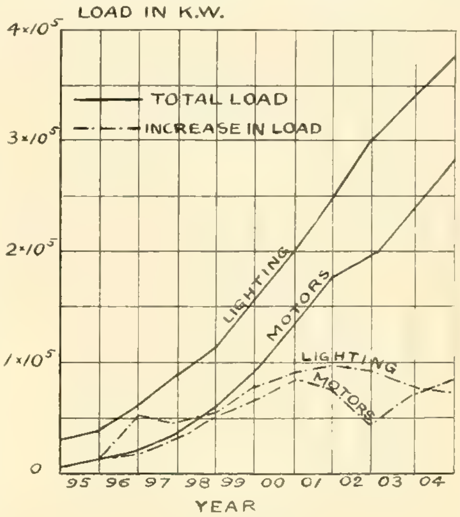


FIG. 2. INCREASE IN CENTRAL STATION LOAD IN GERMANY

voltage. For a 32-candlepower lamp the difference again is frequently given as low as two per cent.

While on this subject I cannot help but say that in my opinion tests of samples from odd lots can only give very unreliable results. I even know of one occasion when such a test of lamps from the same factory showed the 220-volt lamps three per cent. better than the 110-volt ones.

A better insight into the relative efficiency is, in [illegible]

[illegible]

[illegible]

[illegible] to the burning question of today, the incandescent [illegible]

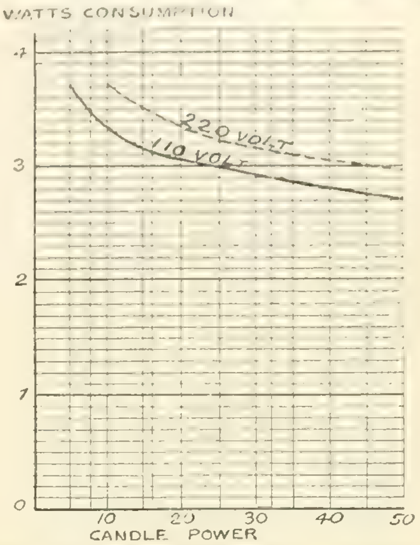


FIG. 3. RELATIVE EFFICIENCY OF 110-VOLT AND 220-VOLT LAMPS.

are the tantalum, tungsten, wolfram, etc., lamps, and each dawn almost sees a new patent for a new filament. To this class may perhaps also be counted the metallized carbon-filament lamp, the remarkable feature of which seems to be, in addition to comparatively low-energy consumption, that the carbon at a temperature of about 3,000° C. changes its inner structure and obtains a positive temperature coefficient, so that the resistance should increase with rising temperature. Few of these lamps are as yet constructed for 220 volts, and difficulties are said to be encountered in making the small sizes even for 110 volts. But to change our voltage policy for this reason only seems, to say the least, a doubtful measure.

The wolfram lamp has successfully been made for 32 candlepower and 220 volts, and the only reason why it is not put in the market is that the factories have not as yet the capacity to fill all orders for 110-volt lamps. And I see no reason why the development of these lamps should not follow the same course as that of the carbon lamp. Surely the electrical engineers have no good ground for entertaining pessimistic views in regard to their own technical ability. The small metallic lamps may or may not be constructed for 220 volts. But this is of slight importance. They are generally installed in closets and such places where high efficiency is of little value, because of the exceedingly short time they are in use. And even if the lower limit should be 32 or even 50 candlepower, this would be no serious objection when we consider that the gas mantle won the field at once, although its lower limit is 50 to 60 candlepower.

In regard to the energy consumption of the metallic lamps I have secured the following data as to the wolfram lamp:

Candlepower.	Watts per Candlepower
16	1.24
25	1.06
32	1.0[illegible]
50	0.[illegible]2
100	[illegible]

It is probable that the 220-volt lamps of this class will have the same relative efficiency as the 220-volt carbon lamps to the 110-volt lamps. It is also said that they might be 12 to 25 per cent. more expensive to buy. Assuming this and a life of 1,000 hours for both and the above-mentioned consumption per candlepower, the price per hour for a 32-candlepower 220-volt lamp at 12 cents per kilowatt-hour would be 0.59 cent, and for 110-volt 0.49 cent. Such a comparison, however, is hardly fair to the higher voltage. The current sold over a 220-volt distribution network could be sold cheaper, say at 10½ cents, and the respective costs per hour would then be 0.52 and 0.49 cent. That we are justified in making such an assumption will presently be seen when we come to deal with the relative cost of the distribution feeders for the two different voltages. In any case we must remember that lighting considerations cannot be allowed to dictate our final judgment.

1. A paper read before the Toronto Branch of the American Institute of Electrical Engineers, March 13, 1908

ARC LAMPS.

For outside lighting and for illumination of public halls, offices, etc., the arc lamps are as yet extensively used. The former objections to the higher voltage for this class of apparatus are now largely invalidated, as we now possess good arc lamps for 110 volts per lamp. And where two lamps in series are not called for, a couple of high candle-power metallic lamps will do the same if not better service.

DISTRIBUTION NET.

We now have one important point left—the influence of choice of voltage upon the economy of the distribution net.

The result of our investigation will here be widely different if we consider alternating or direct current.

ALTERNATING CURRENT.

The chief characteristic of the alternating current is the facility and efficiency with which one voltage is transformed into another. It is therefore possible with this kind of current to derive the benefit of high primary distribution voltage and yet select the lower secondary voltage that is most suitable for lighting purposes. The increased number of transformer stations is no serious objection where no transformer-station attendants are necessary. Whenever a more important consumer of energy for motor drive is located it is a simple matter to install special transformers to deliver, say, 550 volts. This, then, would be the ideal solution if only economical speed control, long life of the lamps and adaptability for battery charging were obtainable with alternating current in the same degree as with direct current.

DIRECT CURRENT.

In direct-current systems, whether the current is drawn directly from the generating units or from rotary converters, the area to be covered from each distribution point is necessarily much larger. As a guide for judging the relations between voltage, area of distribution, feeder losses and cost of feeder

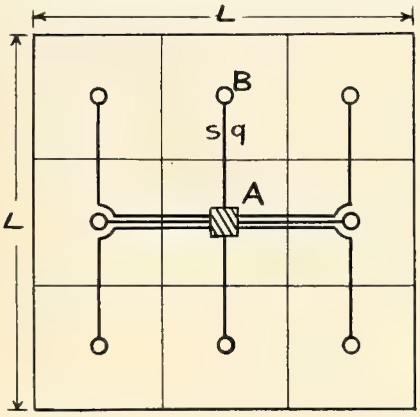


FIG. 4. DISTRIBUTION IN A CITY DISTRICT.

installation, I have made the following calculations for a square city district, with streets crossing at right angle and, to begin with, with the generating or sub-station located in the center and the load evenly distributed over the whole area.

Let us for a first consideration divide the district represented by Fig. 4 and whose side is (L) into nine equal squares and run one feeder with return conductor to the center of each. Let us use the following symbols:

q = cross-section of feeder from (A) to (B) in sq. mm.
s = amp. per sq. mm. in feeder to (B).
e = voltage between outside poles.
b = load intensity in watts per sq. m.
i = current in feeder.
C = total cost of feeder installation in cents.
M = fixed cost of one meter of feeder in cents.
N = extra cost of one meter of feeder in cents per sq. mm.
H = total heating losses in feeder system in watts.
T = number of hours full load equivalent to total yearly load.
v = cost per kilowatt at station bus-bars in cents.
u = cost per kilowatt at distribution points.
p = interest paid on capital outlay in per cent.
p′ = depreciation in per cent.

The cost of the feeder installation may then be written:

$$C = 4 \times 2 \times \frac{L}{2}(M + Nq) + 4 \times 2 \times \frac{2L}{3}(M + 2Nq) \ldots$$

$$= [illegible]\, L\,(M + [illegible]\, Nq);$$

$$\text{but } q = \frac{b L^2}{e\, s\, q} [illegible]$$

We now, therefore, eliminate the cross-section and obtain:

$$C = 8\, L\,(M + \frac{5\, b\, N}{27\, e\, s} L^2) \text{ cents.}$$

The heating losses in all the feeders and in the center district are:

$$H = i^2 \times 9 \times 2 \times \frac{L}{3} \times \frac{\rho}{q},$$ where ρ is the specific resistance. But $i = \frac{b L^2}{e q}$ and $\frac{i}{q} = s$. Therefore

$$H = \frac{2}{3} \times \frac{\rho\, b\, s}{e} L^3 \text{ watts.}$$

The yearly expenses chargeable to the cable net are:

Interest and depreciation: $\frac{p + p'}{100} C$, and heating losses: $\frac{H}{1,000} T\, u$ in cents.

Against this we have difference in cost of energy at station bus-bars and at distribution points:

$$\frac{b L^2}{1,000} T\,(u - v) \text{ in cents.}$$

When the sum of the two former expressions equal the latter, we reach the limit for economical distribution, and should the expenses surpass this value the company cannot pay interest on the cable net. Thus, we may write the equation:

$$\frac{p + p'}{100} C + \frac{H}{1,000} T\, u = \frac{b L^2}{1,000} T\,(u - v).$$

By substituting the values of C and H, just derived, we obtain:

$$(p + p')\, 8 L \left(M + \frac{5\, b\, N}{27\, e\, s} L^2 \right) + \frac{2\, \rho\, b\, s}{30\, e} L^3\, T\, u = \frac{b L^2}{1,000} T\,(u - v).$$

For the limit value of L the constant M is negligible, and the equation may be transcribed:

$$\frac{400}{27}(p + p')\frac{N}{e\, s} + \frac{2}{3}\frac{\rho\, s}{e} L\, T\, u = T\,(u - v);$$

or, solved with reference to L:

$$L = \frac{T\,(u - v)}{\frac{14.8\,(p + p')\, N}{s} + 0.67\, \rho\, s\, T\, u} \times e.$$

This equation contains three variables, e, s and L, and for each chosen value of e we may now calculate the current density, s, which will make L, the side in our district, a maximum.

A first derivation of the denominator gives:

$$-\frac{14.8\,(p + p')\, N}{s^2} + 0.67 \rho\, T\, u = 0.$$

As the second derivative is positive, the value of s, solved from this equation, corresponds to a minimum of the denominator, or a maximum of L. These values of s and L are:

$$s = \sqrt{\frac{14.8\,(p + p')\, N}{0.67\, \rho\, T u}};$$

$$L_{max.} = \frac{T\,(u - v)}{2\sqrt{14.8\,(p + p')\, N \times 0.67\, \rho\, T u}} \times e$$

$$= \frac{(u - v)\sqrt{T}}{6.28\sqrt{(p + p')\, N \rho\, u}} \times e.$$

I have gone through the same calculation, supposing the district to be divided into 25 equal squares, and the coefficient in the denominator became 6.64 instead of 6.28, from which it will be seen that the number of subdivisions is of small importance.

If a three-wire system is used with the neutral of half the cross-section of the other conductors, calling the cost-coefficient of the neutral N′, and taking the heating loss in same as 15 per cent. of the losses in the outside wires, which seems to be a fair average, we obtain the following expressions for s and L-max.:

$$s = \sqrt{\frac{19.3\,(p + p')\,(N + \frac{1}{4} N')}{\rho\, T\, u}};$$

$$L_{max.} = \frac{(u - v)\sqrt{T}}{6.75\sqrt{(p + p')\,(N + \frac{1}{4} N')\, \rho\, u}} \times e$$

Let us take, for an example:

T = 1,500 hours.
p = 8 per cent; p′ = 3.5 per cent.
N = 1.2, and N′ = 0.54c per sq. mm. and m.
u = 5 and v = 3¼c per kilowatt-hour.

Then:

$$L_{max.} = \frac{1.75\sqrt{1,500}}{6.75\sqrt{11.5 \times 1.335 \times 0.018 \times 5}} e = 8\, e$$

Therefore, the maximum length of a district that may be fed from a central without other profit than the interest assumed on the capital outlay:

For 2 × 110 volt is 1,750 meters, or 5,750 feet.
For 2 × 220-volt is 3,500 meters, or 11,500 feet.

These calculations, then, agree pretty well with the figures generally quoted as derived from practice. As mentioned before, they are only given as a guide, and should by no means be applied under all conditions. Some of the suppositions on which they are founded will therefore be considered a little closer.

We assumed that the most economical current density was used in the feeders. Generally, however, the cross-section must be determined with reference to the voltage drop.

In our example the current density is:

$$s = \sqrt{\frac{19.3 \times 11.5 \times 1.335}{0.018 \times 1,500 \times 5}} = 1.5 \frac{\text{amp.}}{\text{sq. mm.}}$$

This corresponds to a voltage drop of:

$$1.5\, \rho \frac{\frac{2}{3} L_{max.}\, 100}{e} = 14.4 \text{ per cent.,}$$

which, of course, generally, will be considered somewhat too high.

In this connection, however, I wish to point out that the introduction of the metallic-filament lamps probably will allow a larger voltage drop. I have been informed that a 32-candlepower wolfram lamp varies from 17.5 candlepower to 33.5 candlepower when the voltage varies from 110 to 120 volts. The candlepower, then, of a wolfram lamp increases as the 3.5th power of the voltage rise, whereas the candlepower of the ordinary carbon lamp grows as the sixth power. At present, however, the feeder drop must be determined so as to obtain even lighting. The current density obtained from above formula might therefore be too high. It might also sometimes be so small that the corresponding capital outlay becomes too high. An adjustment in either case makes the economy less good; and the difference is more marked with the lower than with the higher voltage, as a trial in above equations will show.

It was further assumed that the station was placed in the center of the district. In most cases, however, it is necessary, for well-known reasons, to locate the station more or less eccentric. This, of course, is easier to do with the higher than with the lower voltage; on the other hand, the assumption of an even-load distribution is unfavorable to the lower voltage, as the central often may be placed in the section where the load is heavier.

Generally it is evident that we may economically feed a four times larger district with 2 × 220-volt than with 2 × 110-volt. In our example, for instance, we may feed an area of 4¾ square miles from one 2 × 220-volt central, whereas same district requires four stations for 2 × 110-volt.

Energy of 220 volts might therefore be sold at a lower rate, which would almost wipe out the benefit from the better efficiency of the low-voltage lamps.

The most difficult problem in planning a distribution system is to rightly judge the future development of the community in question. That contingencies in this respect are easier to meet with the higher voltage than with the lower needs no further proof.

If we weigh the advantages and disadvantages against each other, it seems to me, then, that 220-volt undoubtedly is preferable, except in very small communities or in towns of a distinct residence character.

A very good solution, in my opinion, where a city receives its energy in the form of alternating current, is to provide the central parts with direct current and the outskirts and suburbs with alternating current. What has been said above in regard to both systems still holds good, each in its sphere, except that the district fed with direct current now is limited, and further extensions need not to be taken into consideration.

It is interesting to note that the commission appointed to investigate this problem for one of the largest distribution systems of its kind in the world—namely, in Paris, France—decided upon a mixed system of 2 × 220-volt direct current in the central parts of the city, and two-phase, 110-volt in the outskirts and suburbs.

Indiana Electric-railway Statistics.

According to the second report on electric railways in Indiana, just compiled by the Bureau of Statistics, the growth of this industry in 1907 was almost equal to that of the preceding year. In 1907 the companies operated 1,651 miles, against 1,286 miles in 1906. In 1907 the roads carried 152,875,595 passengers, against 127,616,952 in 1906. The amount of freight carried in 1907 was 179,685 tons, against 97,571 tons in 1906. Gross earnings of all the roads were $10,238,776 in 1907 and $8,712,775 in 1906. Additions, betterments, maintenances, operation and general expenses amounted to $4,300,758 in 1907 and $5,541,456 in 1906.

During the year 1907 the companies employed 1,105 motormen and paid them in wages $687,920. Conductors numbered 1,061 and were paid $668,820. The number of other employes and laborers was 3,552, who received $227,743.62.

Sixty-seven persons were killed during the year, 57 by their own carelessness and 10 by causes beyond their control. The injured persons numbered 5,126. Most of those killed and injured were neither passengers nor employes.

The Telephone Situation from the Bell Viewpoint.[1]

By Theodore N. Vail

The unusual production and price during the past few years of those commodities which this country sells to the whole world, with accompanying very general distribution of wealth, resulted in an almost phenomenal financial and industrial activity, stimulating new enterprises and promotions of all kinds, among them Independent telephone companies.

The exaggerated stories of the fortunes made by original telephone investors, together with misleading statements of probable profits, made it possible to launch many of these companies pledged to low rates for exchange service and high dividends to investors. At these low rates, with "maintenance" and "reconstruction" expenses either intentionally or ignorantly disregarded, these companies for a time had an appearance of prosperity.

The result has been unfortunate in nearly every case. The promises and pledges as to rates and profits, made as an excuse for their coming, as a basis for their franchise, and as an incentive to attract capital, are now admitted to be impossible. Most, if not all, of these companies, which have had an existence long enough to force attention to the items of "maintenance" or "reconstruction" are now asking for increased rates and to be absolved from onerous conditions freely accepted and assumed at the beginning. Reorganizations are now in progress.

It would seem as a whole that the gain of the public through competition based on low rates has not compensated for the loss of capital invested in these enterprises.

During this period of strife and rush for development and extension many subscribers were connected to exchange systems with little or no benefit to themselves or advantage to others, and much was done that under ordinary conditions would not have been done.

Rates and Rate Regulation

The result of these conditions has been to create in the minds of the public and of public bodies misleading and mistaken ideas of the telephone business. It has encouraged attempts at regulation of rates and business on lines that if obligatory or persisted in would be ruinous. In controversies as to rates the policy of our associated companies has been to make a complete and absolute showing of the condition, cost and value of plant, cost and value of service, cost and necessity of proper maintenance, and the broad position is taken that neither our company nor the associated companies have anything to conceal or anything to apologize for. That the capitalization of all the companies is conservative, far within justifiable limits, and in the relation between the replacement value of the properties and the capitalization of the companies is unique. Fair rates, therefore, should be authorized or acquiesced in, for it is only by fair rates that good service to the public and permanent, healthy conditions can be created or maintained. With a full knowledge of all surrounding circumstances and conditions it is believed that this would be fully acquiesced in by the public.

Fair rates would insure high-class plant and equipment maintained at a high state of efficiency, and would provide fair wages to employes, the highest paid for similar class of employment. Both of these are necessary to good service.

Fair rates should give fair return on the investment, and promise fair returns on new money needed. This is necessary to maintain the interest of the existing shareholders in the proper administration of the business as well as to provide for the continually increasing public demand.

Any revenue produced over and above such requirements and the proper reserve to provide for contingencies could be used for the benefit of the public, allowing the company to retain a part sufficient to stimulate the most efficient and economical management. It would be difficult, if not impossible, to get effective and economical management, such as would produce the best results for both the public and the shareholders, without recognizing this principle.

It does not seem possible that there can be any question of the justice of this position. That being granted, the facts to be settled are: Is the management honest and competent? What is the investment? Is the property represented by that investment maintained at a high standard? What percentage of return does it show? Is that a fair return? Is it obtained by a reasonable distribution of gross charges?

If these questions are answered satisfactorily there can be no basis for conflict between the company and the public, and the less the working conditions are made inflexible by legislative proscription the better will be the solution of the constantly changing problems incident to a growing business. The question of maintenance is of the greatest importance.

Competition

The value of an exchange system is measured by the number of the members of the community that are connected with it. If there are two systems, neither of them serving all, important users must be connected with both systems. Connection with only one is but partial [illegible] satisfactory. Two exchange systems in the same community, each serving the same members, cannot be conceived of as permanent, nor can the service in either be furnished at any material reduction because of the competition if return on investment and proper maintenance are taken into account. Duplication of plant is a waste to the investor. Duplication of charge is a waste to the user.

The advantages claimed for competition are lower rates and improved service. Exhaustive competition may temporarily produce either or both of these results, but, as before stated, this temporary gain is purchased by an excessive waste. Duplication of plant and operation cannot produce either result without exhaustive competition. Given the same management, the public must pay double rates for service to meet double charges on double capital, double operating expenses and double maintenance. In most cases of proposed competition an examination of the prospectus will show that, by some process, it is expected to make good a capitalization equal to at least two or three times the actual cost of the construction. The only benefits are to the promoter.

Public Control

It is contended that if there is to be no competition there should be public control. It is not believed that there is any serious objection to such control, provided it is independent, intelligent, considerate, thorough and just, recognizing, as does the Interstate Commerce Commission in its report, recently issued, that capital is entitled to its fair return, and good management or enterprise to its reward.

Fair Return on Capital.

With guaranteed or reasonably certain income, money can be obtained for any enterprise at moderate rates. With uncertainty—owing to competition and opposition, possible or actual, or possible regulation of rates without proper investigation of consideration—a more or less speculative price must be paid. Subject to these general rules, "locality" and existing general conditions will establish the rate.

An exchange system is made up of circuits radiating from a central office, or from central offices connected by trunk lines, so arranged that each circuit can be connected directly or through trunk lines with the others. There are in these circuits of the Bell system about 7,000,000 miles of wire—over two miles of wire to each subscriber—one-half in underground conduits. The system of radiating circuits is the most expensive part of the exchange system to build, it is least durable, therefore most expensive to maintain, calls for the largest part of the total investment, and consequently must bear the largest part of the cost of capital.

The real value of a telephone exchange system depends entirely on the distribution and number of other members of the same or other communities connected with the same or connecting systems, with whom any subscriber can have prompt and satisfactory communication.

Any member of a community connected with an exchange system can be reached as well, but not as conveniently, from a central or public office as from a subscriber's station.

To reach any member of a community not connected with any exchange system, whether from public station or subscriber's station, is too inconvenient and impractical to be considered for ordinary use.

Therefore, the particular circuit connecting any subscriber with the exchange is what might be termed a convenience to that particular subscriber, but a necessity to all other subscribers.

It is not merely the maintenance of the individual circuit connecting with the exchange that is paid for by any subscriber; it is in a greater measure the use from time to time of the circuits, trunks and facilities which make communication possible with all other subscribers. It is the ability to communicate with others that makes the exchange valuable; it is the use of other circuits than your own.

The cost and value of the system to any subscriber do not depend so much on the number of communications had as on the number and extent of other circuits and facilities necessary to give the communications desired. It is plain, therefore, that the character of the circuit connecting any subscriber with the exchange does not determine either the cost or value to that subscriber of the exchange connections.

The many and complicated systems of charges prevailing indicate the struggles experts have had in their efforts to establish consistent and reasonable rates. As the value of the exchange to the subscriber depends upon the number of subscrib- [illegible] particular subscriber connected by that circuit.

[illegible] business houses and residences with a sub-classification of plant between "direct" and "party" line.

Business rates are higher for the reason that presumably the business subscriber connects with the greatest number of other subscribers, and consequently makes use of the greatest number of circuits and operating facilities in an exchange.

Residence rates are lower because the residence subscriber connects with a limited number of other subscribers, and because he makes more limited demands on the central office.

It being established that the measure of value is not in the particular class of line connecting any subscriber to an exchange, but in the use of the exchange system as a whole, and that the value of any exchange depends on the area covered and the maximum number of desired individuals that can be reached, rates must be so adjusted that no rate shall bear unjustly on particular individuals or classes; that, at some rate, connection with the exchange is within reach of anyone who can add to the value, to others, of the exchange, and that, as a whole, the revenue will be sufficient to maintain the plant, pay fair wages, make enough return on capital and enterprise to insure good economical management and sufficient capital to meet the increasing demands of the public.

"Toll" Line and "Long-distance" Service.

Toll-line and long-distance communications require, as in exchange connections, the exclusive use of a circuit, two wires, between two points for an interval of time, varying with the conditions; over the whole system the average "time interval" consumed in the completion of each communication is about 7½ minutes.

Direct service between two points with large demands for service is the least complicated; the average "time interval" of each communication lasts about 3½ to five minutes. Between points of small demand, or between intermediate points on local lines, both complications and cost increase, and the average "time interval" is not less than five minutes each. Between points on side or branch lines, or distant points requiring combinations of circuits, or complicated and delicate auxiliary apparatus with many attendant operators, complications and cost increase rapidly, and the "time interval" taken for each communication varies from five or 7½ minutes to an indefinite period.

Cost is determined by the capital and maintenance charges of the plant and operating costs, divided by the average number of communications.

Cheap rates for service depend upon high average use of facilities. High average is obtained ordinarily in public service by putting on higher pressure—crowding—or in some way rendering more than normal service through or over any given facilities during the limited periods of great demand. It is by this means, and by this means only, that cheap service is rendered to the public.

Whatever inconvenience or discomfort there may be caused on one hand is compensated for by the reduced price charged for service. In this particular, toll-line or long-distance service is unique. In whatever way the circuit is made up a certain "time interval" must be given exclusively to each communication and to the communicating parties. No other communication can be crowded on that circuit during that "time interval."

Any "time interval" passed without being utilized is lost beyond recovery. A good average cannot be made by crowding two or more communications into the "time interval" of one, nor by putting on higher pressure to get more "time intervals" over the same circuit.

There are only a certain number of five-minute "time intervals" in each hour, or five-minute "spaces" on each clock. If you want more "time intervals" or more "spaces," you must take more hours or more clocks. In toll-line business anything above the normal capacity of each circuit must be provided for by additional circuits.

Toll-line or long-distance business requires the presence of the communicating parties; for that reason it is confined to the business or working hours of the day; and further, the greater part of this business is not only limited to those few hours when parties are most likely to be located at some particular place, but to that part of those few hours immediately after the general business of the day has developed. For this reason the greater part of the toll line or long-distance business is crowded into an exceedingly small part of the business day. The periods of great demand are short. The facilities provided are idle a great part of even the business hours.

Examination shows that about half the facilities are utilized to a fair part of the capacity during

1. Extracts from the annual report (dated March 10, 1908) of the president of the American Telephone and Telegraph Company. While Mr. Vail looks at the situation from the Bell point of view, his line of reasoning will be of interest to Independent telephone men also, even though they may differ with him materially.

business hours only. All the rest are utilized only to a fractional part of the capacity at any time. If during certain hours the business could be subjected to a half hour's delay, the facilities required could be reduced one-third at least.

Toll-line or long-distance business is in the minds of the public similar to telegraphic message business. There is no comparison. Telegraphic circuits between points are at most one wire; on all trunk lines two to four circuits over one wire.

Telegrams are handed in, filed before an operator and despatched in order. In this way the business is distributed more uniformly over working hours, and during the night hours the lines are used for press messages, night messages, or for long-distance messages in transit.

MAINTENANCE.

Utter disregard for repairs and reconstruction, usually comprised under the head of "maintenance," has been the cause of more misunderstanding on the part of the public and public bodies having to do with rates, of more self—or selfish—deceit on the part of promoters of telephone enterprises, and of more mistakes on the part of the investing public, than any one factor in the telephone business.

With a new plant, "current repair" is at a minimum, and can be for a time disregarded; with a growing plant, it is too easy to lose it in construction; but sooner or later, if not provided out of current revenue, where it belongs, it will be found either in increased construction—that is, capital charges—or in a depreciated plant.

Any company paying dividends and fixed charges, particularly dividends, without first providing for proper maintenance, can have but one end—disaster.

In any consideration of this question the leaning should be toward liberal rather than inadequate maintenance. In any properly administered company any excess would be found in betterments or construction, and consequently in reduced capital investment, while inadequate maintenance would soon show in quality of service and in reconstruction requirements. In other words, surplus maintenance would be offset by decrease of capital charges; while inadequate maintenance requiring new construction in time would increase capital charges.

Binding Posts for Snap Switches.

The following notice has been sent by the Underwriters' Laboratories (Inc.) of Chicago:

"To Electrical Jobbers and Contractors:

"As some misunderstanding appears to exist among the electrical trade in reference to the agreement entered into between manufacturers of snap-switches and this corporation, covering the gradual replacement of the set-screw form of binding post on these devices, we judge it proper to advise you as follows:

"The October (1907) edition of the list of approved fittings contained notice to the effect that switches manufactured after July 1, 1908, and having set-screw form of binding post will not be approved, and the April (1908) edition of the list of approved fittings will contain similar notice.

"On July 1, 1908, all cards registering approval of switches of this type will be withdrawn and new cards will be issued registering approval of the products of those manufacturers who shall have submitted strictly commercial samples of their entire line having the new form of contact.

"The necessary time will be allowed to dispose of reasonable stocks of switches in the hands of jobbers and others, provided manufacturers file with this office assurance that after July 1, 1908, no switches with the set-screw form of binding post will be made up in their factories.

"The October (1908) edition of the list of approved fittings will show only those devices on which approval cards are then outstanding. A suitable statement will also appear in this list regarding the change adopted.

"It is agreed that the above course will give all manufacturers ample opportunity to conclude the arrangements for the necessary changes in the design of their switches. The simultaneous publication of our cards withdrawing approvals on the old type will put all manufacturers on the same [illegible] in the hands of jobbers.

"It is the intent of this action to effect a grad- [illegible] form of binding post without causing depreciation in value of stocks on [illegible]

Publications of the Geological Survey.

[illegible] Survey [illegible] these publications comprise in the aggregate about [illegible] is composed of publications for which payment is [illegible] comprising accounts of the surveys of mineral lands and of mineral deposits of various kinds, statistics of mineral production, reports on the results of technologic experiments—as with coal and cement—investigations of water resources, both surface and underground, and researches and discussions of many other kinds.

Electrical History in the Black Hills.

Grown from a modest beginning in the Black Hills of South Dakota in 1881 to a million-dollar industry, the Consolidated Light and Power Company of Deadwood and Lead has become one of the established industries of the community. The generating plant is located at Pluma, and from it radiate 45 miles of pole lines for transmitting current for light and power to Deadwood and Lead and surrounding territory.

The expenditure of the capital has been judicious and the management of the affairs of the company has been conducted in a manner to insure economy and at the same time to furnish efficient service.

History leading up to the formation of this company is of interest. The Consolidated Power and Light Company is a combination of two former companies—the Black Hills Electric Light Company and the Belt Light and Power Company. The former was the original electric company of the Black Hills and the first to attempt commercial lighting by electricity in that community. It was organized by Judge Romans and associates in 1881 with a primitive plant and modest equipment. The plant, with a generating capacity of about 20 arc lights, was operated without any great success for several years. The service was at times uncertain and the patronage began to fall away, and it was on the verge of collapse when it was bought by Harris Franklin, Sol Star and Paul Rewman in 1884.

With the new owners new life was infused and plans set on foot for giving the people as good service as conditions at that time would permit. The dynamos were moved to the flour mill of Mr. Star, and the mill boilers, used to furnish power to grind grain during the day, produced steam for the light plant during the night, and the plant was run on a fairly economical plan.

The business increased, and in 1886 improvements were decided on. To the arc-light generator there was added a small incandescent machine, which was the first to be brought into the Hills. The business of the company still continued to improve, and in 1889 a brick structure was built, now occupied as the general offices of the Consolidated company. The old equipment was replaced by a new and much larger equipment and business was done on an increased scale.

An attempt had been made in 1883 to build a transmission line from the plant of the Black Hills Electric Light Company at Deadwood to Lead for the purpose of furnishing arc lighting in that city. The attempt was a failure and the scheme was abandoned. In the winter of 1891 Arthur McHose and Edward Ford secured a 30-light arc generator, established it in a planing mill at Lead and undertook the first electrical lighting for that city. Their scheme was a success, and the following year Mr. McHose, securing the entire control of the outfit, moved it to a new location, erected a building and installed another boiler and generator. He supplied Lead with light from this plant until the next year, when a new wooden building was put up at Pluma, where the present plant stands.

A step of great importance was taken in 1904, when the first steam-turbine generator was bought and installed. Two of these units of 200-kilowatt capacity each were placed in the new building and gave entire satisfaction from the start. For their operation another marine boiler was added to the equipment. The plant was then ready for furnishing electric power as well as light, and in that year built its power lines to a mill in Bald Mountain. The following year lines were built in an opposite direction and the Gilt-Edge Maid Mill was supplied with electric power.

The Pluma plant at that time had a capacity of 400 kilowatts, supplying 200 kilowatts during the day and 350 during the hours of the night, the former almost exclusively for power and the latter for both light and power. This was the condition of the plant at the time the union of the Deadwood and Pluma companies was effected and the Consolidated Power and Light Company began its existence.

On June 1, 1905, the Consolidated Power and Light Company was formed and took over the two old companies. The plant at Pluma was reconstructed and modern machinery was installed at once, so that on January 1, 1906, the Deadwood plant went out of commission. From that time the generation of all the electric energy for Deadwood and Lead has been effected at the Pluma plant.

The Pluma plant of the Consolidated company is one of the most complete and best equipped west of the Missouri River. The arrangements have [illegible] adjusted with a view to its operation on a most economical basis and the extent of its capacity assures its usefulness in its present condition for some years to come without any material additions.

The total available generating capacity of the plant amounts to 5,850 kilowatts, of which 3,650 kilowatts are in general use and 2,000 are held in reserve for emergencies. The generating units consist of two 2,000-kilowatt and one 500-kilowatt Curtis turbo-generators and two 200-kilowatt De Laval horizontal turbine generators. The boiler outfit consists of four 500-horsepower Babcock & Wilcox boilers and three marine boilers of 250 horsepower each. The boilers are supplied with coal through a system of Jones underfeed automatic stokers. In connection with the boiler department is a cement smokestack 210 feet in height and the most formidable structure of its kind in the West. It is 10 feet 6 inches in diameter, inside measurement, 13 feet 4 inches outside measurement at the base.

The 2,000-kilowatt machines generate directly 11,000 volts, at which tension the current is conducted to the transmission wires. The switchboard was installed at a large expense. The switching is all accomplished by small switches, which control motors that throw the large high-tension switches. A 25-ton crane is installed. The generators and feeder lines are equipped with instruments for the recording of all power leaving the plant.

New York Electrical Show.

Electrical men generally will be interested in the knowledge that Mr. Arthur Williams of the New York Edison Company and former president of the National Electric Light Association has been elected president of the Electrical Show Company of New York city. The other directors are Dudley Farrand of Newark, N. J., the present president of the National Electric Light Association; George F. Parker, New York; Walter Neumuller, New York Edison Company; W. W. Freeman, vice-president of the Edison Electric Illuminating Company of Brooklyn; James R. Strong, president of the National Electrical Contractors' Association, and James C. Young, secretary of the Madison Square Garden Company. This is a strong directorate. The show will be held at Madison Square Garden on October 3d to 14th. Many interesting features are promised, and it is said that the incandescent lighting will practically all be by tungsten lamps. A new departure will be the donating of the receipts of one entire day to some worthy charity. The admission for this day will be raised to $1, and the occasion will be called "Society Day."

Omaha Electrical Show.

One of the entertaining and instructive features of the Omaha electrical show will be the electric cottage which will be erected in the center of the exhibition floor by the Omaha Electric Light and Power Company. The cottage will be equipped with electrical devices applicable to home comforts and convenience.

This show is to be the first one to be given by the Nebraska Electrical Trades Association and the Omaha Auditorium Company. It is hoped that it will be an annual affair. The dates of the show are May 4th to 9th, and the Auditorium, where it is to be held, is one of the finest show buildings in the West, located within two blocks of the heart of the city. An elaborate scheme of decorative lighting is being prepared for the big building.

In addition to the large exhibition of electrical devices and machinery, many educational features will be introduced, such as wireless communication, laboratory experiments and scientific demonstrations. During the show the Nebraska Electric Light Association will hold its annual convention in Omaha, bringing hundreds of electrical men to the city. J. M. Gillan, Omaha Auditorium, is manager of the show.

Quick Work.

To accommodate the occupants of the Warren Springer Building, Canal Street, near Jackson Boulevard, the Commonwealth Edison Company, having been notified of the breakdown of the private plant supplying electric light and power at those premises, on a recent Saturday secured a street permit, and the following day, Sunday, made an excavation and built a brick manhole, installed the regulation junction box therein, connected it with the company's nearest street mains by pulling in extra cables, and extended service into the building, the work being entirely completed by 12:30 a. m., Monday morning. As soon as the mains of the building could be extended to the service and connected, the first thing Monday morning, the usual power accommodations were again ready for use. This is an unusually quick service installation, considering that there was not sufficient service in the street to carry the load of 1,000 horsepower, and cables had to be pulled in from other manholes to provide the capacity.

The New "G and W" Ground Pipe Cap.

The making of a good and permanent ground connection from electric lighting, power, telephone or telegraph circuits has been [illegible] problem. This is especially so in making ground connections on alternating-current circuits and from lightning arresters. "Grounds" have, however, in recent years become generally standardized [illegible] standard method consists of driving a [illegible] vanized wrought iron pipe into the ground at the unexposed side of the pole to the necessary depth

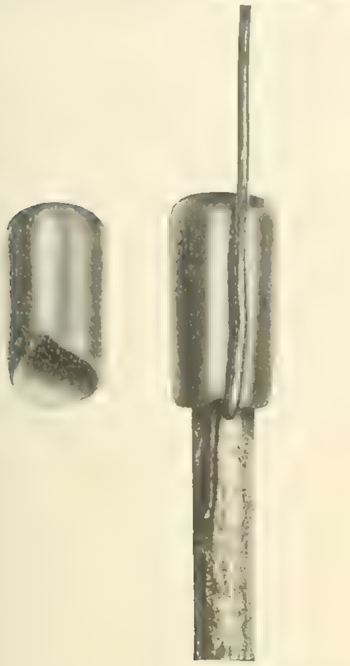


FIG. 1. "G AND W" GROUND PIPE CAP. FIG. 2. PIPE DRIVEN AND JOINT MADE.

to reach permanently moist soil. The ground wire is then joined to the top of the pipe. With many companies it is the custom to make this joint about seven feet above the ground, and some cover the ground pipe and wire with a wooden moulding. Where the pipe is covered it requires rather a large moulding, and the soldering of the wire into the pipe at the top of the ground is objectionable because of the possibility of the soldering acid starting corrosion at that point, and because of the time required to do the soldering effectively.

To save the cost of the portion of the pipe above the ground and its moulding, to give a good driving head for the pipe, and to make a good joint between the pipe and wire at the top of the ground, the G and W pipe cap, manufactured by the G and W Electric Specialty Company, Chicago, has been developed.

This cap is shown in Fig. 1, and consists of a hollow galvanized malleable casting, internally grooved along one side and so shaped at the mouth that the end of the ground wire can be introduced into the casting along the groove. The cap with the wire in place is put upon top of pipe and pipe driven into place, as shown in Fig. 2. In driving the pipe the cap is driven on and the copper wire wedged in securely between the inside wall of cap and outside of pipe, all in one operation.

The cap protects the top of the pipe from being battered out of shape and saves the time required to cut off the battered end as is often necessary in driving pipe in hard soils, and makes a joint of good conductivity between the ground wire and pipe.

Joints so made show the following under resistance test: Volts, 0.0114; amperes, 50; ohms, 0.000228.

This cap is made for a ⅝-inch pipe or rod, and when No. 6 wire is used as ground wire, doubling the wire makes a better joint. When No. 4 wire is used it is not necessary to double the wire.

Electrical Operation of a Cutlery Plant.

The Cattaraugus Cutlery Company, one of the oldest corporations in the United States manufacturing pocket knives, razors, etc., recently placed in operation its new central power plant on a spur of the Erie Railroad in the town of Little Valley, N. Y. Heretofore this company has been maintaining separate steam plants at each of the three factories which it controls. In the new two-story brick building is installed an Allis-Chalmers heavy-duty engine belted to a 150-kilowatt, three-phase, 60-cycle alternator. Steam for the unit is supplied from two horizontal return tubular boilers, furnished by the Pennsylvania Boiler Works.

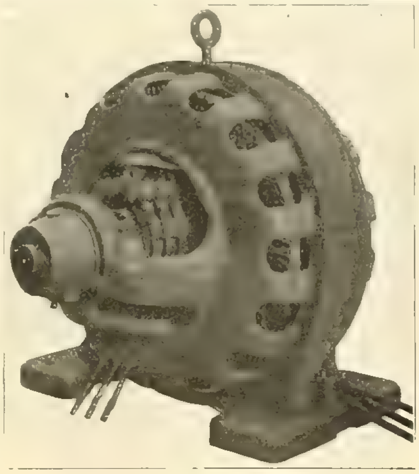
On account of the fact that plenty of floor space was available a belted unit was selected. The generator is a revolving-field, self-contained machine. Three-phase current is transmitted at 480 volts to the various factories and operates induction motors at 440 volts.

[illegible] shaft and the shafts in turn driven by induction motors ranging in size from five to 50 horsepower. Grinders, polishers, fans, punches, cutters, hammers, drill presses and various other tools utilized in the manufacture of cutlery [illegible] method. Mr. W. H. Hildreth is chief engineer of the company and the entire work of designing and installation was under his direction.

New Westinghouse Induction Motor.

The flexibility and economy of the alternating-current method of power distribution has led to its wide adoption in central-station service, and because of the economy of the use of this central service many industrial plants are now purchasing power. The same features that led to the selection of alternating-current generation and distribution for central stations have, in a somewhat lesser degree, led to its use for large industrial works. On account of this it was necessary to provide alternating-current motors of varying characteristics. The earlier polyphase motor was of the brushless or squirrel-cage type, and compared more nearly with the shunt-wound direct-current motor. To meet the varying conditions imposed by high starting torque with a low initial starting current, a modified form of motor has been produced by the Westinghouse Electric and Manufacturing Company, known as the type HF.

The general appearance of this motor is shown in the illustration, from which it will be noted that it is especially rugged and substantial. The frames are amply ventilated, but so constructed as to pro-



FIFTY-HORSEPOWER WESTINGHOUSE INDUCTION MOTOR.

tect the laminations from injury. Throughout, the motors have been designed for hard service. The insulation on the coils has been very thoroughly made and will stand much greater stresses than it receives in normal service.

Attention is called to the brushes, by means of which connection is made to an external resistance. These bear on continuous rings of metal, so that there is no occasion whatever for sparking. The brushes are liberally proportioned, so that they have long life and require the minimum of attention. The rotor is unlike the usual short-circuited type of rotor on induction motors, and has a regular winding in which the resistance is inserted while starting, and thus the starting current is limited. Approximately full-load current is required to produce full-load starting torque.

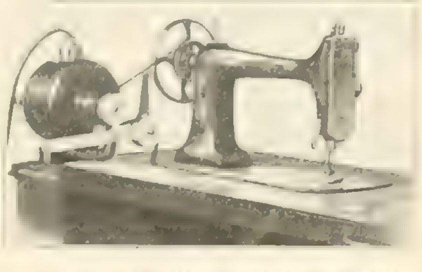
Special covers are provided for enclosing the brushes where this may be desired. There are semi-enclosing covers, by which the brushes and slip rings are protected from any coarse particles, and the totally enclosing covers, which prevent all dust from lodging on these parts.

Type HF motors are built in the usual sizes from 5 to 500 horsepower, with larger sizes on special order. The standard frequencies are 25, 40 and 60 cycles, but motors for other frequencies are supplied when required.

In connection with these motors, special starting devices are supplied by which the current at starting is varied by hand. These starters cut resistance out of the circuit of the rotating part until the handle reaches the full-on position, when the resistance is all short-circuited, and the motor runs with practically the constant-speed characteristics of the squirrel-cage motors. A special short-circuiting switch is provided on motors of 100 horsepower or larger, if desired. This relieves the brushes and the leads and contacts on the starter, as the windings are short-circuited inside the motor.

A Universal Family Sewing-machine Motor.

[illegible] sewing machines of various makes in use that the [illegible]



[illegible] MACHINE.

can be attached to one make of machine as well as to another. Otherwise a profitable business is bound to become troublesome to handle and require the carrying of a large stock of motors and consequently a considerable investment.

To meet the demand for a motor that will reduce the selling effort upon the part of the dealer to the minimum and enable him to get prompt returns, the Westinghouse Electric and Manufacturing Company has placed upon the market a motor with all the necessary attachments for fitting any one of the standard types of sewing machines.

This motor is equally satisfactory on drop-head and stationary-head machines, and may be fitted to new or old machines. Full instructions for mounting and operating the motor are supplied with each outfit.

The motor is mounted on the top of the table and runs at a constant speed. The speed of the needle is regulated by increasing or decreasing the belt tension. A special brake and belt-tightener arm is attached by chain to the foot pedal, which should be disconnected from the large balance wheel. Pressure on the pedal releases the brake, tightens the belt and starts the machine. Perfect regulation of the speed is obtained after a few minutes' practice. In fact, the needle may be stopped with greater promptness than when running from the foot pedal, and the usual control over the speed is readily learned.

The entire outfit presents a neat appearance, being well finished in black japan, with nickel trimmings. The motor and its attachments are especially well made, and will require a minimum of care and of attention in operation. These machines are made for 100-110-volt alternating current, 60 cycles, and for 100-110-volt direct-current circuits. The illustration shows the direct-current type and method of attachment, with braking and speed-regulating devices.

Electrical Dock Equipment in Brazil.

The Companhia Docas de Santos (Santos Dock Company), through whose docks most of the coffee exported from Brazil passes, has recently placed a large order with the General Electric Company of the United States for the complete electrical equipment of its sub-station and docks at Santos. The order is comprehensive and includes six 3,000-kilowatt, water-cooled, three-phase, 60-cycle, 40,000-6,600-volt transformers, 23-panel switchboard and the necessary cables and wiring supplies. The order also includes five 50-light, constant-current transformers, 208 series arc lamps, 420 multiple arc lamps, a large number of induction motors for operating air compressors, hoists, cranes, etc., and a large number of type H oil-cooled transformers.

Besides furnishing power for the docks, the sub-station will also supply energy for light and power to various other enterprises thereabout.

Power is supplied at a line potential of 40,000 volts by a hydro-electric plant some 35 miles from Santos, the equipment of which was furnished by the General Electric Company two years ago.

The Bartlesville Interurban Railway Company of Bartlesville, Okla., is preparing to build an electric railway between Bartlesville and Dewey. The contract for overhead construction, track laying and installation of power-house machinery has been let to the Treeborn Engineering and Construction Company of Kansas City, Mo. J. J. Curl is president of the railway company.

Ohio Telephone Convention.

The annual convention of the Ohio Independent Telephone Association took place in Columbus on March 19th. After the opening business these committees were appointed: Auditing—G. H. Carter, Mansfield; S. E. Ward, Delaware; H. E. Curran, Elyria. Nominations—G. P. Thorpe, Wilmington; S. R. Newberry, Ashtabula; S. Guy Jones, Columbus. Constitutional Amendments—W. L. Cary, Cleveland; H. P. Folsom, Circleville; D. J. Cable, Lima.

A. C. Lindemuth, president of the International Independent Telephone Association, delivered an address, and there were talks by J. B. Ware, secretary of the International Independent Telephone Association; Mr. Barnes of Fairmont, W. Va.; W. C. Polk and E. S. Cline of Toledo, and A. C. Davis, president of the West Virginia Independent Telephone Association.

On recommendation of the committee on legislation, the association, "representing more than 350 Independent companies, 25,000 local stockholders and 300,000 subscribers," reiterated its belief in the principle of competition as against combination and monopoly in telephone service, and also declared for the reasonable regulation of telephone rates. It endorsed House Bill No. 1037, by Mr. Stewart, in the Ohio Legislature.

Some remarks by D. C. Warner concerning the situation in Clermont County followed. In response to an appeal by Mr. Beam, the convention spontaneously pledged about $2,400 to further the work of the association.

These officers were elected: President, Frank L. Beam, Mt. Vernon; secretary, O. O. Welsheimer, Columbus; treasurer, Ralph R. Reamer, Columbus. Delegates and alternates-at-large to the next international convention were named as follows:

Delegates—J. C. Boush, Cleveland; G. H. Metheany, Lima; O. J. Hess, Sidney; E. L. Barber, Wauseon; Lewis Brucker, Mansfield; L. M. Flesh, Piqua; Washington Hyde, Warren; G. R. Johnston, Columbus; C. H. Marvin, Urbana; C. Y. McVey, Cleveland; H. P. Swisher, Newark; W. F. Laubach, Akron; H. L. Beatty, Ravenna; J. S. Brailey, Jr., Toledo; F. L. Beam, Mt. Vernon; W. R. Fee, Portsmouth; J. B. Hoge, Cleveland; C. L. Jones, Athens; J. Mallahan, Ottawa; R. M. McLaughlin, Carrollton; S. B. Rankin, South Charleston; G. P. Thorpe, Wilmington.

Alternates—F. A. Knapp, Bellevue; H. Hildebrandt, Washington; C. C. Heller, Beaver Dam; G. Adams, Millersburg; Charles Heinlein, Bridgeport; D. O'Dell, Springfield; J. G. Steinkamp, Elmore; H. M. Allen, Troy; J. Babst, Crestline; E. L. Coen, Vermillion; D. H. Fuller, Clyde; I. H. Thiedick, Sidney; J. McDowell, Ironton; W. A. Norton, Kenton; O. L. Spangler, Bryan; C. D. Young, Delaware; W. H. Bowron, Caldwell; Charles Duncan, Chillicothe; A. V. Hageman, Lorain; N. Liggett, Marysville; G. E. Nungester, Celina; J. F. Smith, Cadiz; S. E. Ward, Mansfield.

Governor A. L. Harris received the delegates in the evening. A very enjoyable banquet and programme of toasts and music closed the convention.

GENERAL TELEPHONE NEWS

The Saskatchewan Telephone Company of Moosejaw, Sask., intends to construct a long-distance telephone line from Estevan to the Manitoba boundary, a distance of about 70 miles. At the boundary connection will be made with the Manitoba government telephone system. The company recently completed its system between Moosejaw and Estevan.

Among recently incorporated telephone companies are the Pipestone Company, Rural Telephone Company, Airlie, Minn.; Norway Telephone Company, Kanawha, Iowa; Rudolph Telephone Company, Rudolph, Wis.; Straight West Telephone Company, Okarche, Okla.; Sentinel Long-distance Rural Telephone Company, Sentinel, Okla.; Boyd County Mutual Telephone Company, Bristow, Neb.; Wood Lake Telephone Company, Wood Lake, Neb.

The German postal department, which owns and operates the telegraph and telephone system of the empire, except in Bavaria and Wurtemberg, purposes to change the present method of charging by substituting a certain fee for every call or conversation instead of the fixed sum per annum for each subscriber. The present rates for telephoning in Germany, according to Richard Guenther, consul-general at Frankfort, are lower than those in the United States.

It [illegible] plans have been completed whereby the Illinois Tunnel Company will be en[illegible] telephone rights in [illegible] and that [illegible] part of the property will [illegible] will be [illegible] telephone system that will serve the entire city within a period of five [illegible] the Illinois Tunnel Company's entire issue of five per cent. first-mortgage bonds for four per cent. [illegible] Chicago Subway Com[illegible]

CORRESPONDENCE.

Continental Europe.

Paris, March 17.—The minister of posts and telegraphs has lately presented a project for a bill before Parliament relating to the work which will be needed in order to improve the telephone system in Paris, as well as in the leading cities of France and the interurban lines. According to this, it is proposed to erect two new central exchanges at Paris. The total cost of the present project is no less than $8,000,000.

It is reported by the Italian journals that a syndicate of capitalists has been formed for the purpose of constructing an extensive network of subway lines in Naples and the suburbs, and the plans for the work are now being prepared. The preliminary project for the underground system has already been communicated to the State Railroad Department. It is said to call for an expenditure of $2,000,000 for the present plans.

On the Rhine it is proposed to erect a hydraulic plant at Eglisau, near Winterthür, and the hydraulic work also includes the use of the affluents of the Rhine, the Glatt and the Töss. A series of dams will be constructed so as to give water storage in these cases. One of these reservoirs will afford a supply of 5,000,000 cubic meters, on the Glatt River. A tunnel will connect the two reservoirs together. In this way the turbine station will be able to provide for variable current during the different hours of the day, by using the reserve water. On the Rhine will be built a turbine plant which will use a low pressure and large volume, and to it will be run a penstock from the Glatt reservoir. It is thought that the Rhine can be called upon for 16,000 horsepower, in addition to the reserve water which is given by the Glatt system, this latter affording about 3,000 horsepower extra. On the Töss River the hydraulic work will give about the same amount.

The town of Samara, in Russia, is to erect a municipal plant, and bids have been advertised for, providing for the construction of the central station and the organization of a tramway line. These will both be operated as concessions.

From a financial viewpoint the electric plants of Berlin made a very good showing in the last fiscal year (1906-1907), and the profits coming to the city from this source are about $120,000, not including the payment of an 11 per cent. dividend. The total production for the year is 143,000,000 kilowatt-hours, of which 89,000,000 were used for light and motors and the rest for tramways. There are now 890,000 incandescent lamps installed in Berlin, besides 30,000 arcs, and the motors now figure at 21,000.

In the region of Naples there is a project on foot for the construction of an electric railroad for Salerno to Amalfi, and the administration of the former locality has already presented the matter to the State Railroad Department. There is also talk of a railroad line running from Salerno to Valle Pompeii. At Pisa there has been formed a company which is to construct a line of electric road in the northern region, starting from Viareggio.

A new hydraulic plant at Laufenberg, on the Swiss portion of the Rhine, will be erected by a syndicate which has been recently formed among several of the leading electrical construction firms, including the Felten-Guilleaume-Lahmeyer Company of Mülheim and the Swiss Compressed Air and Electric Company. The syndicate expects to secure a large amount of power from the Rhine, this being estimated at 50,000 horsepower, so that the plant will rank among the largest in Europe. It is to cost about $4,000,000.

A. DE C.

Great Britain.

London, March 21.—The inquiry into the Home Office regulations referred to last week has been continued during the present week, and a feature of the proceedings has been the appointment of a committee representing the varied interests of the objectors who, by informal conference with the advisers of the Home Office, have been able to effect more progress in two days than had been made during the whole of the previous week. Out of the 33 regulations, practical agreement has been come to on about 20, and at the moment of writing it would appear that agreement will be come to, to all intents and purposes without the intervention of the legal fraternity upon all regulations except two, viz., that relating to the dimensions of height and width of switchboards and switchboard passageways, and the one having reference to the use of no-volt releases upon alternating-current motors. For the present, discussion upon the former has been postponed, while in connection with the latter the Home Office, in the light of the evidence, has made a further concession to the extent of prefacing the regulation with the words "Where necessary to prevent danger" these appliances are to be used.

The rumor that the much "boomed" electrical exhibition in Manchester this autumn was to be postponed until next year has called forth from the executive committee a full statement of the position, and it is a matter for congratulation that the exhibition is to be carried through. Mention may be here made of the possibility of an electrical exhibition being held in London in 1910.

A somewhat novel proposal was put before the postmaster-general a few days ago, viz., that the Postoffice should give preferential rates of postage to the publications of scientific and engineering societies, in order to extend the beneficial influence of such institutions. The postmaster-general did not take kindly to the idea.

The French Society of Electrical Engineers is presenting the British Institution of Electrical Engineers a portrait of Ampere as a memento of the part it took in the visit of foreign engineers to this country in 1906.

Sir William Preece delivered a lecture before the Institution of Electrical Engineers last week, entitled "America Revisited—1907." One of his first comments was in relation to the enormous use of the telephone in the United States as compared with Great Britain, while on the question of education he made the characteristic remark that, whereas in England the government was expected to do everything, in America they expected the millionaire to do, at any rate, the major portion of what was necessary. Figures were given to show that the telephones per 100 population are only 1.98 in London, against 8.12 in New York, 7.44 in Chicago, and 7.41 in Philadelphia.

The death is announced of the founder of the well-known firm of Callender's Cable and Construction Company, Mr. W. O. Callender. Since 1893 Mr. Callender has not taken an active part in the company's operations, although he remained a member of the board until 1903.

G.

New England.

Boston, March 28.—By a new arrangement between the city of Boston and the Edison Electric Illuminating Company there will be a saving to the city in comparison with the cost under the old contract of $1,000 a month.

As the result of a report submitted to the Massachusetts highway commission, which has supervision over the telephone service in this state, by Prof. Dugald C. Jackson of the Institute of Technology, after an expert investigation made by him, the commission recommends a reduction in the toll rate in the metropolitan district, so-called, from 10 cents to 5 cents. This would affect a five-mile radius from the business section of Boston. It is also recommended that an inventory be made of the New England Telephone and Telegraph Company's property and a study of traffic conditions be made in order that the commission may have a basis upon which to proceed in its supervisory work.

The General Electric Company gave a banquet on Friday evening at the American House in Boston to about 300 electric-light station managers from all parts of New England. It was the ninth annual gathering of the kind under the company's auspices.

The tenth annual dinner of the Harvard Engineering Society was held at the Harvard Union in Cambridge on March 21st. J. R. Worcester was elected president of the new organization formed at this gathering, to be known as the Association of Harvard Engineers, which will further the interests of graduates of the engineering department of Harvard University. Prof. F. L. Kennedy of Harvard is the secretary.

Dr. Charles P. Steinmetz gave an address on "Electrical Conduction" at the meeting on Friday evening of the Worcester Polytechnic branch of the American Institute of Electrical Engineers.

The New England Street Railway Club held its eighth annual banquet Thursday evening at the Hotel Somerset, Boston. Matthew C. Brush was elected president. The other officers are: Vice-presidents, W. D. Wright, C. H. Hile, Charles E. Hubbard, J. Brodie Smith, F. H. Foote, E. A. Newman; secretary, John J. Lane; treasurer, H. L. Wood.

B.

New York.

New York city, March 28.—It is said that General Manager Oren Root of the Metropolitan Street Railway Company will try to improve the new pay-as-you-enter system by the addition of a nickel-in-the-slot machine on the iron railing which guides the way of the entering passengers. This plan, Mr. Root says, will allow the conductor to give more attention to starting and stopping the car and will insure the company getting all the fares.

Arrangements have been completed to extend the Electric Zone on the Hudson River division of the New York Central from High Bridge to Yonkers tomorrow. Daily meetings have been held between the electric and the operating departments, and instruction is being given to motormen, conductors and signalmen. It was originally planned to run trains to Yonkers by electricity on the first day of March, but the burning down of a factory from which important parts of the signal system are purchased has caused a delay of nearly a month. Work north of Yonkers is rapidly progressing, and before long the electric system will be in operation as far as Harmon.

The connecting of the Blackwell's Island Bridge and the cutting through of the last of the four

Pennsylvania tunnels are generally taken to indicate that the most needed transit facilities for the northerly part of Long Island are near at hand. With the bridge and all the tunnels completed some of the changes that will take place in the average man's time table are little less than astonishing. Between any two points in the two boroughs the saving in time will be not less than 15 minutes, taking the best means of transit now available, and the average gain will be fully half an hour. In certain cases, as for instance the trip between the Central Park Plaza and the center of Long Island City, a matter of less than two miles, the new routes will cut down the time nearly an hour.

The Board of Estimate has approved a plan to advertise for bids for the entire sections of the Fourth Avenue Subway in Brooklyn, instead of section by section.

The stockholders of the Interborough Rapid Transit Company have authorized an issue of $50,000,000 first-mortgage bonds in accordance with the plan announced some time ago. The creation of a mortgage to cover the proposed bond issue was opposed at the meeting by minority stockholders, but the management had greatly more than the amount of stock needed to carry the plan through, as the great bulk of the company's stock is owned by the Interborough-Metropolitan Company. W.

Ohio.

Toledo, March 28.—The village of Montpelier, Ohio, recently decided to issue bonds in the sum of $30,000 for the rebuilding of the municipal lighting and water plant. The proposition carried by a vote of 256 to 32.

An automobile carrying Mr. and Mrs. George Morely of Cleveland was demolished by a Lake Shore electric car after the occupants of the automobile had jumped for their lives. No one was injured.

W. Kelsey Schoepf, head of the Ohio Electric Railway Company, has refused to accede to the demand of the council of Bellefontaine that the West Columbus Avenue line be operated in return for a 25-year franchise for the Lima-Bellefontaine extension now in process of construction. The franchise question has reached an acute stage.

Electric wiring and fire alarms will be installed in all of the Toledo school buildings during the coming summer. The schools will be closed two weeks earlier than usual in order to give ample time for the work before the fall term opens.

Limited electric trains will be in operation between Toledo and the Ohio River by autumn. Construction work on the Lima-Toledo line will be under way in a few days and cars will be running between Toledo and Lima by June 1st.

H. L. S.

Illinois.

Peoria, March 28.—The Gilmore Arc Headlight Company of Chicago has been incorporated with a capital of $3,000 to manufacture headlights. The incorporators are Alfred C. Gilmore, Roscoe L. Wicks and Frederick Arnd.

The Vox Electric Company of Chicago has been incorporated with a capital of $2,500 to do a general contracting and construction business. The incorporators are O. P. Thompson, A. Christienson and E. T. Kennedy.

There is some talk of securing the passage of a bill in the State Legislature for the interchange of passenger and freight traffic between the steam and electric lines in this state.

The wall of the coal room of the electric-light plant at Mason City fell this week. The company was storing a large amount of coal in anticipation of a strike, and the extra weight was too much for the walls.

At Springfield the city is endeavoring to secure the building of a subway under the Chicago and Alton tracks by the steam road and the Consolidated Railway Company that operates the street cars in the city. Several plans have been proposed, and at a meeting of those interested the street-railway company, through the manager, Mr. Schmidt, submitted several propositions. The matter will be taken up by a special committee of the City Council.

V. N.

Pacific Sope.

San Francisco, March 25.—The American Institute of Electrical Engineers (San Francisco Section) recently made an inspection trip over the line of the Vallejo and Napa Valley Electric Railroad Company, extending from Vallejo to St. Helena, Cal. The observations will be reported at the next monthly meeting.

At the Northern California Power Company's annual meeting, held in San Francisco, last week, the directors and officers were re-elected. The annual report stated that although the past year was not as prosperous as was expected, there was a gain of $82,231 in gross earnings over the previous year. The gross earnings for the year ended February 29, 1908, were $297,061. "Had not the price of copper dropped to the very low figure which it did," said President Nobie, "we would have earned at least $50,000 additional. When copper declined [illegible] Copper Company and [illegible] Company [illegible] The Mammoth and Bully Hill companies [illegible] construction work at Kennett and the Balaklala shut down after spending over $[illegible] on its smelter, and being within 60 days of completion. The Balaklala has installed in the smelter [illegible] horsepower in motors and at its mine 225 horsepower. The Trinity Copper Company also has 350 horsepower in motors installed that will be in use when the Balaklala smelter is completed. Work will be resumed at once. In order to take care of this increased load we have run a second transmission line from Keswick to Kennet, through Coram, for the Balaklala smelter, 14 miles in length, and have erected and equipped a large substation at Coram for the Balaklala smelter; also a sub-station at the Balaklala mine large enough to take care of the Trinity Copper Company. We have extended our lines to the Sugar Loaf group for the Stauffer Chemical Company; also to Quartz Hill. At Heroult-on-the-Pitt we have put up a sub-station where I expect more power will be sold than on all the rest of our system. In behalf of our Battle Creek Power Company we have purchased the Hazen property of 2,360 acres, together with rights on South Battle Creek, which will enable us to develop 5,000 horsepower at very low cost."

An election will be held the latter part of April at Lodi, Cal., to vote on a proposition of issuing bonds to the amount of $76,000 for the purpose of putting in an electric-light and power plant.

Dr. E. L. Woods, who is promoting the construction of an electric-lighting plant at Socorro, N. M., has agreed on terms of the proposed franchise with the town authorities, and the franchise will now be formally applied for.

The city trustees of Richmond, Cal., have granted an electric-lighting franchise to the Richmond Light and Power Company.

The directors of the Portland Railway, Light and Power Company of Portland, Ore., have decided on extensive expenditures for improvements and extensions during the coming year. These include considerable track relaying and street paving, in accordance with city ordinances, new fenders, double-tracking the main passenger line of the Oregon Water Power Line, the bonding of tracks, track work at Salem, the putting in of meters, lamps, transformers, etc., in the electric-lighting and power departments, the building of a concrete dam around a portion of the falls at Oregon City, extensions to the car barns at Piedmont, Savier and East Akeny streets, and the erection of new car barns for the Oregon Water Power division at Golf Links Junction.

The Lovelock Light and Power Company of Lovelock, Nev., has closed a deal with Stephen R. Young by which the company leases for 25 years all of the power to be generated from the flow of Walker River at the Young Ranch, near Lovelock. The plans of the company call for the building of a 10,000-volt transmission line from the ranch to the town of Lovelock, where a transformer house will be built.

A.

PERSONAL.

Mr. H. C. Porter of Wheeling, W. Va., has taken charge of the commercial business of the Lincoln (Neb.) Gas and Electric Light Company.

Charles E. Brown of the Central Electric Company, Thomas I. Stacey of the Electrical Appliance Company and James Wolff of the New York Insulated Wire Company constitute the subdivision on electrical goods of the ways and means committee of the Chicago Association of Commerce.

Major-general A. W. Greely, U. S. A., formerly chief signal officer of the army, having reached the age of 64 years on March 27th, was transferred to the retired list in accordance with the law. He was recently relieved of command of the Department of the Lakes at Chicago and is now traveling in the Orient on leave of absence. General Greely's exploits as an Arctic explorer are well known. He also kept in touch with many phases of electrical development by reason of his interest in the Signal Service.

Mr. W. R. Bonham, until recently head of the lamp department of the Chicago district of the Westinghouse Electric and Manufacturing Company, has resigned that position to accept the Chicago agency of the Sterling Electric Manufacturing Company of Warren, Ohio, maker of incandescent lamps. Mr. Bonham will undoubtedly handle other specialties and conduct a manufacturer's agency in Chicago. He is an experienced lamp man, with a number of years of Chicago experience, and he leaves the Westinghouse service with the kindest of feelings on both sides.

ELECTRIC LIGHTING.

Kewaunee, Wis., will vote on a bond issue of $20,000 for an electric-light plant.

The Lee Electric Company of Baltimore, Md., has been incorporated with a capital of $50,000. Arthur L. Bosley, 221 North Calvert Street, Baltimore, [illegible]

The [illegible] Electric Light and Power Company has been organized with a capital stock of $[illegible]

[illegible] has purchased the power and light plant of the Hazen[illegible] Mining Company, at [illegible], Mo.

Plans are being prepared for the [illegible], Mo., for an electric-light plant to cost about $25,000.

The Atchison Electric Railway, Light and Power Company expect to spend about $[illegible] in improvements this year.

The city of Stillwater, Tex., will vote on April 7th on a proposition to issue $7,000 of bonds for extending the electric-light plant.

The R. A. Horlock Company of Navasota, Tex., will establish an electric-light plant in connection with its ice plant and cotton gin.

R. H. Norris and associates of Childress, Tex., have incorporated as the Childress Ice and Light Company, with a capital of $40,000.

The proposition to make an additional tax assessment for electric lights in Smithville, Mo., was carried by a vote of nearly four to one.

F. H. Kennedy and associates of Cotton Plant, Ark., have incorporated the Cotton Plant Light and Power Company with a capital of $10,000.

The Montgomery Electrical Company of Christiansburg, Va., has organized with J. L. Vaughn of Roanoke, Va., as president, and T. W. Simpson, chief engineer. The new company has bought and will develop the properties of the Grayson Electric Company and the municipal plant at Christiansburg.

Commonwealth Edison stock advanced on the Chicago exchange from 91 to 95 as the result of the recent passage by the City Council of the rate ordinance. The stock was firm at the closing figure. At present the stock pays five per cent., but there are persistent rumors that the eight per cent. rate of the old Chicago Edison Company will be revived in time.

The Consolidated Light and Power Company, operating plants at Lewisburg and Ronceverte, W. Va., has recently purchased a 150-kilowatt Allis-Chalmers alternating-current generator, 60-cycle, two-phase, together with exciter and transformers. The new equipment is intended to supplement that already installed, which includes a 115-kilowatt Allis-Chalmers machine placed in service some three years ago.

The North Shore Electric Company, which already serves an extensive territory, is to extend its service still further and for that purpose will put out more stock. At the same time the earnings of the company have increased in a ratio to have warranted the directors to put the $3,250,000 stock now outstanding on a dividend basis. A quarterly payment of three-fourths of one per cent. has been ordered payable May 1st to holders of record April 17th. The company in its statement for the year ended last September shows gross earnings of $665,890 and net $234,435.

ELECTRIC RAILWAYS.

A dispatch from Los Angeles, Cal., says that E. H. Harriman has taken over all interests of H. E. Huntington in steam and electric railways in Los Angeles and Southern California, paying $50,000,000 for the properties, which include the Pacific Electric, Los Angeles-Pacific, Los Angeles Railway Company, Los Angeles Interurban Railway Company and Los Angeles and Redondo Railway Company. Mr. Harriman will also control the Pacific Light and Power Company, it is said. According to the terms of the agreement, Mr. Huntington will retire from active participation in the management of the great properties which he has built up in Southern California.

The Winnebago Traction Company of Oshkosh, Wis., which operates the Oshkosh Interurban, the Oshkosh-Omro Interurban and the Oshkosh City lines, has recently purchased from the Allis-Chalmers Company car equipments for new rolling stock lately acquired. These equipments comprise type R-50 railway motors with double-end control and the usual auxiliaries, including circuit-breakers, lightning arresters, trolleys, car-lighting and power wiring. The motors are each capable of developing a normal output of 55 horsepower, with 500 volts at the motor terminals. The field frame or yoke is built in two parts, divided horizontally through the armature and axle bearings. It is made of cast steel of high magnetic permeability. The lower half of the field is provided with hand holes at each end for inspection and measurement of clearance between armature and poles. The field coils are of the mummified type. During the process of winding they are filled with a special compound which closes all open spaces between turns and leaves no air cells or pockets; this greatly aids the passage of heat from the interior of the coil. A quadruple equipment of these R-50 motors will

operate cars about 45 feet long, weighing approximately 45,000 pounds, without load or equipment, in interurban service with an average of one stop per mile at a schedule speed of 23 miles per hour. A maximum speed of 35 miles per hour can be obtained.

Charles K. Mohler, engineer, has been engaged as consulting engineer by the Loop Protective Association, Chicago. Mr. Mohler has made an extensive examination of the Loop questions and will proceed to make a thorough investigation for the purpose of discovering to what extent and in what way the present nuisance features can be modified or eliminated. He is working on plans for a station entirely beneath the elevated structure which would give considerably more station room.

Through cars will be in operation between Peoria and Springfield in a few weeks on the line of the Illinois Traction System. Temporary crossings of the steam lines at Lincoln have been made until the overhead crossing can be built, and cars from Mackinaw are now running to the station in Lincoln. The ballasting of the 23 miles of road between Mackinaw and Lincoln will be finished early this summer, and then the through business from Peoria to St. Louis and Springfield can be handled to better advantage as to time.

POWER TRANSMISSION.

The Broad River Power Company of Elberton, Ga., proposes to build a hydro-electric power plant on the Broad River, from which it will transmit current to lighting and manufacturing plants. A. S. Stovall, A. S. Oliver and associates of Elberton are interested.

It is understood that W. J. Massee of Macon, Ga., president of the Central Georgia Power Company, has completed arrangements with A. B. Leach & Co. of New York for financing the power company, including bonds for $16,000,000 and stock for $20,000,000. Contracts for the construction of the proposed waterpower electric plant will therefore be let soon, it is said. The company's ultimate development will be for 125,000 to 150,000 horsepower on Oconee, Ocmulgee and Flint rivers, the electricity to be transmitted over an extensive territory for manufacturing and lighting. The first plant will be near Jackson, where 18,000 horsepower is available. This plant, including dam, power house, waterpower and electrical machinery, transmission lines, steel towers, etc., is estimated to cost $1,850,000.

WIRELESS COMMUNICATION.

A bill introduced in Congress by Senator Hale would require a Federal license for foreign and interstate communication by wireless telegraphy, which is to be put completely under the jurisdiction of the government and can be abolished by the president in times of war. The bill would impose a license on land stations of $100 a year and a license of $5 a vessel on all equipped with wireless apparatus. The act makes it the duty of every person or corporation using or operating wireless systems under a license issued by the United States to answer wireless calls and signals from any other person or corporation so licensed.

PUBLICATIONS.

The Boss Manufacturing Company of Kewanee, Ill., has issued catalogue No. 3, showing a very large line of workingmen's gloves and mittens. Some of them are applicable to linemen, motormen, etc.

The Wire and Telephone Company of America, Rome, N. Y., has issued a "Copper History" folder, giving the monthly and yearly average selling prices of copper since 1883. It will furnish a copy for the asking.

The annual report of the Chicago Association of Commerce has been issued in a neatly printed and well-designed booklet. This excellent organization has done good work in advancing the commercial interests of Chicago, and its rapid growth is deserved.

A new miniature arc lamp known as the Queen Acme Arc is described in a leaflet sent out by Queen & Co., Inc., of Philadelphia, Pa. This lamp [illegible]

[illegible] H. W. Johns-Manville [illegible] Street, New York [illegible] is said to be the most economical, and can be de- [illegible]

[illegible]

and alternating-current motors and generators suitable for such an installation are also described and illustrated.

The Blake Signal and Manufacturing Company of Boston has published a folder on Blake insulated staples and Blake compressed cleats. These are both designed for low-voltage circuits and have many desirable features. The cleats are for use on plaster or other places where the staples cannot be used.

The Commutator Company of Minneapolis, Minn., manufacturer of "Hard Drawn" commutator segments, has just issued a small folder, entitled "Segment Essentials," in which is explained the numerous requirements a commutator segment must meet to establish its claim to merit. The folder can be obtained free of charge by addressing the company.

In Bulletin No. 5910-4 from the Western Electric Company, entitled "Power Equipment for Breweries," the superiority of electric motor drive is again made apparent. The various types of motors adapted to brewery service are described and illustrated, and there are some good pictures of a number of representative installations of Western Electric equipment for breweries.

The F. Bissell Company of Toledo, Ohio, has ready special list No. 27 of bargains in electrical machinery, including direct-current and alternating-current motors, dynamos, as well as circuit-breakers, switches, meters, belting, etc. The company is also sending out a little booklet on credit that will be of interest to all business men at this time and probably to electrical men more particularly.

"Unilets" is the title of catalogue No. 4, prepared by the Appleton Electric Company of Chicago. Thirty-two pages are filled with a complete list of Unilet conduit fittings of all kinds, including nipples, receptacles, snap-switches, etc. While those listed are intended for rigid conduit, the company also makes these fittings for flexible conduit. This catalogue is a valuable one for electrical engineers, contractors and jobbers.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has prepared a circular especially for the guidance of purchasers of telephone apparatus in becoming better acquainted with the superior features of "Quality Apparatus," particularly in the form of an improved self-restoring gravity drop switchboard for magneto telephone service. Telephone managers and users will find much of interest in the detail description and illustrations of the No. 8 self-restoring gravity drop and 150-line unit type magneto switchboard contained in the circular.

SOCIETIES AND SCHOOLS.

The next meeting of the Electrical Section of the Western Society of Engineers will be held on April 10th, when "The Relation Between the Banker and the Engineer" will be discussed by Mr. J. C. Kelsey.

At an extra meeting of the Western Society of Engineers, held on March 25th, Mr. J. N. Darling presented a paper on "Some Features of Construction of the South Side Elevated Railway." The points touched on were principally structural details in connection with the recent extensions and third-track work on the road.

In less than a week after circulars were sent out announcing the exhibition in connection with the Chicago convention of the National Electric Light Association nearly one-half of the exhibition space available was applied for. This interest and cooperating promptness on the part of the associate members would already seem to assure the success of the exhibition. Mr. Walter Neumuller, 55 Duane Street, New York city, is secretary of the exhibition committee.

MISCELLANEOUS.

Prof. R. W. Wood, of the chair of experimental physics at Johns Hopkins University, has made a discovery which he hopes to apply to the improvement of stage scenic effects. Dr. Wood calls his invention the optical intensification of paintings. It is a device arranged by lanterns and slides for heightening scenic color effects.

The United States Civil Service Commission announces an examination on April 15, 1908, to secure eligibles from which to make certification to fill a vacancy in the position of engineer (with knowledge of ice machinery, pumping and electrical plants), $900 per annum, Indian service, Colorado River Agency, Arizona, and vacancies as they may occur in the Indian service.

The Marconi Wireless Telegraph Company of America in its balance sheet as of January 31 shows cash on hand and in bank amounting to $1,757; accounts receivable, $17,947, and stocks of [illegible] on hand valued at $16,854. The cost of stations and experimental work, less depreciation, [illegible], and the value of patent rights, contracts, and good-will at $5,491,855. Deficit ac- [illegible] $422,422 [illegible]

and accounts payable and legal expense account of the London company add $34,645 to liabilities, bringing the total up to $6,079,445.

To what extent electric mining machinery has been introduced from America into Mexico and has aided in a practical revolution of the entire mining industry of that country may be estimated from the fact that in one of the mining camps at Guanajuata, the Pinginco mines, no less than 250 Westinghouse electric motors, ranging in capacity from 5 to 200 horsepower, are now being operated.

TRADE NEWS.

The supervising architect, Washington, D. C., will receive sealed proposals until April 25th for an electric passenger elevator in the postoffice and court house at Green Bay, Wis. Drawings and specifications may be obtained at the above office or at the office of German & Lignell, architects, at Duluth, Minn.

From Boston comes the report that the volume of new business being booked by the General Electric is at the rate of $40,000,000 a year, against a low point in December, not exceeding $30,000,000. It is declared there is no question whatever about the intention of the directors to pay the regular eight per cent. dividend throughout 1908.

The Central Electric Company of Chicago is now delivering the first installations of the new arc-lighting equipment for the city of Chicago. This is one of the largest arc-lighting equipments that has been secured for some time, covering approximately 900 G. I. series alternating-current lamps, 16 50-light oil-type arc-light regulators and approximately 800 kilowatts of transformers.

At the special meeting of stockholders of the Strowger Automatic Telephone Exchange and of the Automatic Electric Company, held on March 27th, the consolidation of the companies was unanimously approved. A new Illinois corporation is to be formed, known as the Automatic Electric Company. The capital stock will be $5,000,000 and the bonded debt $1,000,000. These bonds will be exchanged for the stock of the Strowger concern.

Reports from Pittsburg state that the receivership for the Westinghouse Machine Company, created last October, was vacated on March 31st by Judge James S. Young of the United States Circuit Court on petition of the company and the receivers. On April 1st the property was turned back to the stockholders, and the company began its fiscal year free from debt, with cash in bank and orders to justify operating the plant on about a 75 per cent. basis.

BUSINESS.

The Westinghouse Electric and Manufacturing Company, through its export department, has received a contract from the Dominion Iron and Steel Company of Halifax, N. S., for a 500-horsepower electric generator which will be used in the operation of one of the company's iron mines on Belle Isle, Newfoundland.

Among the orders recently received by the General Electric Company are the following: Three hundred four-motor equipments for the Chicago Railways Company; three 1,000-kilowatt, 2,300-volt, three-phase alternators for the Manchurian railway, Corea; 25 GE-202, 600-volt, two-motor equipments and 40 type H oil-cooled transformers for the Sao Paulo Light and Power Company, Sao Paulo, Brazil. A shipment of two 50-kilowatt, cross-compound marine sets, together with switchboards and necessary instruments, has been made to Olongapo, Philippine Islands. These will be used in the United States government floating dry-dock Dewey, which recently made the trip around Cape Horn.

DATES AHEAD.

Iowa Electrical Association (annual meeting), Savery Hotel, Des Moines, April 22d and 23d.

Iowa Street and Interurban Railway Association (annual convention), Savery Hotel, Des Moines, Iowa, April 23d and 24th.

Missouri Electric Light, Gas and Street Railway Association, Marquette Hotel, St. Louis, April 23d, 24th and 25th.

Omaha Electrical Show, Auditorium, Omaha, Neb., May 4th to 9th.

Nebraska Electrical Association (annual meeting), Omaha, Neb., May 6th and 7th.

Missouri Independent Telephone Association, Kansas City, May 6th and 7th.

Southwestern Electrical and Gas Association (annual meeting), El Paso, Tex., May 7th, 8th and 9th.

National Electric Light Association (annual convention), Auditorium Hotel, Chicago, May 19th to 22d.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 20th and 21st.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Chicago Electrical Show (fourth annual), Coliseum, Jan [illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 24, 1908.

882,553. Block signal System. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 9, 1905.

In this system there are separate transformers for supplying current to the track circuits of the several blocks, relays each comprising two coils, one connected to the rails of a block and the other connected to the transformer that supplies the track circuit of an adjacent block, and signals controlled by the relays.

882,554. Signal. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company. Application filed February 17, 1906.

In a signal for electrically operated roads employing separate circuits for the power current and signal current, there are provided means for shifting the signal mechanism operated by power current, and means operated by current from the signal circuit for locking the signal when shifted.

882,555. Electric Sign. Samuel E. Doane, Cleveland, Ohio. Application filed April 25, 1907.

An illuminated sign, such as that of the National Electric Lamp Association, has the characters and the field forming the background therefor composed of incandescent lamp bulbs, the bulbs of the characters and those of the field being contrasted in color.

882,564. Electric Heater. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company. Application filed August 3, 1907.

The heater has a number of disks, each consisting of a resistance strip mounted upon a support in the casing and extending back and forth therefrom, and connections whereby a continuous path for the current is established throughout the disks.

882,565. Brush Holder. Fred B. Howell, Schenectady, N. Y., assignor to the General Electric Company. Application filed June 4, 1906.

In this brush holder there is a tension spring comprising a steel helical body portion, and a brass helical separator threaded into it, so that the turns of the spring and the separator lie side by side and are free to move relatively to one another.

882,569. Rheostat. Charles D. Knight, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 18, 1907.

This is a starting and speed-regulating rheostat for a shunt motor. The armature and field resistance contacts are in separate arcs engaged by the same contact arm, which carries an armature that engages the release magnet as soon as the starting resistance is cut out and then permits the arm to move over the field contacts.

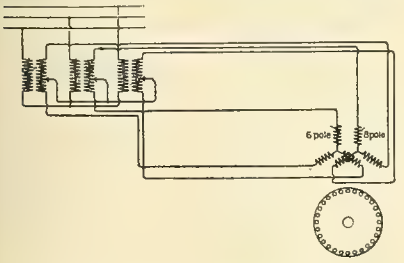
882,570. Burglar Alarm. Cosmo Liaci, New Haven, Conn. Application filed June 6, 1907.

The alarm comprises a movable spring-controlled contact device included in an electric circuit, connections between the same and the point to be protected for actuating the contacts against the action of the spring to close the circuit, other contacts operated by the spring for closing the circuit, and a removable insulating retaining device introducible between the contacts.

882,573. Storage Battery. William L. Merrin, Fredericktown, Ohio. Application filed October 5, 1896.

This storage battery has a container of corrugated sheet iron, an electrode shell therein of corrugated sheet iron, an electrolyte having no chemical effect on the container and electrode shell, and active material in the shell.

882,581. Induction-motor Control. Karl A. Pauly, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 9, 1906.



NO. 882,581.—INDUCTION MOTOR CONTROL.

The method of operating at varying speeds an induction motor, having two windings of different pole numbers, consists in connecting both windings to a source of voltage so as to cause them to produce simultaneously in the motor tendencies to run at two different speeds and varying the relative torques produced by the two windings. (See cut.)

882,582. Process of Producing Manganese Silicide. Edgar F. Price, Niagara Falls, N. Y., assignor to the Central Trust Company of New York. Application filed November 14, 1905.

A continuous process of producing manganese silicide consists in smelting a charge containing compounds of manganese, silicon and carbon by means of an electrically heated resistance conductor, withdrawing the molten product from the furnace, and supplying the charge-mixture as required.

882,586. Electrical Recording Instrument. Lewis T. Robinson, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 29, 1902.

The instrument has a moving element suspended by a spring and comprising an armature, a flexible jointed arm and a recording pen having a siphon capillary feed carried by the [illegible] beneath the pen.

882,587. Cable Reel. Edmond Rosenberg, Paris, France, assignor to the General Electric Company. Application filed August 16, 190[illegible].

A movable vehicle carries a cable reel. A flexible cable has one end connected to the reel and the other connected at a fixed point. [illegible] between the reel and the axle of the vehicle.

882,602. Controlling Switch. Harold [illegible] White, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 18, 1906.

In combination with a rotary drum [illegible] engaging therewith are individual [illegible] coils connected directly in series with the several fingers, one end of each coil being connected to its core. There are also auxiliary pole pieces in magnetic and electrical contact with the cores of the coils [illegible] main pole pieces [illegible] from the auxiliary [illegible] by insulation and magnetized inductively thereby.

882,606. Induction-motor Control. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 7, 1906.

This is a modification of No. 882,581, which consists in supplying current to both primary windings and varying simultaneously and oppositely the impedances of the circuits of the secondary windings.

882,607. Magnetic Clutch. Robert Anderson, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 18, 1906.

This clutch has a magnet with an energizing winding and two mechanically connected armatures on opposite sides of the magnet and movable toward each other into engagement with the magnet, which is arranged to attract them both simultaneously.

882,609. Bonding Pin. Frederick H. Ayer, Chicago Heights, Ill. Application filed February 23, 1907.

A rail-bonding pin has a circular cross section with a triangularly shaped longitudinal channel cut out to receive the bond wire.

882,610. Adjustable Electrical Resistance. Frederick O. Ball, Plainfield, N. J. Application filed November 21, 1907.

Upon an insulating base is mounted a series of clamps insulated from each other. A series of resistance loops is arranged in the clamps, one side of each loop being secured by one clamp, and the opposite side by another clamp, so as to carry the current from clamp to clamp, the loops being adapted to be adjusted as to length in the clamps.

882,639. Controlling System for Electric Motors. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed April 3, 1905.

In combination with a motor and a reversing switch therefor, which is normally maintained in its open circuit position, are holding-magnet windings that retain the reversing switch in its closed circuit position while the counter electromotive force generated by the motor exceeds a predetermined amount.

882,640. Advertising Indicator. Charles E. Johnson, Indianapolis, Ind. Application filed July 15, 1907.

A pair of reels and a web carried thereby are provided with a pair of magnetic clutches, one for each reel, a motor for driving the clutches, and means controlled by the movement of the web for alternately energizing the clutches.

882,658. Control System for Electric Motors. Hermon L. Van Valkenburg, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed September 2, 1904.

Means are provided for connecting a resistance either between the leads from successive points of subdivision of a transformer winding or in series with the leads.

882,673. Lightning Arrester. Walter T. Goddard, Victor, N. Y., assignor to the Garton-Daniels Company, Keokuk, Iowa. Application filed August 7, 1905.

In this arrester there is a resistance, a binding post mounted on the base near one end of the resistance, and a single supporting means arranged near the other end farthest away from the binding post for supporting the resistance, so that a large surface distance is interposed on the base between the support and the binding post.

882,675. Announcing or Station Indicator for Railroads and Street Cars. William S. Gunter, Swedeburg, and Carrie E. Wilton, Fairbury, Neb. Application filed October 18, 1906. Renewed January 30, 1908.

An apertured casing has an indicating apron mounted therein, a roller for moving the apron in either direction, electrically controlled actuating means for the roller provided with a clutch, a shouldered crank disk, a rod connected therewith for actuating the clutch, shouldered bars adapted to engage with the disk, and means for moving them to release the disk.

882,681. Electromagnetic Toy Engine. Harry G. Hawekotte and Henry W. Klausmann, Indianapolis, Ind. Application filed December 18, 1907.

The electromagnet has cores attached to the under side of a yoke which act on a set of armatures mounted on a wheel. Contact pins and a contact finger provide for intermittent action of the magnet.

882,682. Commutator for Polyphase Currents. Alexander Heyland, Brussels, Belgium. Application filed January 21, 1903.

In combination with a commutator are brushes bearing thereon, circuits connected to a portion of the seg-[illegible]

882,6[illegible]. [illegible] Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed April [illegible], 190[illegible].

[illegible]

882,69[illegible]. System for Automatically Stopping Cars or Trains. Edward L. [illegible], New York, N. Y., assignor to George M. [illegible], New York, N. Y. Application filed February 8, 1906.

In this system there is a track electromagnet and a coil carried by the car or train wherein an induced current is set up by passage over the magnet when the latter is energized. Means are controlled by the induced current to effect the stoppage of the car or train.

882,699. Electrical Receptacle for Plants. Harry S. Latshaw, Jersey Shore, Pa. Application filed January 24, 1906.

The receptacle comprises a body provided with a negative and a positive element surrounded by the body, and a metallic connector embedded within the body and connecting the negative and positive elements.

882,716. Igniting Device for Gas Engines. John V. Rice, Jr., Bordentown, N. J. Application filed June 5, 1906.

A yielding oscillating electrode consists of a contact finger with a lug at the end that engages stationary hooked jaws.

882,717. Combined Trolley-wheel and Sleet-cutter. Edmund M. Schollenberger, Chicago, Ill., assignor of one-half to August C. Berwanger, Chicago, Ill. Application filed October 30, 1907.

The trolley wheel is in three sections, the central part being longitudinally adjustable on the axle and fitting into a recess in each flanged part.

882,733. Electric Furnace. Edwin Appleby, Chicago, Ill. Application filed March 26, 1906.

A vertical cylinder is mounted in a frame so that it can be lowered below the electrodes, placed into trunnions and tilted to discharge the contents.

882,744. Signaling Device. Spencer C. Cart, Spokane, Wash. Application filed April 6, 1907.

The device consists of a vertical spring roller mounted on a support, a signal flag wound upon the roller, and an electric motor for unwinding and holding the flag extended, and for rewinding the flag upon the roller, actuated by the closing and opening of an electric circuit.

8882,752. Letter-box Alarm and Indicator. Oscar F. Erickson, Berkeley, and Richard H. Bradshaw, Oakland, Cal. Application filed September 5, 1907.

An alarm is rung when the lid or door of the box is opened.

882,753. Trolley-wheel. Daniel D. Grant, Pittsfield, Mass. Application filed February 11, 1907.

The wheel has a core upon either side of which is a circular guard plate holding a series of anti-friction rollers between the body and core of the wheel.

882,758. Fire-alarm System. Henry H. Hillier, Pasadena, Cal. Application filed April 13, 1907.

In a signaling device there are a number of rotative disks; a contact adapted to engage with any of the disks; means to rotate and to lock the disks from rotation; means to automatically release the disks when the contact is placed in engagement with one of the disks.

882,788. Electric Furnace. Albert L. Marsh, Lake Bluff, Ill., assignor to the Hoskins Company, Chicago, Ill. Application filed September 19, 1907.

The lining of this furnace forms a variable-resistance rheostat constituting the furnace resister and consisting of contacting bodies of solid electro-conductive material in series, with compressing means for the sections adapted to increase and decrease the pressure contact between the bodies.

882,803. Insulator. Leonard W. Storror, San Francisco, Cal. Application filed January 2, 1906.

A doubly petticoated insulator has an independent insulating ring fitting around and below the inner petticoat but spaced apart therefrom.

882,806. Adding Machine Attachment. Harold R. Wellman, Riverside, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed September 30, 1905.

In a calculating machine there is a crank arm connected to the driving shaft, a motor and circuit therefor, a gear-wheel driven thereby, a rod connecting the gear-wheel and crank arm, a switch carried by the crank arm for cutting the motor in or out of circuit, and a key accessible to the operator of the machine for closing the switch.

882,833. Trolley-harp. Frank M. Mudler, Pittsburg, Pa. Application filed December 5, 1907.

In this harp there is a pair of slotted separable sections, one at each side of the trolley, and a projection on each section arranged to enter the slot in the other section to lock the sections together.

882,835. Device for Attaching Cross-arms to Telegraph Poles. John E. McGillivray, Walla Walla, Wash. Application filed January 21, 1907.

The device consists of a body part and a shelf and lug made of sheet metal, the lug and shelf being cut one from the other, and the shelf struck up at right angles to the lug and body part.

882,848. Snap-switch. William M. Scott and James H. Wyatt, Philadelphia, Pa.; said Wyatt assignor to said Scott. Application filed September 10, 1907.

In combination with a contact-carrying member is a locking member engaging the same, a latch for restraining this member, a switch-actuating member, and a loose cam member operated by the latter, the loose cam member being adapted to actuate the latch to release the locking member.

882,850. Lineman's Portable Telegraph and Telephone Pole Seat. Charles T. Troell, Seguin, Tex. Application filed May 11, 1906.

Curved clamp-bars are secured to the seat frame and arranged to embrace the pole to engage it through spikes. The ends of the clamp-bars are joined by an eye-bolt and hooked lever.

882,872. System of Electrical Distribution. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battery Company. Application filed January 17, 1906.

The system consists of a main generator, storage battery and booster, a coil controlling the booster electromotive force, energized by the resultant of opposing potential differences and means for applying another potential difference to the coil operated by changes of electrical condition in the circuit containing the coil.

882,876. Spark-timing Apparatus. Charles C. Dodge, Wollaston, Mass., assignor to the Dodge Lubricator Company, Boston, Mass. Application filed November 29, 1905.

This timing device comprises a casing formed of insulating material, flat stationary contacts having their faces in the same plane, an arbor, an arm pivoted to the arbor, a roll journaled on the end of the arm and a spring bearing against the free end of the arm.

882,878. Coal and Rock Drill. Henry R. Ford, Buffalo, N. Y. Application filed December 17, 1906.

This drill is driven by an electric motor.

882,892. Electrical Protective Apparatus. James A. Kenny, Chicago, Ill. Application filed January 7, 1904.

The apparatus has two pairs of carbon-holders, a base supporting the lower holder of each pair, a connection uniting the upper holder of each pair, a spring for separating the carbon-holders and a screw mechanism for simultaneously adjusting the carbon-holders and their carbons relatively to each other.

882,966. Trolley. Henry C. Reynolds, Portersville, Cal., assignor of one-half to Albert J. De Laney, Portersville, Cal. Application filed August 24, 1907.

The trolley head is pivoted for lateral movement on the pole. A pinion is mounted in the trolley head, and a segmental gear at the entering end of the trolley pole, the teeth whereof mesh with the pinion and are eccentric to the pivot for the pole.

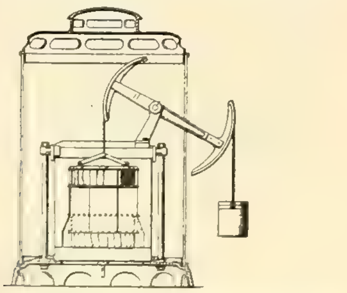
882,979. Strain Insulator. William C. Terry, Boston, Mass., assignor to the Macallen Company, Boston, Mass. Application filed February 14, 1907.

This insulator is provided with an end cap having thereon two side walls, cross-pieces between the side walls, between and about which the wire to be attached to the insulator passes and a lug to be bent about the wire.

882,990. Resistance Unit. Lawrence E. Barringer, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 30, 1907.

The resistance member consists of alundum, graphite and clay, an enamel upon the surface of the member and means for making electrical contacts with the ends of the rods.

883,007. Alternating-current Regulator. Augustine R. Everest, Rugby, England, assignor to the General Electric Company. Application filed July 13, 1906.



No. 883,007.—CONSTANT CURRENT TRANSFORMER.

A [illegible] transformer has a primary and a secondary winding, means for allowing the windings to [illegible] each other upon increase in current and to approach each other upon decrease in current in the [illegible], and means for varying the mean [illegible] in the path of the leakage flux [illegible] the windings change their relative [illegible]

[illegible] Charles J. Fox, London, England. Original application filed April 3, [illegible] Divided and this application filed January [illegible]

[illegible]

[illegible] G. Gr[illegible] St. John, New [illegible] Application filed Septem[illegible] 1907.

[illegible]

883,026. Signaling on Railways. Charles M. Jacobs and Robert J. Insell, Reading, and Ernest A. B. Bowden, Hanwell, England. Application filed August 9, 1907.

A ramp on the track engages a lever carried by the train which mechanically operates the whistle. An electromagnet when energized through a circuit including the ramp restrains the whistle.

883,029. Engine-stop. Vernon J. King, Lorain, Ohio. Application filed May 3, 1907.

A valve carries a drum on its stem. A bracket on the supply pipe has a locking device directly engaging the drum. An electromagnet controls a latch fulcrumed on the bracket, and a motor is connected with the drum for actuating the valve.

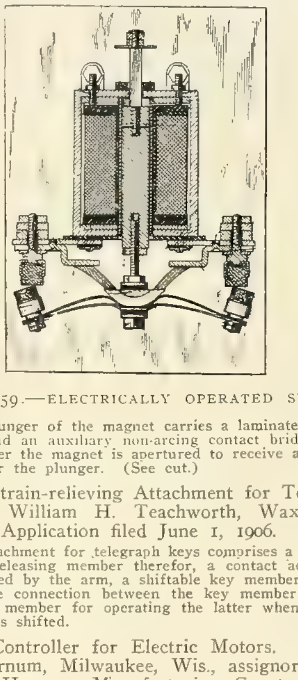
883,030. Vapor Electric Apparatus. Osias O. Kruh, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 15, 1905. Renewed January 31, 1908.

A mercury-vapor rectifier has an exhausted tube with a cathode and a number of anodes located therein, and a tube for carrying the blast or discharge from the cathode past the anodes.

883,043. Dynamo-electric Machine. John P. Nikonow, Pittsburg, Pa. Application filed April 13, 1907.

A dynamo-electric machine has a number of poles, each formed of a series of cores constituting parts of distinct magnetic circuits, the cores being arranged to cause the magnetic circuits to flow from the far side of one pole to the adjacent side of the next pole.

883,059. Electrically Operated Switch. Henry F. Starrett, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed February 7, 1902.



No. 883,059.—ELECTRICALLY OPERATED SWITCH.

The plunger of the magnet carries a laminated contact bridge and an auxiliary non-arcing contact bridge. The frame over the magnet is apertured to receive a resilient buffer for the plunger. (See cut.)

883,062. Strain-relieving Attachment for Telegraph Keys. William H. Teachworth, Waxahachie, Tex. Application filed June 1, 1906.

An attachment for telegraph keys comprises a vibratory arm, a releasing member therefor, a contact adapted to be engaged by the arm, a shiftable key member, and an adjustable connection between the key member and the releasing member for operating the latter when the key member is shifted.

883,078. Controller for Electric Motors. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed March 2, 1904. Renewed February 21, 1906.

An electromagnetic switch for controlling the motor has means operated at predetermined periods for actuating the switch.

883,088. Telephone Instrument. Clifford E. Cole, Birmingham, Ala., assignor of one-half to Sarah A. White, Birmingham, Ala. Application filed January 10, 1906.

The receiver head has a bell-shaped mouth and a transverse slot intersecting it in combination with an imperforate slide engaging the slot and capable of being moved bodily into the path of the mouth of the instrument.

883,093. Divided Central Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 15, 1903.

In this common-battery system there is a resistance at each sub-station of the line and means under the control of the subscriber to close circuits from the central source over the telephone line and at will to include or exclude the resistance to thereby selectively operate different line signals.

883,110. Electric Furnace. Herman L. Hartenstein, Constantine, Mich., assignor to the Continental Investment Company, Duluth, Minn. Application filed November 30, 1906.

Stationary electric leads extend through the wall of the furnace chamber. Movable means are provided for supporting and operating the electrodes situated wholly within the chamber and electrically connected with the leads.

883,114. Vapor Electric Apparatus. Osias O. Kruh, Schenectady, N. Y., assignor to the General Electric Company. Application filed October 18, 1905.

In this mercury-vapor apparatus there are shields for [illegible] the electrodes, the shields being arranged one about the other and provided with openings located to produce a change in direction of the arc stream going to the electrode.

883,140. Process of Electrolyzing Aqueous Solutions of Stannic Chloride. Franz von Kugelgen, Holcombs Rock, Va., and George O. Seward, New York, N. Y. Application filed June 10, 1907.

The process consists in conducting the electrolysis in a diaphragm cell until stannic hydroxide and hydrochloric acid accumulate in the anolyte and catholyte, respectively, removing the electrolyte from the cell and combining the accumulated products with the production of stannic chloride.

883,141. Process of Electrolyzing Aqueous Stannic-chloride Solutions. Franz von Kügelgen, Holcombs Rock, Va., and George O. Seward, New York, N. Y. Application filed June 10, 1907.

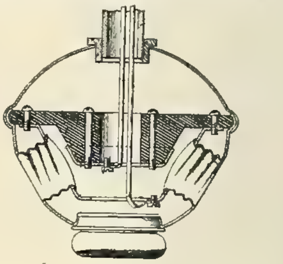
This is a modification of the above.

883,150. Actuating Mechanism for Electric Switches. Harry B. Snell, Toledo, Ohio, assignor to the Snell-Judd Company. Application filed January 26, 1907.

A notched disk driven by clockwork engages a pair of parallel levers that periodically govern the rotation of a cam disk connected with the switch.

REISSUES.

12,765. Plural-lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed February 6, 1908. Original application filed May 20, 1898. Renewed August 10, 1901. Original No. 721,774, dated March 3, 1903.



No. 12,765.—PLURAL-LAMP SOCKET.

In combination with an insulating base and a metallic contact plate mounted thereon are a number of metallic threaded shells for the lamp bases, supported thereon and in electrical contact therewith, and contacts for the central-lamp terminals arranged opposite the respective shells. (See cut.)

12,766. Plural-lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed February 6, 1908. Original application filed May 20, 1898. Renewed August 10, 1901. Divided and application filed February 7, 1902. Original No. 721,777, dated March 3, 1903.

This patent covers further details and modifications of the previous one.

12,767. Electrically Operated Baggage Truck. Tracy V. Buckwalter, Altoona, Pa. Application filed February 19, 1908. Original No. 875,893, dated January 7, 1908.

The truck has a frame with four relatively fixed points of support, wheels having pivotal connections with the frame at these points, mechanism connecting the wheels so that they are moved together about their respective pivotal connections and a lever at each end of the truck for operating the mechanism.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 31, 1908:

449,106. Telephone Circuit and Apparatus. J. J. Carty, New York, N. Y.
449,108. Electric Cash Indicator and Recorder. W. F. Z. Desant, New York, N. Y.
449,125. Electric Metallic Pole and Electric Wires. C. A. Lieb, New York, N. Y.
449,174. Telegraph Transmitter. H. G. Robbins, Minneapolis, Minn.
449,180. Telephone Sound Transmitter. A. E. Schatz, New York, N. Y.
449,186. Thermo-electric Battery. J. N. Webb, Birmingham, Ala.
449,188. Electric Switch. William White, London, England.
449,196. Electric Railway Conduit. F. O. Blackwell, New York, N. Y.
449,197. Electric Motor Truck. F. O. Blackwell, New York, N. Y.
449,206. Electric Magnetic Device. M. G. Crane, Newton, Mass.
449,209. Electric Fuse. G. F. Curtiss, Lynn, Mass.
449,226. Guard for Electric Railway Trolleys. A. W. Mitchell, Boston, Mass.
449,227. Electrical Railway System. S. F. B. Morse, Brooklyn, N. Y.
449,237 and 449,238. Electric Arc Lamp. J. H. R. Ward, New York, N. Y.
449,245. Dynamo Regulator. B. H. Fisher, New York, N. Y.
449,249. Electric Cash Register System. R. H. Nelson, Jr., Columbia, Va.
449,254. Telephone. W. Humans, Cambridge, Mass.
449,258. Method of and Apparatus for Electric Soldering. A. Robinson, Lewiston, Me.
449,282. Electric Switch. H. T. Clark, Bridgeport, Conn.
449,288. Regulating Apparatus for Electric Currents. W. Lahmeyer, Aix-la-Chapelle, Germany.
449,30[illegible]. Electric Contact Protector. R. Varley, Jr., Englewood, N. J.
449,318. Electric Contact. O. J. Depp, St. Louis, Mo.
449,3[illegible]. Burr Preventer for Electric Welding Machines. E. Thomson, Swampscott, Mass.
449,358. Electromagnet. F. A. Wessel, Brooklyn, N. Y.
449,40[illegible]. Electric Lamp Reflector. F. Cooley, Cincinnati, O.
449,40[illegible]. Electric Heating Apparatus. M. W. Dewey, Syracuse, N. Y.
449,4[illegible]. Shade for Electric Lights. J. W. Easton, New York, N. Y.
449,4[illegible]. Electric Alarm for Shaft Bearings. G. Hannah, Brooklyn, N. Y.
449,4[illegible]. Guard for Electric Railway Trolleys. A. W. Mitchell, Boston, Mass.
449,[illegible]. Repeater. F. W. Cole, Newton, Mass.
449,[illegible]. Non-interference Signal Box. F. W. Cole, Newton, Mass.

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Axwell Park Colliery Electric Hoisting Plant.

The accompanying illustrations show the electrical hoisting equipment of the Axwell Park Colliery at Durham, England. The steam winding plant was replaced by an electrically operated winding plant, the shaft in question being 252½ feet deep, and being used mainly for the workmen, most of the coal being brought out through a drift.

In order to avoid large fluctuations in the current taken from the supply, it was decided to adopt the Ilgner system, the principle of which is to interpose between the supply mains and winding motor a motor-generator having a heavy flywheel capable of storing up energy during periods of light load and of delivering energy by dropping in speed during times of heavy load, and thus equalizing the demand upon the supply mains.

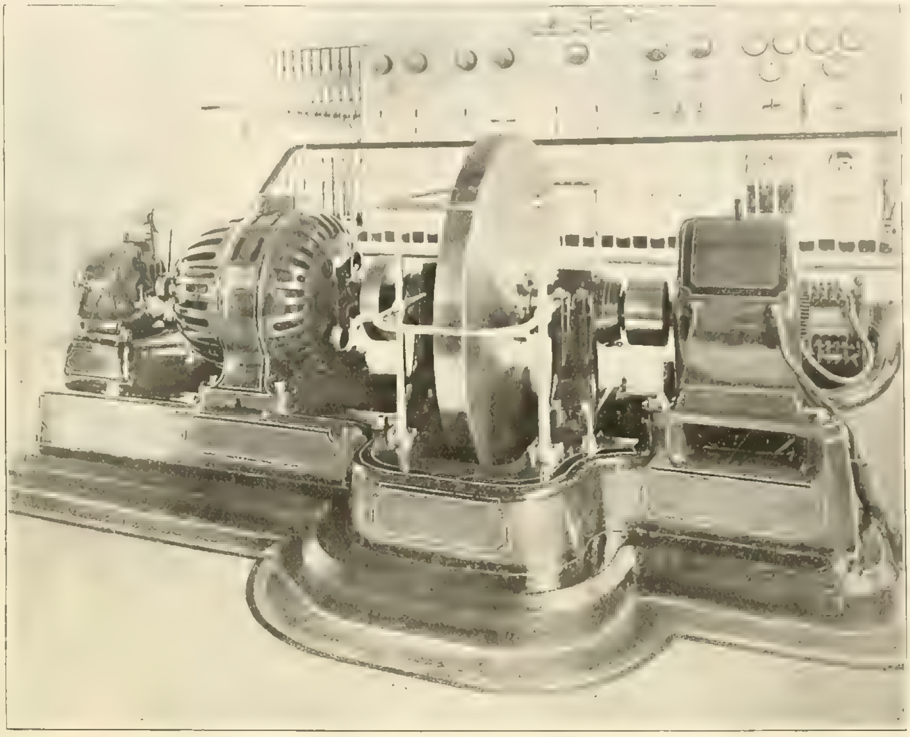
At this English mine, the power for operating the plant is obtained at 550 volts, 40 cycles, from the Axwell Park substation (about 1,000 yards from the pit's mouth), which in turn is fed with three-phase current at 5,500 volts from the Carville power station of the Newcastle-on-Tyne Electric Supply Company, some nine miles distant, and from the Priestman power station, about five miles away, both working in parallel.

At the mine the low-tension alternating current, after passing through the fuses and main switches, is led to the three-phase motor of the Ilgner set, and direct current at varying voltages is obtained from the direct-current generator of the set and led to the winding motor, which is mounted on a common bed-plate with winding gear about 55 feet above the ground, directly over the shaft.

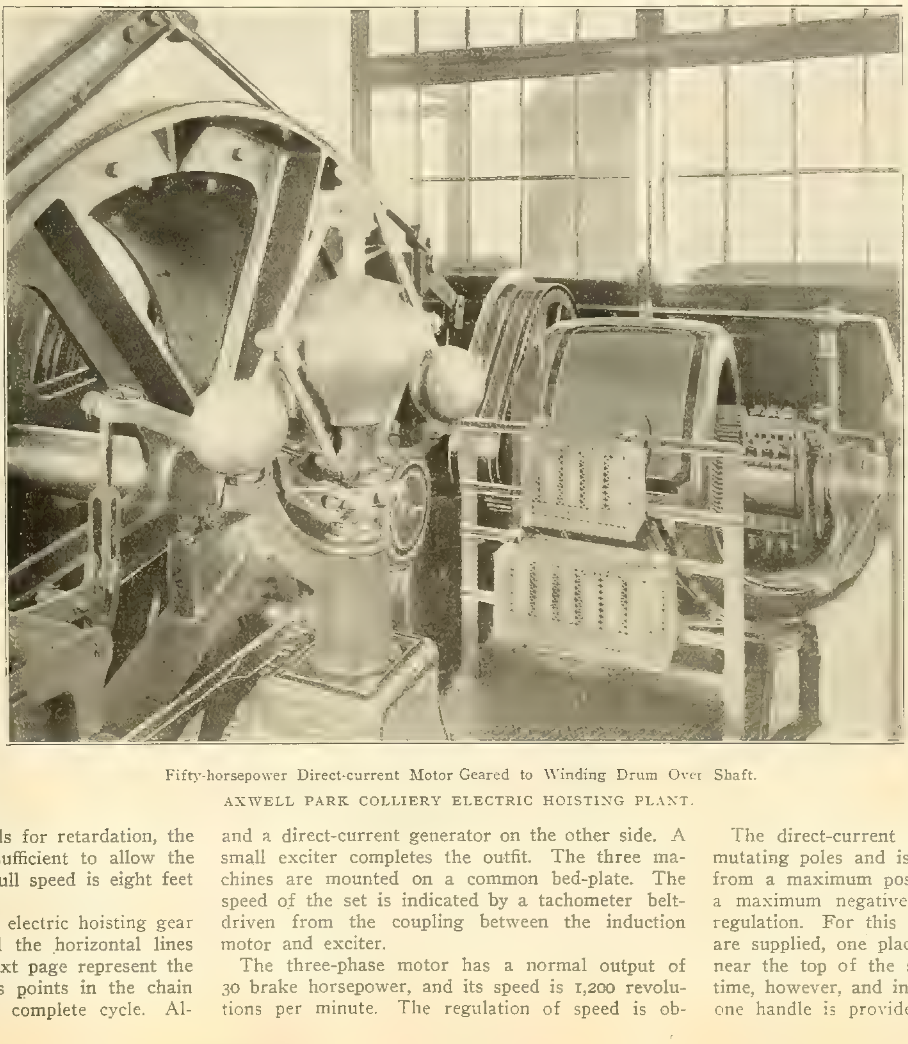
The total maximum weight to be hoisted is 6,700 pounds, the cage weighing 3,200 pounds and the men 3,500 pounds. A balance weight is provided approximately equal to the weight of the cage plus half the weight of the men. The time allowed for a complete cycle is 55 seconds in round figures, and of this time 12 seconds is taken up for acceleration, followed by 23 seconds of full speed run and five seconds for retardation, the remaining 15 seconds being sufficient to allow the men to enter or leave. The full speed is eight feet a second.

The mechanical efficiency of electric hoisting gear is taken as 80 per cent., and the horizontal lines of the power curve on the next page represent the average horsepower at various points in the chain of transmission taken over a complete cycle. Although it is not possible to level out the peaks in such a manner that the energy taken from the supply is absolutely steady, yet the Ilgner flywheel motor-generator set achieves this to a degree which meets all practical purposes. In this set a three-phase motor is placed on one side of the flywheel and a direct-current generator on the other side. A small exciter completes the outfit. The three machines are mounted on a common bed-plate. The speed of the set is indicated by a tachometer belt-driven from the coupling between the induction motor and exciter.

The three-phase motor has a normal output of 30 brake horsepower, and its speed is 1,200 revolutions per minute. The regulation of speed is obtained by a [illegible] which automatically adjusts the [illegible] in accordance with the [illegible] taken from the supply. [illegible] the three-phase [illegible] with the primary winding of a small current transformer, the secondary winding of which is connected to a relay. The tongue of the relay is placed between two contacts, touching neither at normal load, that is at a given supply current. When an overload occurs, however, the relay tongue closes against one of the two contacts and closes a local circuit through a small auxiliary motor which now commences to drive the regulator switch in a direction corresponding to a cutting in of resistance in the rotor circuit of the three-phase induction motor. The latter at once tends to run slower than before, and the flywheel is called upon to assist the motor by giving off part of its stored energy. On the other hand, when the current taken from the mains drops below normal value, the relay tongue touches the second contact, and the auxiliary motor drives the rheostat in the opposite direction, thus increasing the speed of the three-phase induction motor. The surplus energy beyond that necessary for the winding plant is utilized to increase the speed of the flywheel.



Motor-generator Set with Flywheel and Exciter—Switchboard in Background.



Fifty-horsepower Direct-current Motor Geared to Winding Drum Over Shaft.

AXWELL PARK COLLIERY ELECTRIC HOISTING PLANT.

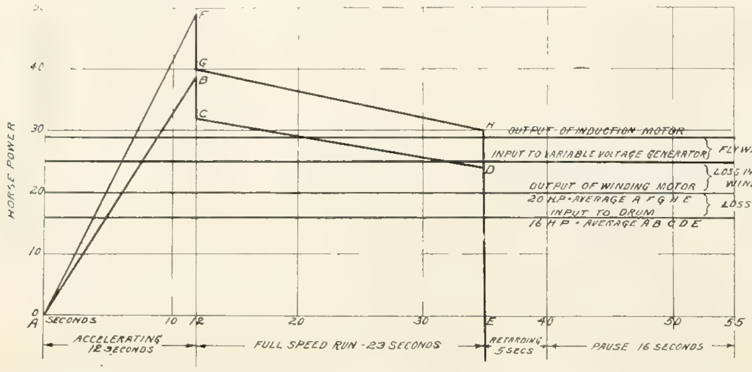
The relay may be adjusted to keep the energy taken from the supply within any predetermined limits. It is in fact adjusted so that the input to the three-phase motor varies between 28 and 38 horsepower, the maximum drop in the speed of the flywheel being 15 per cent. below normal. The automatic regulator is combined with the starter, the design being such that the first contacts are used for starting by hand, while the other contacts are for the speed regulation of the three-phase motor.

Of forged steel, 4½ feet in diameter, the flywheel is of the plain disk type. It weighs 2,800 pounds. It is essential that the flywheel be of the best material and most accurately machined and balanced, and the steel has a tensile strength exceeding 40 tons per square inch.

The direct-current generator is fitted with commutating poles and is capable of supplying current from a maximum positive voltage through zero to a maximum negative voltage by means of shunt regulation. For this two reversing field regulators are supplied, one placed in the cage and the other near the top of the shaft. Only one is used at a time, however, and in order to avoid mistakes only one handle is provided, which cannot be taken off

unless the controller is in the "off" position. The reversing shunt regulator in the cage is electrically connected with the generator of the Ilgner set by a flexible six-core cable.

It is interesting to note that the speed and direction of rotation of the winding motor are solely controlled by the Ilgner set. This winding motor has a normal output of 50 horsepower at 800 revolutions per minute. It is mounted, together with the winding gear, on a common bed-plate, and drives the winding drum by means of a double-reduction spur gearing.



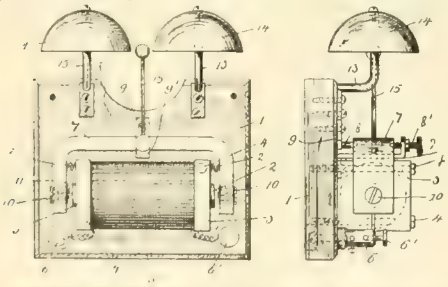
POWER DIAGRAM OF AXWELL PARK COLLIERY HOISTING PLANT.

At the mine shaft the depth indicator is driven by a chain of bevel gears and shafting, and is fixed in a position convenient for the attendant. The steel winding cable has a diameter of about 0.95 inch. Both ropes wind toward the center of the drum during the greater part of the lift, but at the highest position of either cage or balance weight the rope is exactly vertical.

For safety the cage suspension is such as will bring the cage at once to a standstill in the shaft if the winding rope breaks. In order to prevent the attendant in the cage from overrunning the banks, there are fixed in the shaft, both at the top and bottom, wooden cams which engage with a lever fixed to the controller, so that the latter is brought automatically to the "off" position should the cage rise higher than a few inches above the bank, or sink lower than a couple of inches below the bottom level. This arrangement, however, does not prevent the attendant from moving the cage in the proper direction.

A Simple Bell for Alternating Currents.

A simple construction for alternating-current bells has been invented and patented by Charles J. Wagner of Chicago. The aim of the inventor was to provide a very quick-acting bell which would readily respond to the pulsations of the currents and produce a loud and clear sound. In this electric bell an oscillating permanent magnet controls the hammer and is provided with means which not only give it a quick action, but also act to normally center the hammer and hold the poles of the permanent magnet out of contact with the core



FRONT AND SIDE ELEVATIONS OF ALTERNATING-CURRENT BELL.

of the electromagnet when the current is off. Further, the bell is of cheap and simple construction and the permanent magnet is so balanced that [illegible] the influence of weak as well [illegible]

[illegible] the front and side [illegible] The core (2) of the electromagnet is rigidly engaged near its ends [illegible] conducting material, which are slotted, so that when they are [illegible] of the bolts (4), which extend therethrough, they firmly grip the core in place. Upon this core is wound the [illegible]

[illegible] thereon equally distant from the supports (3). The magnet may be supported in any manner capable of permitting it to oscillate freely, but, as shown, two pointed trunnions (8) and (8′) are carried on suitable brackets (9) and (9′), which are rigidly fastened to the base-plate and engage in suitable sockets in the side of the magnet. The trunnion (8′) has threaded engagement in the bracket (9′), thereby enabling it to be adjusted with respect to the other trunnion, and permitting the magnet to be removed when desired. The arms of the permanent magnet project past the ends of the core and are provided, in alignment with the core, with screws (10), each of which has a point (11) of brass or other non-magnetic material adapted to engage the core and prevent the magnet from clinging thereto. Coiled springs (12) are engaged between the supports (3) and the arms of the permanent magnet and act normally to center it with respect to the core.

Rigidly engaged on the base-plate by means of the stems (13) are the bells (14), which are spaced a distance apart. A hammer (15) is secured to the magnet, adjacent its pivotal point, and projects between the bells in position to strike the same alternately when the magnet is oscillated.

The operation of this bell is as follows: When an alternating current is sent through the electromagnet the arms or poles of the permanent magnet are alternately attracted and repelled by the core, thereby causing the permanent magnet to oscillate on its pivot and cause the hammer to strike the bell alternately. A bell so constructed is adapted to strike in very rapid succession with a minimum amount of current and is not liable to get out of repair.

Arc-lamp Electrode Containing Metallic Network.

In arc lamps used for searchlights and projectors it is important to keep the arc well centered in the carbons to permit steady focusing. This has been accomplished by using special cored carbons. For this service also rather heavy currents are used; to keep the drop in potential over each carbon within low limits it has been necessary to reduce the resistance of the carbon electrodes as much as possible. Both these objects have been attained by means of an invention of Hermann Viertel of Charlottenburg, Germany. This electrode construction has been recently patented in the United States and the patent assigned to the Gebrueder Siemens & Co. of Germany.

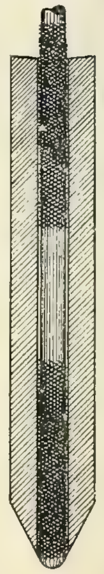
Metal has hitherto frequently been employed in arc-light electrodes for reducing the resistance of the same, but in the method in accordance with the present invention metal in the form of woven or laced net-like pipes or tubes is inserted into the carbons. The meshes of these reticulated metallic tubes are filled up as completely as possible with conducting carbon cement or with core material.

When finished hard cores are employed in making these electrodes, it is preferable to place the metallic tube between the outer carbon casing and the core, thus concentrically with the core. The manufacture of such electrodes may be effected by the metal tube being pushed on to the hard core in the form of a rod. By pulling in the direction of the longitudinal axis of the tube, the latter is readily brought into intimate contact with the core, as tubes of such a kind become diminished in cross-section when pulled longitudinally. The core, covered over with the tube, is now dipped into a suitable cement. In this way the meshes of the tube become filled up as completely as possible with the cement, in order to bring about a perfect cementing between the outer casing, the metal tube and the core. The core-rod with its metal covering thus prepared is now inserted in the carbon casing, which is likewise filled with core-cement, the superfluous core material being pressed out. In this manner a deficient filling up of the intermediate space between the core-rod and the casing is avoided. The carbons are then dried in the usual manner.

The accompanying drawing shows in vertical section an arc-light electrode made in accordance with this method. In this drawing are shown the core, the reticulated metal fabric tube (of which the interstices are entirely filled with core material) and the outer casing of the electrode.

If, instead of finished cores being employed, the plastic core material only is to be used, it is preferable to insert the metal tube into the hollow carbon tube which serves as a casing, and bring it into as intimate contact as possible with the casing by compression in the longitudinal direction, the casing being filled up afterward in the usual manner with core material. In this case also the meshes of the metallic net are very perfectly filled up, and a certain and good cementing between the core and casing is brought about, and an excellent contact between the metallic tube and the core material.

Besides the advantage of a good and certain contact which is particularly obtained through the large surface and the reticular construction of the



ARC-LAMP ELECTRODE CONTAINING METALLIC NETWORK.

tube, the electrode built according to the present invention has the advantage that the arc is maintained on the core very much better than in other arrangements, and the metal is prevented from being melted out very much better. As opposed to forms of electrodes with cores which are copper-plated, besides the advantage of the intimate cementing as described above, electrodes made in accordance with this method have the substantial further advantage that the core is not permeated by the electrolytic liquid, which is unavoidable in the case of the electrolytic production of coats of metal.

Copper is suitable in a particularly high degree for employment as the metallic meshwork for these electrodes. Electrodes made as above described burn exceedingly well with high-current densities, and are particularly suitable for reflectors on account of the great stillness of the arc. When burning with alternating current they have the advantage that the considerable noises which arise with other carbons when burning with high-current densities are infinitesimally small.

Consolidation in Davenport.

Competition in the light and power field may be brought to a termination in Davenport, Iowa, through the purchase of the Independent Light and Power Company by the People's Light Company, both of Davenport. The People's company is a part of the merged properties operated in Davenport, Rock Island and Moline by Stone & Webster. The Independent Company received a franchise a year ago for gas and electric distributing systems in Davenport. It did much construction work, but was checked by the financial difficulty last fall. Stockholders in the Independent company will take the value in stock of the People's company.

Electrical Exports for February.

Electrical exports from the United States for the month of February, 1908, show a marked recovery from the decline of January, and a substantial increase over the figures of February, 1907. For February, 1908, the total value of electrical exports from this country reached $1,323,826, compared with $1,161,527 for February, 1907, and $999,606 for January, 1908. The increase is due to large volume of electrical machinery exported, about one-third more than for January, 1908. Electrical appliances show a decrease as compared with February a year ago. Following are the figures: Electrical appliances—February, 1908, $479,779; February, 1907, $599,855. Electrical machinery—February, 1908, $844,047; February, 1907, $561,672.

Below are given the principal distinations of electrical exports from the United States for February, together with the value of the goods sent to each country:

Electrical appliances—Brazil, $96,532; British North America, $92,358; United Kingdom, $54,725; Cuba, $44,292; Mexico, $44,231; Argentina, $32,488; Central American states and British Honduras, $16,856; Japan, $12,113; Germany, $11,187; Belgium, $8,477; British Africa, $6,963; Philippine Islands, $4,793; British Australasia, $4,787; France, $1,555; other South America, $22,607; other Europe, $13,747; other countries, $12,068.

Electrical machinery—Mexico, $181,218; Japan, $127,636; British East Indies, $124,627; France, $61,889; Philippine Islands, $57,758; Brazil, $38,096; United Kingdom, $36,364; Argentina, $29,941; British North America, $27,584; Central American states and British Honduras, $19,968; British Africa, $12,689; British Australasia, $8,770; Germany, $8,104; Cuba, $4,118; Chinese Empire, $2,160; other Europe, $81,687; other South America, $7,676; other countries, $13,764.

In comparing the above exports of electrical machinery with those of February, 1907, the most noteworthy feature is the large increase in the exports to Mexico, the British East Indies and Japan. The exports of electrical machinery to these countries in February, 1907, were, respectively, $119,970, $25,687 and $63,044. On the other hand, British North America shows a decline from $109,576 in February, 1907, to $27,584 for February, 1908.

Electric Locomotives for Detroit River Tunnel.

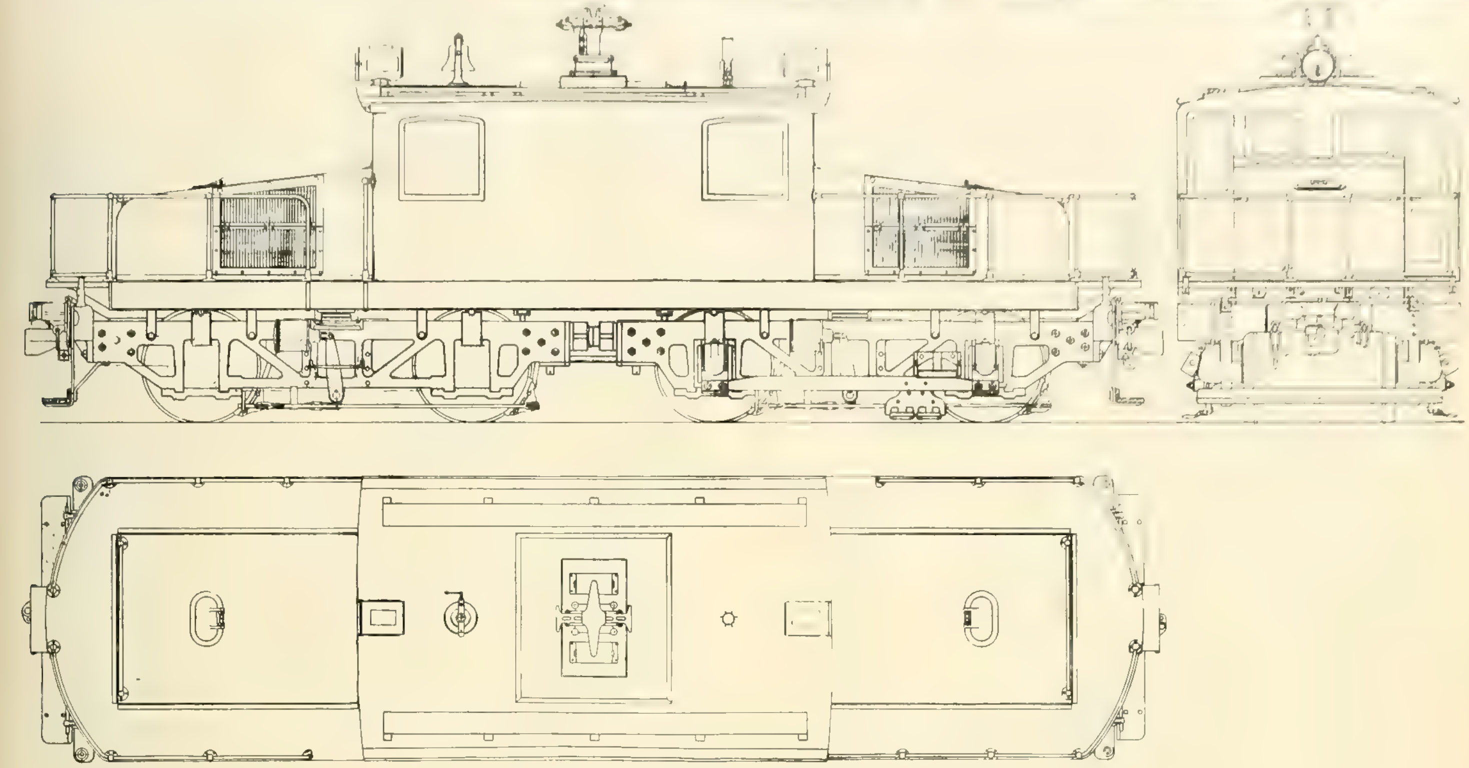
The accompanying illustration shows one of the [illegible] electric locomotives now building for the Detroit River Tunnel Company by the General Electric Company and the American Locomotive Company. These locomotives will be used to haul both passenger and freight trains of the Michigan Central Railroad through the tunnel now being constructed under the Detroit River, from Detroit, Mich., to Windsor, Ont.

They are moderately slow-speed machines and weigh 100 tons on the drivers. The frame is of the articulated type and can best be described as consisting of two four-wheel trucks hinged together. The trucks are of a very solid construction, with cast-steel side frames of truss pattern carried on semi-elliptical journal-box springs. The diameter of the driving wheels is 48 inches. The draft rigging is carried directly on the outer end frames of each truck, the two trucks being hinged together by substantial hinges and pins. By adopting this method of construction, the draft of the locomotive is carried directly through the truck frames, and the center pins are relieved of all hauling strains.

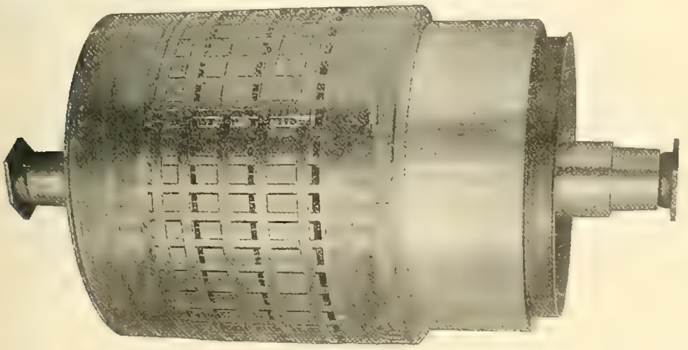
The superstructure consists of a main operating cab and two auxiliary end cabs. The main cab is 15 feet 6 inches in length and contains the engineer's operating mechanism and valves, while the contactors, rheostats and air reservoir are contained in the [illegible] view of the tracks. Easy access to the couplers is provided [illegible] the main cab to the ends of the locomotives.

The electrical [illegible] of four [illegible] eral Electric multiple-unit train control. Each motor will develop [illegible] at its hour rating will develop a tractive effort of 9,000 pounds [illegible] while a complete [illegible] a 900-ton train up a two per cent. grade at the required schedule speed. The motors are of the commutating-pole type, and are among the largest units of this type yet constructed for railway work. The current will be supplied to the motors from an inverted third rail at a potential of 600 volts. On account of the heavy torque developed, which amounts to 4,050 pounds at a one-foot radius, a pinion is mounted on each end of the motor shaft.

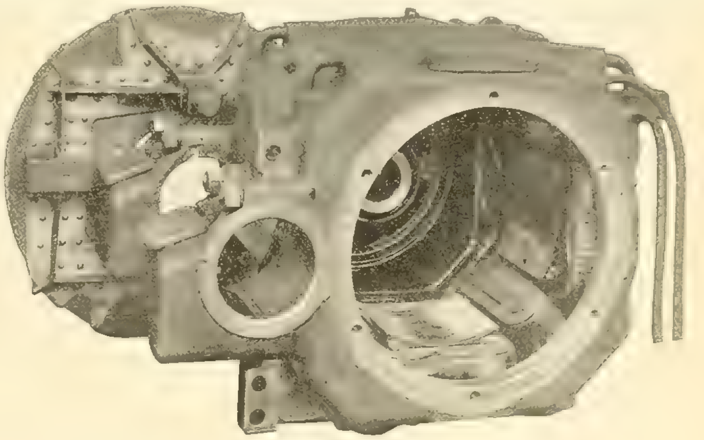
The motors will be cooled by forced ventilation, a blower having a capacity of 2,000 cubic feet per minute being installed in the main cab for this purpose. A separate compressor of type CP-26, with a capacity of 100 cubic feet per minute piston displacement, provides air for operating the air brakes.



THE 100-TON ELECTRIC LOCOMOTIVE FOR DETROIT TUNNEL.



Armature.



Side View of Field.

DETAILS OF 300-HORSEPOWER MOTOR, FOUR OF WHICH ARE USED ON DETROIT TUNNEL LOCOMOTIVE.

With the announcement that the Knickerbocker Trust Company has resumed business, the Central Colorado Power Company states that its working force at Boulder and Colorado Springs on its power plants and reservoirs will be increased 1,000 men within the next 60 days. The power company had over a half million dollars on deposit when the Knickerbocker Trust Company closed its doors last fall, and it was compelled to discharge a number of men and curtail expenses.

Steam-turbine Power and Transmission Plant of the Moctezuma Copper Company, Nacozari, Sonora, Mexico.[1]

By John Langton and Charles Legrand.

This power plant was erected to provide for a large extension in the operations of the Moctezuma Copper Company, both at its works, situated at Nacozari, and at its mines, six miles distant. The plant was planned with the aim of providing comprehensively, not merely for present needs, but for all probable contingencies, and for possible further extensions.

The duty on crude petroleum into Mexico being prohibitive, and the wood supply in the neighborhood being inadequate to furnish fuel for a steam plant of the requisite capacity, coal is the only available fuel; and bituminous coal from northern New Mexico is the nearest and cheapest to be had. Since this coal has to be hauled 750 miles by rail to Nacozari, its excessive cost required that the plant should be planned for the greatest fuel economy consistent with that simplicity in operation which is essential in a plant which must run continuously in an isolated situation, such as Nacozari, where skilled labor is frequently scarce. The cost of fuel dictated the addition of economizers to the boilers and also superheaters to give a moderate degree of superheat.

After careful investigation and consideration of all the conditions, both local and general, it was decided to use steam turbines.

The water at Nacozari is saturated with lime salts and deposits hard scale in large quantities in the boilers, unless it is chemically treated to replace the lime salts by sodium sulphate. In the latter case great waste is involved in blowing off the boilers to keep down the degree of concentration of the sodium sulphate in solution, which would otherwise cause foaming. The use of steam turbines and the consequent absence of oil in the exhaust steam, makes it easily possible to get pure feed water for the boilers by using surface condensers, thus transferring scale deposit from the economizer and boiler tubes to those of the condenser, where it is more easily dealt with, and where, at the lower temperature, the deposit will possibly be lessened.

In addition to the water being hard, it is also scarce in the dry season, and very turbid and full of sediment during the rains. Of necessity, in times of scarcity and for the sake of clear water in times of plenty the condensing water is passed over a cooling tower, the new water supplied being only that quantity needed to make up for the evaporation in the cooling tower. Whether it will be cheaper to treat this water supply chemically or to expend labor in scaling the condenser tubes remains to be determined by experience.

The near-by load on the power plant is about 1,000 kilowatts. This is consumed by the concentrating mill, the town lighting and a few general service motors, and is approximately fixed in amount. The transmission load is about 500 kilowatts, and this is the portion of the load which is most likely to require extension, possibly in several directions; since the broken and mountainous character of the country, the scarcity of cheap fuel and of water of any kind, make any but transmitted power for mining operations very costly. It was therefore decided to generate power at a voltage suitable for direct transmission to the mine, having in mind also that step-down transformers would, in any case, be needed for the bulk of the near-by load, since no good site for the power plant could be found sufficiently near the concentrating mill to permit transmission of the mill power at motor voltage.

Description of Power Plant.

The plan and sectional elevation of the plant are shown by Figs. 1 and 2. The framework of the buildings is steel. The roofs are corrugated steel. The walls of the boiler-room are also corrugated steel. The outside wall of the turbine-room is concrete, and the partition between the turbine-room and the boiler-room is reinforced concrete.

[Referring to the drawings, the reference numbers [illegible] (1), 1,000-kilowatt turbo-generator; (2), surface condenser; (3), circulating pump; (4), [illegible] pump; (5), oil filter; (6), [illegible] (7), 50-kilowatt steam-turbine exciter; [illegible] (9), oil-switch cells; (10), 6,600-volt main switchboard; [illegible] (12), 75-kilo[illegible] feed-water tank; [illegible] duplex steam [illegible] (17), [illegible]]

[illegible]

[1] [illegible]

the plant it is therefore necessary to carry a large stock of coal at all times. It was considered desirable to provide storage for one month's fuel consumption. Storage by reserve stock pile entails the expense of double handling, and with bituminous coal involves deterioration, both in heat value and in physical character. Some form of bin storage, by which the whole stock is carried in the bins, and is continually moving through them, is therefore very desirable.

The form of storage adopted for this plant is that shown by the coal dock, numbered (18) in Figs. 1 and 2. The site selected afforded the opportunity of getting a trestle for main line cars 33 feet above the boiler-room floor at the cost of a spur of moderate length from the main line and a short trestle approach, both on a four per cent. grade. The trestle continues over the coal dock on a level and 24 feet above the floor of the dock. This floor is of reinforced concrete, resting on a series of transverse walls. The two ends and one side of the dock have reinforced concrete walls 12 feet high. For the present the wall on the side next the boiler house is omitted, though anchorages are provided by which it may be added in the future if desired.

The transverse foundation walls form a series of tunnels under the dock, in each of which coal

In the first case, spiral conveyors will distribute the coal along the length of the pocket, from which it will be drawn through weighing chutes to the hoppers of the automatic stokers. In the second case, charge cars filled from the crushed-coal bin and weighed will run on a platform placed at a convenient height for the cars to discharge into the hoppers of the stokers.

If desirable and profitable in the future, the extended central transverse passage may be continued into the boiler room and carried along the front of the boilers, under the boiler-room floor, forming a basement about 12 feet high, which will allow the use of hopper-bottomed ash pits, discharging their contents either into cars or to a suitable ash conveyor.

Stirling boilers, class A, are used. They are of 435 horsepower each, with safety valves set to pop at 160 pounds gauge pressure. Each boiler is equipped with a Foster superheater to give 75° F. superheat. Directly back of and in continuation of each boiler is a 160-tube Green fuel economizer, 16 rows of 10 tubes wide. The gases from the economizer, or from the by-pass flue beneath the economizer, pass into the main flue, eight feet wide by nine feet high, and thence to the central stack, 12 feet inside diameter and 184 feet in height above the boiler-room floor. In addition to dampers

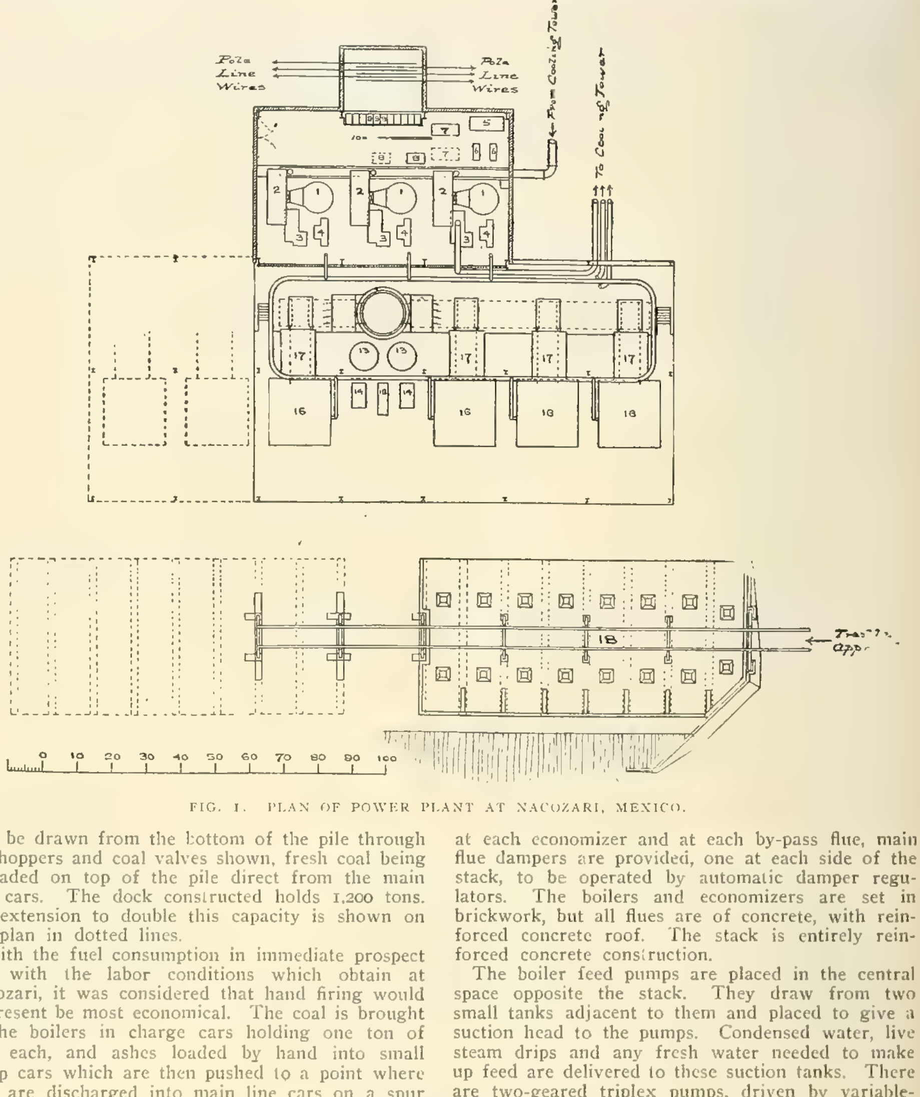


FIG. 1. PLAN OF POWER PLANT AT NACOZARI, MEXICO.

may be drawn from the bottom of the pile through the hoppers and coal valves shown, fresh coal being unloaded on top of the pile direct from the main line cars. The dock constructed holds 1,200 tons. An extension to double this capacity is shown on the plan in dotted lines.

With the fuel consumption in immediate prospect and with the labor conditions which obtain at Nacozari, it was considered that hand firing would at present be most economical. The coal is brought to the boilers in charge cars holding one ton of coal each, and ashes loaded by hand into small dump cars which are then pushed to a point where they are discharged into main line cars on a spur from the main line, the latter being parallel to the boiler house, 150 feet distant from it, and 26 feet below the level of the boiler-room floor.

All charge car and ash-car tracks are on the boiler-room floor level and are without grade.

In case future extension and other developments make it profitable to use automatic stokers, provision is made for delivering coal to them from the coal-storage dock by means of the apparatus indicated by broken lines in Fig. 2. Coal, fed by gravity from the present hoppers to a spiral conveyor for which openings (shown in Fig. 2) are provided in the transverse walls, will be carried by the conveyor to the central transverse passage between the two coal docks. This passage will be excavated to a depth of about 12 feet below the boiler-room floor, giving space for crushing rolls and drop enough to feed the lump coal by gravity through the rolls to the boot of an elevator. This elevator will either deliver the crushed coal to a pocket running the length of the boiler house, suspended from the roof trusses, or, if it is preferred to deliver coal to the stokers by charge cars, the [illegible] deliver to [illegible] small crushed coal bin.

at each economizer and at each by-pass flue, main flue dampers are provided, one at each side of the stack, to be operated by automatic damper regulators. The boilers and economizers are set in brickwork, but all flues are of concrete, with reinforced concrete roof. The stack is entirely reinforced concrete construction.

The boiler feed pumps are placed in the central space opposite the stack. They draw from two small tanks adjacent to them and placed to give a suction head to the pumps. Condensed water, live steam drips and any fresh water needed to make up feed are delivered to these suction tanks. There are two-geared triplex pumps, driven by variable-speed induction motors, one in operation and one in reserve, and a duplex steam pump for emergencies. The latter is also piped to give high-pressure cold water to the turbine scale borers for scaling boiler and condenser tubes.

The main steam pipe is eight inches in diameter and is a ring system, divided into sections by gate valves to allow repairs to piping or branch valves without a general shut-down. All piping is overhead.

The turbine room contains three 1,000-kilowatt Curtis turbo-generators. They run at 1,800 revolutions per minute and are three-phase, 60-cycle, 6,600-volt machines. One turbine is always in reserve. Each turbine has its own condenser, air pump and circulating pump.

The condensers are counter-current Alberger surface condensers, with a motor-driven dry-vacuum pump. By carrying the condensed water drain pipes a short distance outside the building to a seal tank, a sufficient difference of elevation is obtained to give a barometric column. This obviates the necessity of a condensed water pump at each condenser. Two simple low lift centrifugal pumps, motor

driven, are provided at the seal tank to return the condensed water to the feed pump suction tanks in the boiler room. One centrifugal pump is in operation and one always in reserve.

The circulating pumps are of the Root or Connersville impeller type. They are motor driven and handle 3,000 gallons per minute each.

The cooling tower is placed on a tableland, which begins about 100 feet back of the power plant and which is 55 feet higher than the boiler-room floor level. It is of the open atmospheric type, which is found very satisfactory in the dry, western climate, where for the greater portion of the year the relative humidity is about 30 per cent.

A 24-inch cast-iron pipe 150 feet long carries the circulating water from the cooling tower sump to the turbine room, along which it runs with a branch to each condenser. The valves in these branches are the only ones in the circulating water system. The elevation of the cooling tower sump gives a static head of 35 feet at the condensers; the circulating pumps draw from the condensers, and each pump delivers through its own 16-inch pipe, opened at the top of the cooling tower, 14 feet above the level of the water in the cooling tower sump.

The turbines and condensers are set high enough above the floor to give head room under the pipes, draining water from the condenser and oil from the footstep bearings of the vertical turbines. This sets the operating gallery for the turbines at 12 feet above the floor. In the middle section of the turbine room this gallery is continued to the back wall of the room and carries the main switchboard and a 50-kilowatt motor-driven exciter, with space for a second identical exciter. A feeder from the main high-tension switchboard supplies three 75-kilowatt station transformers placed under the gallery, which furnish 230-volt current to an adjacent distributing switchboard, whence wires run on the underside of the gallery floor supply all the motor-driven station apparatus and auxiliaries.

The circulating pumps and air pumps are on the main floor, as are also the oil filter and the two steam-driven oil pumps which supply the turbines and a steam turbine-driven 50-kilowatt exciter; space is provided for a second steam-driven exciter.

The overhead crane will reach all machines and carry them to or from a truck or car which may be run into the building in the vacant floor space left for that purpose. The station transformers under the gallery are alone out of reach of the crane, and they therefore stand on small trucks, that they may be wheeled out into a space inaccessible to the crane.

The pole-line wires pass out from the lean-to behind the switchboard, which contains the arrangement of wires for connecting any pole-line wire to any feeder panel, and also the lightning arrester and choke-coil system.

Normally, the plant is run with motor-driven auxiliaries throughout, but in starting up, or in case of accident to the station feeder or the transformers, the steam-driven boiler feed pump and the steam-driven exciter enable the plant to operate with the turbine on open-air exhaust, each turbine having its own atmospheric relief valve and open-air exhaust pipe.

The turbine room exemplifies the concentration of power which is possible with steam turbines; the three 1,000-kilowatt machines with condenser and auxiliaries and with switchboards and exciters being comfortably housed in a floor space 45 by 72 feet; practically one kilowatt per square foot.

The four boilers at present installed are for the immediate load of 1,500 kilowatts; three boilers under steam and the fourth a spare for cleaning and repairs. One or two more boilers, depending on what the load factor and the peak loads of the increased consumption may prove to be will be needed to bring the boiler plant up to the full capacity of two turbines. An extension for two or more boilers is shown by dotted lines in Fig. 1.

Electrical Distribution.

As stated previously, the load consists of a few scattered motors, the town lighting, the concentrator and the mine motors and lights.

The feeders are all of bare half hard-drawn copper wires spaced 24 inches apart, except between the transmission line and the mine.

Where transformers are operated in parallel, or are likely to be operated in parallel in the near future, they are provided with a primary oil switch and a secondary knife switch. These switches are located near each other [illegible] interlocking arrangement [illegible] ary switch being left [illegible] is open. The locking device [illegible] of secondary switch with primary switch closed, but secondary switch cannot be [illegible] is open, or primary switch opened without first opening secondary switch. The device [illegible] prevent a man working on [illegible] getting to open secondary switch.

Concentrator.

The house which contains the transformers for furnishing current to the [illegible] and light is a two-story [illegible] building, [illegible] 32 feet, with concrete walls, steel trusses and corrugated iron roof. The floor, made to stand a load of 1,000 pounds per square foot, is the so-called multiplex plate (a corrugated steel plate with a special form of corrugation) filled with concrete. The building is provided with two 48-inch adjustable ventilators and the necessary openings in the floor and lower walls to insure a good circulation of fresh air in both stories.

The ten 125-kilowatt transformers are located in the upper story and are connected in groups of three on each phase; the tenth transformer is a spare one which can be connected to any of the three phases.

The high-tension wires after passing through choking coils are run on insulators on the bottom chord of roof trusses. Low-equivalent lightning arresters are connected to each wire where it enters the building.

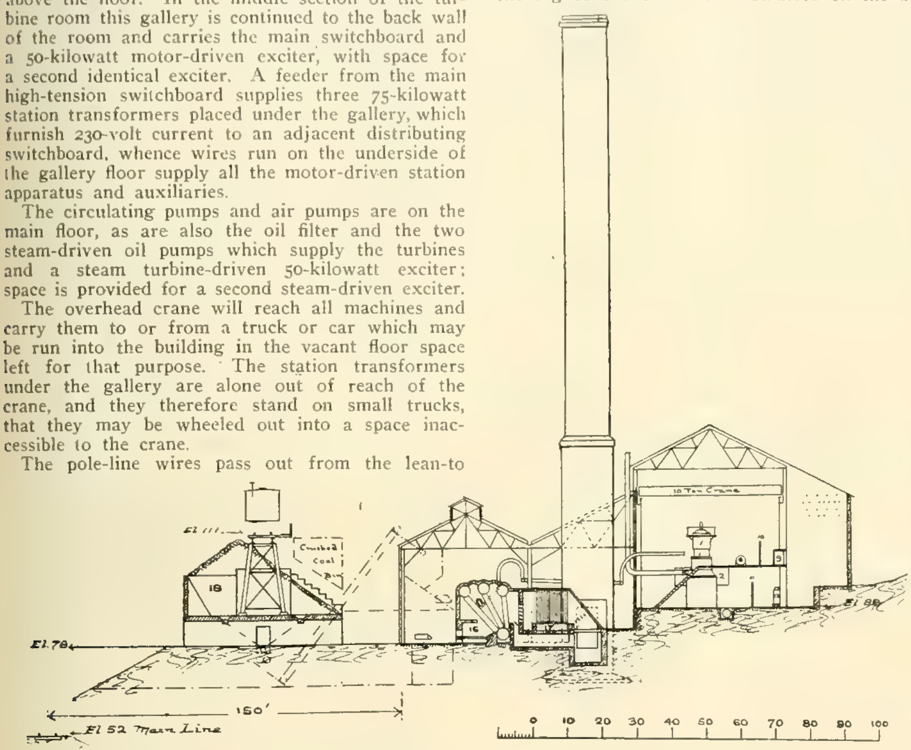


FIG. 2. SECTIONAL ELEVATION OF POWER PLANT AT NACOZARI, MEXICO.

The primary of each transformer is connected to its proper phase through an automatic two-pole oil switch and two single-pole disconnecting switches. The secondary of each transformer is connected to the distributing switchboard bus-bars through a two-pole knife switch with enclosed fuses. The primary and secondary switches are interlocked as explained above.

The secondary wiring between transformers and switchboard bus-bars is arranged to give as nearly as possible an equal load on each transformer connected to the same phase.

The distributing switchboard is located in the lower story, where there are no high-tension wires, and consists of eight panels of black enameled slate, on which are mounted 16 three-pole feeder switches with fuses.

Three transformers in parallel were used on each phase instead of a single one for several reasons:

First—The transformers had to be self-cooling to reduce attention to a minimum.

Second—In case of trouble with one transformer, the operation of the concentrator would hardly be interfered with.

Third—Greater ease of handling.

Fourth—Figuring on having a spare unit, which is necessary when plant is so far from manufacturers and continuous operation is of the utmost importance, the total cost is smaller.

These advantages more than balance the slightly decreased efficiency and difficulty of maintaining an equal load on transformers connected in parallel.

The transformer house is situated as nearly as possible at the center of the load and over half of the load is within 300 feet radius.

The motors connected to these transformers con- [illegible] and also to reduce the trouble with insulation, a [illegible] building.

Mine.

The power is transmitted to the mine at Pilares, [illegible] miles from Nacozari by a line consisting of three No. 2 wires spaced 32 inches apart, mounted on porcelain insulators suitable for 20,000 volts. The poles are of Michigan cedar with [illegible], spaced at an average distance of [illegible] feet.

The transmission line has been operated at 6,600 volts and 25 cycles from another power plant, and in three years operation has not given any trouble from lightning or other causes, although a great many insulators are broken by being used as targets for revolver shooting.

At Rosario, 3½ miles from Nacozari, are located three 10-kilowatt transformers with necessary switches and lightning arresters. They are used to operate a motor-driven pump delivering water against 600 feet head to a tank at Porvenir. A part of this water is used for steam locomotives operating on the railroad between the mine and the concentrator; the rest is pumped 700 feet higher to Pilares for domestic use.

At a point five miles from Nacozari the line divides in two branches, one going to the Pilares shaft, the other to the Y shaft. At Pilares are located three 15-kilowatt transformers for lighting and power circuits on the surface and in the mine. At the Y shaft are located two 300-kilowatt, six-phase, 260-volt rotary converters, one 150-horse-power 220-volt induction motor driving a compound air compressor and three 15-kilowatt transformers for lighting and power circuits on the surface and in the mine; these transformers operate in parallel with those at Pilares, their circuits being connected through the mine workings, and both sets are provided with primary and secondary interlocking switches.

The air compressor is belt-driven and delivers air at 100 pounds pressure for the operation of air drills in the mine.

The direct current from the rotary converters is used to operate electric locomotives in the mine and on the surface, two electric hoists, one at the Y shaft, the other at Pilares shaft, and one stationary motor at Porvenir driving pump mentioned previously.

The electric locomotives in the mine consist of three 10-ton locomotives for 36-inch gauge, of which any two are operated in tandem from one controller by means of cable connections; they are equipped with air brakes. This tandem arrangement was used in preference to a 20-ton locomotive, because when the use of a 20-ton locomotive became necessary a 10-ton locomotive was already in service. It was also difficult to get a 20-ton locomotive for the narrow gauge and with the necessary clearances to operate in mine tunnel. It also gave a spare half unit corresponding practically to a whole spare unit.

The trolley pole is of the "scissors" type, with a roller two feet long instead of a wheel, capable of eight feet vertical motion, as the locomotives have to operate outside of the mine in the same yard with the steam locomotives. This trolley pole has no lateral motion. The trolley wire in the mine is eight feet from the rails, the tunnel in which locomotives run being large enough to give clearance to 30-ton double-truck steel ore cars. These cars are loaded at bins in the mine, and after loading are passed under a timber gauge which limits the height of the ore so as not to interfere with the trolley wire.

The hoists at the Y and Pilares shafts are duplicate as far as the electrical equipment is concerned. They are designed to lift an unbalanced load of 5,500 pounds at a speed of 525 feet per minute with 250 volts at the motors; with an unbalanced load of 3,000 pounds the hoisting speed to be 600 feet per minute.

The hoists are double-drum geared hoists, which can be operated balanced or unbalanced, each drum being driven independently of the other by means of clutches.

The Y shaft hoist is a new one, with motors mounted on same bed plate as the drums.

The Pilares hoist is an old steam hoist which has been operated electrically for the past three years. The motors in this case are set outside the hoist frame on independent foundations and geared to the crank disks of the steam engine, crown gears having been shrunk and keyed on the disks.

[Continued on page 280.]

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[illegible] of analysis by means of the electric current are in progress at the laboratory of physical chemistry of the Massachusetts Institute of Technology. The idea is not new, and in its old form has been used many years. In most electrolytic methods in use the substance, the quantity of which is to be determined, is caused to deposit on a stationary metal plate. It has been found that if the plate is made to rotate at high speed, the deposition takes place much more rapidly. More recently an electrical arrangement has been devised by which the solution containing the substance can be made to spin around a fixed plate on which the deposition occurs. On this idea, as yet practically undeveloped, Dr. Spear is working. The character of the deposit in this "electric whirlpool" seems to be satisfactory, and it is hoped in this way to reduce the time required for certain analyses from 24 hours to as many minutes.

AN UNUSUAL electric-railway accident happened near the Forty-third Street station of the South Side Elevated Railroad during the rush hour on the morning of April 7th. A southbound five-car train was slowing down to make the station stop when suddenly the front end of the leading car was lifted from the track and swerved off of the structure. The front end was badly wrecked on striking the ground, but the rear end remained tilted against the structure; the remaining cars remained on the track. About a score of men that were in the leading car, which was a smoker, were injured more or less seriously. The accident was attributed to the dropping of a motor casing from the leading truck, the casing on landing between the ties and truck acting as a hump to raise the front end of the car clear off the track.

A derail due to a cause of this kind is almost unknown. Its liability to reoccur is likewise remote. However, electric-railway officials should not ignore the possibility of its happening. More rigid and frequent inspection may be required to guard against it. Otherwise the opening of the motor casing upward for motor inspection through the floor of the car may be suggested.

WHILE CONVENIENT occasionally to drop a telegram to be transmitted into a postoffice window like a letter, one would think the disadvantages of the plan would outweigh its slender benefits. However, it is under trial in Paris, where a paternal government operates both posts and telegraphs. There are of course a great number of branch postoffices placed all over the city and within convenient reach of the public, while the central postoffice on the Rue du Louvre is not patronized except by those who live in that district. The telegrams can be deposited either at the telegraph window or in the mail boxes within the postoffices which are now in use for the pneumatic-tube correspondence. One of the usual telegraph blanks is used for the purpose, and after writing the message, postage stamps to the proper amount are affixed. It is of course necessary to know what is the telegraph rate in such cases, but it is probable that the system will be used by those who are most in the habit of sending telegrams, and they will likely be familiar with the rates. In general, the telegrams will not be sent (at least by wire) unless the rate is fully prepaid. But there are certain exceptions, and in such cases the person who receives the telegram is obliged to pay an amount which is equal to double the insufficiency, as in the case of unpaid rates on letters. Should the unpaid amount be larger than the proportion allowed, the message is sent by mail. In case a telegram cannot be transmitted, this being the case for foreign telegrams which are underpaid, or for an insufficient address, etc., the sender is notified of this fact, provided he places his address upon the telegraph blank.

ONLY a month ago a lecturer on municipal ownership, Mr. Glenn Marston, speaking in Brooklyn, emphasized the point that many failures of public ownership in this country are due to incompetent management on the part of the city operators of the plants; either the city officials were "grafting" from these as from other parts of the public service, or else the managers were politicians and filled their positions on the principle of making good places for political followers instead of with the object of getting good service. And on this the Brooklyn Eagle comments: "Until we can manage the municipal business we have honestly and efficiently, it is hopeless to place our street railroads and our lighting systems in the control of practical politicians. When the taxpayers really care enough about efficient administration to take some of their time and energy from their own personal pursuit of wealth and devote it to seeing that their elected officials serve them instead of the political organizations, then we may be ready for municipal ownership on a larger scale than we have it now; but it will take at least one more generation to grow that breed of public-spirited citizens."

A striking exemplification of this unfortunate fact followed close on the heels of this Brooklyn declaration. The Chicago Daily Tribune of March 26th tells the story: "An amazing system of robbery and 'graft' involving city employes and big business firms, and extending back through several years, was uncovered yesterday in the Water Department. As a result of the revelations two employes, including a division head, were removed and 38 subordinate employes are slated for discharge today. Some of them may be indicted for complicity in the thefts. This same Water Department has been the city's boasted example of municipal ownership. Through the use of tampered meters and the connivance of city employes several large corporations have defrauded the city of hundreds of thousands of dollars in water taxes."

This investigation is still going on, and is not lessened in importance with further probing. It affords one of many potent arguments against the municipal-ownership theory.

MR. W. R. BONHAM'S contribution in this issue bearing the title "Problems in Illumination Made Easy" is one of especial value and importance, and one which we commend to the careful attention of all readers.

When one reflects upon it, it is astonishing that it is only within the last few years that the study of illumination has been taken up in an earnest, systematic and scientific manner. The value of man's eyesight has been recognized for many centuries, ever since Adam and the children of Adam realized that they were fearfully and wonderfully made and lifted their minds in gratitude to their Creator. One of the masterpieces of Shakespeare, the great delineator of the workings of the human mind, relates the impassioned pleading of the boy-prince Arthur that his jailer shall not put out his eyes. And yet how ignorant, how careless, are civilized men in providing artificial illumination, or even in utilizing the light of the sun! The structure and functions of the eye have been studied by physicians for many years, but how little attention has been paid to the matter of providing light, on which the usefulness of this most delicate and beautifully adapted organ entirely depends! How many injured eyes, how much eye-strain and consequent ills, how much wearing of spectacles could have been avoided had the laws of illumination been understood and applied!

In building bridges and other structures the engineer calculates the exact weights which the various bearing members are to carry. In heating rooms, where the wall area, window area, external temperature and steam pressure are known, the exact radiating surface necessary to maintain a given measure of heat may be calculated by simple rules. The rating of engines, boilers, dynamos and motors and other machinery is calculated by comparatively simple measurements. In like manner, it is highly desirable to provide rules for the calculation of illumination.

Mr. Bonham is an electrical engineer of Chicago who has made a special study of lighting problems for several years past. In his article "Problems in Illumination Made Easy" he provides tables and explains them so that they can be applied by any electrician to the illumination problem in hand. By substituting the known quantities in each individual case, the user of these tables, after reading the article carefully, should be able to solve any ordinary problem in illumination as readily as the heating engineer calculates the radiating surface necessary for a given room. In presenting this information in tabulated and conveniently accessible form, Mr. Bonham has performed a service of real value, for which he deserves the thanks of the electrical fraternity.

Problems in Illumination Made Easy.

By W. R. Bonham.

With the advent of the new high efficiency lamps it is fitting that the study of illumination should be taken up from a scientific and practical point of view. While the manufacturer was producing the comparatively inefficient carbon filament lamp it is little wonder that so little time was spent in laying out a lighting scheme to produce known and practical results.

Fortunately the eye is so constructed that it can adapt itself to lighting conditions through an extremely wide range, not, however, without producing a strain upon the eye which reacts and affects the entire system. Were the eye as sensitive to changing light values as the body is to temperature changes, it would readily be seen that the question of illumination would have been more seriously considered at an earlier date.

Most people can see to read very easily with one foot-candle of light. Should the light be increased to two or even four foot-candles the increase of light is only noticeable for a short time, as the iris of the eye immediately adjusts itself to the new condition, so that practically the same amount of light is allowed to reach the optic nerve as before.

When the light is deficient the eye strains itself in endeavoring to admit more light. When the light is too strong it is strained in an endeavor to keep out some of the light.

If the temperature of a comfortable room is increased or decreased 20 per cent. it becomes very uncomfortable. This is considering a temperature of 32 below the freezing point of water as zero. Should the true zero be considered (as is absolute darkness), which is 273° Centigrade below the freeze-point of water, it is readily seen that the change in temperature through which the body can adapt itself is extremely small.

The temperature of rooms for various classes of service has long since been determined, and buildings are so equipped that the rooms maintain automatically this predetermined temperature. In buildings which are similar in all other respects, it is not difficult to find the illumination in one to be 500 or 600 per cent. greater than the illumination in the other. From this it is quite evident that either both are very improperly lighted, or that one is greatly lacking in illumination or the other is highly wasteful. It is to be hoped that this condition will soon be the exception rather than the rule.

In the following discussion no attempt has been made to discuss light values or efficiencies, but simply light quantities. However, in considering the new incandescent units, it must be remembered that the intrinsic brilliancy is very high, and unless the lamp is to be used at quite a height, it should be either frosted or covered with a diffusing reflector or globe in such a manner that the direct rays of the glower cannot strike the eye.

Injuries to the eye occur from both natural and artificial light. Snow blindness is produced by exposure to reflected light from snow in a clear and rarefied atmosphere, and cases of temporary blindness following an exposure to the direct rays of an arc lamp are still quite common. Yellow sunlight, which is due to the chemical rays being absorbed by atmospheric dust, is much safer and far more agreeable to the eyes than the white light of the sun.

Great care should be used, therefore, in introducing these new lamps; first, not to allow the eye to be exposed to the direct rays of the light, and second, not to produce a too great intensity, for in either case the impression is likely to be produced among the laymen that these lamps are harmful to the eyes and thereby retard their introduction. It is just as harmful to overlight a room as it is to overheat it, although the immediate effect is not likely to be so apparent.

The subject of illumination from an engineering point of view will now be taken up and an endeavor made to simplify methods and formulas, so that by the use of mathematics not higher than multiplication or division any practical problem can be solved.

In designing the illumination of any room there are certain features which must be decided which have no bearing on the problem of illumination. The number and location of light units will be determined by the size and shape of the room. If there are pillars or beams or any feature in the architectural design which tends to divide the room into sections, they should be taken into consideration, so that the location of the light units will be in harmony with the general design.

Table No. 1.—Illumination Required for Different Classes of Service.

[illegible]	[illegible]

For example, if a small room is to be lighted which is perfectly square it will not look well to have either two or three light sources. In this case either one, four or five units must be used; otherwise they will appear out of balance with the design of the room. If the room is oblong a row of lights may be placed down the center. Two, three, or any number of rows of lights may be used, but each side of the room must balance with the opposite side. It is seldom ever possible to stagger or have them located in a zigzag manner and still give a pleasing effect unless by so doing both sides of the room produce a balance.

The location of the units as to vertical elevation, or distance from the floor, must also be determined by the size of the room, the height of the ceiling and the architectural design. After locating the light units both as to vertical elevation and horizontal distance apart comes the real problem of illumination. The quantity of light required at or on the objects to be illuminated must now be determined.

[illegible]

A foot-candle is the total quantity of light striking a surface one foot square and one foot distant from a source of light giving one candle in that direction, the plane of the surface being at right angles to the source of light. When the source of light is an incandescent lamp giving 16 candlepower in this direction, the illumination is 16 candle-feet. When a 16 candlepower lamp is placed four feet from the surface, still keeping the plane of the surface at right angles to the source of light, since 16 divided by the square of four equals one, the illumination is one candle-foot. When the surface is at some other angle than 90 degrees the quantity of light is necessarily less.

This may be understood by imagining a volume of light one foot square to strike a surface which is not at right angles to it. If this volume of light can be imagined as being solid like a piece of wood it will not be cut off square but at an angle, or, in other words, it will be oblique to the surface upon which it falls. This surface contains more square inches than if it had been cut off at a right angle, and since the light has been distributed over a greater area the intensity is therefore less. For that reason the candle-feet on a given surface cannot always be determined by merely dividing the candlepower of the light by the square of the distance between it and the object to be illuminated, but the angle at which the light strikes the given surface must be considered.

This is why it is cold weather here in the winter time, although the earth is about 2,000,000 miles nearer the sun, the giver of all light and heat, than in the spring and fall. The rays of light coming from the sun during winter strike the earth's surface on the northern hemisphere at such an oblique angle that the rays are very thinly scattered and the earth receives but comparatively little heat during this period. The earth's surface therefore cools very rapidly, thus producing winter.

To eliminate this difficulty and also the necessity of squaring each distance and dividing this into the candlepower of the light in each particular case, Table 3 has been prepared. This table will simplify any problem within its scope; that is to say, at any given point within this table a constant is found by which to multiply the candlepower of the light which would strike that particular point, and the result gives the illumination in candle-feet.

For example, suppose a store is to be lighted for general illumination; the units have been located and three foot-candles has been decided upon. Three points at least in the room must now be located. One point will be directly under a unit; this location will be called station one. One point will be half-way and on a line between two units; this location will be called station two. Another point will be located, if possible, at the center be-

Table No. 3.—Used for Calculation of Indoor Illumination.

Vertical Height in Feet		Horizontal Distance from Lamp in Feet									
		Zero.	2	4	6	8	10	12	14	16	18
2	Angle	0°	45°	63° 25′	71° 35′	76	78° 40′	80° 35′	81° 50′	82° 55′	83° 40′
2	Constant	.25	.0883	.0224	.0079	.00355	.001907	.001106	.000722	.000473	.000341
4	Angle	0°	26° 35′	45°	56° 20′	63° 25′	68° 10′	71° 35′	74° 5	76°	77° 30′
4	Constant	.0625	.0447	.02206	.01064	.0056	.00322	.001975	.001136	.0008875	.000631
6	Angle	0°	18° 25′	33° 40′	45°	53° 5′	59′	63° 25	66° 5′	69° 25′	71° 35
6	Constant	.02775	.02365	.016	.0098	.00602	.003802	.002185	.001689	.001207	.000876
8	Angle	0°	14°	26° 35′	36° 50′	45°	51° 20′	56° 20′	60° 15′	63° 25′	66°
8	Constant	.01563	.01420	.01119	.008015	.00552	.003815	.002665	.001913	.001402	.00105
10	Angle	0°	11° 20′	21° 50′	31°	38° 40′	45°	50° 10′	54° 30′	58°	60° 55′
10	Constant	.01	.009417	.007097	.0063	.004757	.00353	.002623	.00196	.00149	.001149
12	Angle	0°	9° 30′	18° 25′	26° 35′	33° 40′	39° 50′	45°	49° 25′	53° 5	56° 20
12	Constant	.006945	.00665	.00592	.00496	.004	.00312	.00245	.0019	.001506	.001181
14	Angle	0°	8° 10′	16°	23° 10′	29° 45′	35° 35′	40° 40′	45°	48° 50′	52° 10′
14	Constant	.005105	.004905	.00453	.00397	.003335	.002745	.00222	.001801	.001455	.001178
16	Angle	0°	7° 10′	14°	20° 35′	26° 35′	32°	36° 50′	41° 10′	45°	48° 25′
16	Constant	.00391	.003818	.003567	.003202	.002795	.002383	.002001	.001665	.00138	.001142
18	Angle	0°	6° 20′	12° 30′	18° 25′	24°	29° 5′	33° 40′	37° 55′	41° 40	45°
18	Constant	.00309	.003030	.002875	.002648	.002353	.00206	.001781	.001517	.001288	.00109
20	Angle	0°	5° 45′	11° 20′	16° 40′	21° 50′	26° 35′	31°	35°	38° 40′	42°
20	Constant	.0025	.00246	.002355	.002197	.002	.001786	.001575	.001375	.001186	.001025
22	Angle	0°	5° 10′	10° 20	15° 15′	20°	24° 30′	28° 35	32° 36′	36° 5′	39° 20′
22	Constant	.002065	.002047	.001967	.001852	.001711	.001553	.001368	.00124	.001088	.000955
24	Angle	0°	4° 45′	9° 30′	14°	18° 25′	22° 35′	26° 35′	30° 15′	33° 40′	35° 50
24	Constant	.001736	.001715	.001662	.001582	.00148	.001365	.00124	.001118	.001	.00089

As a rule, the customer knows very little, if anything, as to the amount of illumination desired. By referring to Table 1 some assistance in determining this point may be obtained. This is a comparative table of required illumination for various classes of service. This table represents the best judgment of men who have made a specialty of illumination. After locating on the table the class of service, two widely varying figures are given. These figures are not given as absolute, but are for the purpose of aiding to determine the amount of light to use. If the customer wants fair illumination at a minimum cost, choose the first or smaller of the figures given; if, on the other hand, the best illumination is wanted in keeping with the class of service, regardless of maintenance cost, use the larger of the figures given. These are the two extremes beyond which it is not well to go.

Should this table be not sufficiently complete, so that there is still doubt as to the required illumination, it should be remembered that the eye is affected only by the light which is reflected to it from the object observed. While the square of the distance between the object and the eye need not here be considered, on account of the light being so thoroughly diffused instead of coming from a

Table No. 2.—Reflective Power of Colors in Illumination.

Color of Wall.	Coefficient of Reflection.	Total or Effective Illumination Factor.
White Paper	.70	3.33
Chrome Paper	.62	2.63
Orange Paper	.50	2.00
Plain Deal (clean)	.45	1.82
Yellow Paper	.40	1.67
Yellow Painted Wall (clean)	.40	1.67
Light Pink Paper	.36	1.56
Plain Deal (dirty)	.20	1.25
Yellow Painted Wall (dirty)	.20	1.25
Emerald Green Paper	.18	1.22
Dark Brown Paper	.13	1.15
Vermilion Paper	.12	1.14
Blue Green Paper	.12	1.14
Cobalt Blue Paper	.12	1.14
Deep Chocolate Paper	.04	1.04

Table No. 4.—Showing Candlepower Delivered at Different Angles by Various Types of Lamps.

Source of Light	Type of Lamp	Type of Reflector.	Watts.	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°
Gem	2	C	100	97	92	87	80	73	66	60	54	48	42	39	36	34	32	30	28	26	23	20
Gem	3	C	125	120	115	110	105	96	87	78	71	64	56	51	46	42	39	36	34	30	26	22
Gem	4	C	187½	180	175	163	150	138	126	114	105	96	87	82	76	70	67	62	55	50	45	40
Gem	5	C	250	240	236	226	208	180	164	150	133	125	114	102	94	90	83	78	73	70	64	58
Gem	2	D	100	50	50	52	54	56	56	56	54	52	50	48	46	44	42	40	38	36	33	30
Gem	3	D	125	60	61	64	68	70	70	69	67	65	62	60	58	56	53	50	47	43	39	35
Gem	4	D	187½	90	94	98	102	106	106	104	100	95	90	86	83	80	77	74	70	66	62	58
Gem	5	D	250	120	121	124	128	132	136	140	140	135	130	123	117	110	105	100	95	89	83	77
Gem	2	B	100	42	43	48	52	55	58	62	64	64	63	60	55	49	42	36	30	26	23	20
Gem	3	B	125	55	56	58	64	70	75	77	80	80	78	76	68	58	51	44	37	34	31	28
Gem	4	B	187½	80	83	90	95	101	110	115	120	120	115	108	98	88	76	66	56	50	45	40
Gem	5	B	250	100	105	115	130	140	148	155	160	160	155	150	135	120	100	85	70	64	58	50
Tungsten		B	60	34	35	40	45	55	62	67	68	67	65	63	58	53	47	42	37	33	29	27
Tungsten		B	40	23	23	27	30	37	41	45	45	45	43	42	39	35	31	28	25	22	19	18
Tungsten		C	60	84	82	82	77	73	68	63	60	57	54	52	50	47	43	38	33	28	24	20
Tungsten		C	40	56	56	48	52	48	45	42	40	38	36	35	33	31	29	25	22	19	16	13
Gem	1	B	50	27	28	30	33	35	37	39	40	40	40	38	34	29	24	20	18	16	14	13
Gem	1	C	50	48	43	45	41	37	33	30	27	25	22	20	17	15	14	13	12	11	10	10
Gem	1	D	50	25	25	26	27	28	28	28	27	26	25	24	23	22	21	20	19	18	16	15
Nernst	6 gl.	Alab.	528	440	440	440	440	440	440	432	424	416	402	384	362	338	310	284	260	230	198	164
Nernst	4 gl.	Alab.	352	292	291	290	289	288	286	284	280	272	262	252	240	220	200	180	162	146	128	110
Nernst	3 gl.	Alab	264	218	218	217	216	215	214	213	208	204	196	190	180	162	152	140	128	110	94	80
Nernst	2 gl.	Alab	176	146	146	145	145	144	143	142	140	136	130	124	120	110	100	92	84	76	66	52
Nernst	1 gl.	Alab.	88	80	79	78	77	76	74	72	68	65	62	60	56	52	50	48	40	35	30	25
Tungsten		B 3	100	82	96	96	105	113	119	124	125	126	121	116	105	94	80	66	58	50	45	40
Tungsten		C 3	100	194	188	180	164	145	130	115	105	96	90	84	80	75	70	65	60	55	51	47
Tungsten		D 3	100	96	100	105	108	112	112	110	107	104	100	96	91	87	84	80	76	73	65	57

tween four light units; this location will be called station three. The units are assumed to be eight feet above the plane which is to be illuminated, and that they are 12 feet apart.

By referring to Table 3, at eight feet below the vertical will be found the constant 0.01563, and since an illumination of three foot-candles is desired, divide three by this constant, which gives 192 candlepower. Next take station two, and by referring to Table 3 at a point six feet on the horizontal, which is one-half way between the lamps, and eight feet vertical, the constant 0.008015 is found; also note that the angle is 36° 50′. Since the light at this point is to be supplied by two units instead of one, take 1.5 candle-feet and divide it by this constant, which gives 187 candlepower to be delivered from each light unit at the angle of 36° 50′. Now take station three, the center between four lights. Here the horizontal distance is practically 8.5 feet from each lamp. Refer again to Table 3. Since eight feet is the nearest division, follow down this line to eight feet vertical; here the constant 0.00552 is found and the angle is 45°. Since the light in this case comes from four sources, use 0.75 of a candle-foot instead of 3; dividing this by the constant gives 101, which is the candlepower required from each lamp at an angle of 45°.

The candlepower required vertically beneath each lamp, at an angle of 36° 50′, and at an angle of 45°, is now known. If it is deemed necessary to take a greater number of locations it will simply mean that the required candlepower at a greater number of angles from our light source must be known. The only error to this method would be that where the lamps were not very far apart with respect to their vertical height that each station will receive light from a greater number of lamps, but ordinarily this method is accurate enough for practical purposes.

Now refer to Table 4, which shows the candlepower at the different angles delivered by a few of the standard lighting units on the market. If some other source is to be used, a candlepower curve must be secured. Locate in Table 4 some unit that gives the candlepower required at the corresponding angles. If a unit is found which is an approximation of what is wanted, whose vertical candlepower is less than required but whose candlepower at an angle of 36° or 45° is greater than required, the probabilities are that the lighting will be very satisfactory, inasmuch as the light beneath each unit will be increased by the increased light thrown at an angle from adjacent lamps.

If the candle-feet given in an installation already installed is required, the constant found in Table 3, as before, should be multiplied by the candlepower of the light unit at the proper angle for each particular location.

For example, suppose it is required to find the candle-feet [illegible] lamp at a horizontal [illegible] vertically, [illegible] the vertical. and also at a distance of 10 feet from the vertical. The lamp is assumed to give 100 candlepower vertically, 155 candlepower at an angle of 45° and 120 candlepower at an angle of 59°. By referring to Table 3, the constant for vertical light at a distance of six feet is found to be 0.02775; this multiplied by the vertical candlepower, 100, equals 2.775 candle-feet. At a horizontal distance of six feet (45°) the constant is 0.0098 times the candlepower (155), which equals 1.519 candle-feet. At a horizontal distance of 10 feet (angle 59°) the constant is 0.003802 times the candlepower (120), which equals 0.456 candle-foot.

The above methods are to be used where accurate results are required. However, where the space to be lighted is large and the ceiling high it is sometimes more convenient and sufficiently accurate, where the units are fairly well distributed, to figure on the total candlepower per total area. On this basis, where the light required is for good reading illumination, it is best to allow two or three square feet per rated candlepower. This will give very good illumination. Where it is not necessary to see to read well by the light, four or five square feet per rated candlepower can be allowed.

In the case of street illumination it is not considered proper to consider the angle at which the light strikes the surface of the street. This is because the light is used for the purpose of distinguishing objects on or above the surface, such as trees, fences, rocks, or people. The light is therefore considered as that amount which will be delivered upon a normal plane; that is, a plane at right angles to the source of light. The light, therefore, can be considered as coming from one general direction only; consequently the illumination between two sources of light will not be the sum of the two lights, but simply the amount given by each lamp as the rays of light from each lamp will strike the opposite sides of the different objects. Since the light is considered in a normal plane, Table 3 cannot be used in calculating street illumination. In this case refer to Table 5, which is based upon the square of the cosine of the angle instead of the cube of the cosine.

This table is used exactly the same as Table 3, and where the horizontal column is crossed by the vertical line, for a given location, a constant is found by which to multiply the candlepower of the light given at the angle shown adjacent to this constant. This gives the useful candle-feet at this point as considered for street illumination.

For example, suppose it is required to find the useful light of a direct-current enclosed arc lamp hung 20 feet above the street level. The vertical light of this lamp is 80 candles; this multiplied by the constant 0.0025 shown in Table 5 gives 0.2 candle-foot. Suppose it is required to know the useful light at a distance of 80 feet from this lamp. Locating the column in Table 5 for 80 feet horizontal distance and following it down until it is crossed by the 20-foot vertical line, the constant is found to be 0.00015 and the angle to be 76. Now refer to the candlepower of the lamp and find that at this angle it gives 290 candles; 290 times 0.00015 equals 0.0435 foot-candle.

Since street illumination is generally done with large units, it is safe to consider only the minimum illumination allowable, and this is usually based on getting something like the effect of average moonlight, which is about 0.02 candle-foot.

If the candlepower of a unit necessary to give a predetermined illumination is required, divide the candle-feet determined upon by the constant found in Table 5, according to the vertical height and horizontal distance. The angle opposite this constant is the angle at which this candlepower must be delivered.

[illegible]—[illegible] of Street Illumination

[illegible]	[illegible] Distance [illegible] Lamp in Feet							
	Zero.	20	40	60	80	100	120	150
[illegible]	0°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00016	.0001	[illegible]	.000045
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	78° 40	[illegible]	82° 25
[illegible]	[illegible]	.00125	[illegible]	[illegible]	.00015	.000096	.000068	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	73° 20′	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	.00022	[illegible]	[illegible]	[illegible]	.000043

Doings of the Electric Club.

The Electric Club of Chicago met as usual on Wednesday, April 1st, at the Grand Pacific Hotel. The attendance was larger than usual, the breakfast room being completely filled. Mr. George Cutter of the Cutter company and Mr. Thorpe of the Franklin Electric Company took sides in a debate as to "Which Is the More Important, the House or the Salesman, in the Sale of Goods?" Mr. Cutter talked on the side of the house, while Mr. Thorpe took the side of the salesman.

On Friday night, April 3d, the club held its first smoker in the main dining room of the Grand Pacific Hotel. There were 200 gentlemen present. Mr. P. B. Boole was toastmaster and the speakers were Mr. Frank L. Perry, Mr. Homer E. Neisz, Mr. F. P. Vose and Thomas G. Grier, the last-named recently returned from Panama. Later the entertainment committee provided a very elaborate vaudeville programme. Some of the "top liners" at the vaudeville theaters were secured as talent and no expense was spared to produce a good entertainment.

At one of the regular weekly meetings, which are held on Wednesdays, Mr. F. P. Vose is on the programme to give a talk on the legal aspect of the electrical business, and in the near future Mr. H. Parsons is to talk on "Electric Credits."

BOOK TABLE.

Universal Electrical Directory (J. A. Berly's). London: H. Alabaster, Gatehouse & Co. 1908. Pp. (6 by 9½ inches), 1,598. Price, in the United States, $4.40.

Published in January of each year and revised locally as well as by circulars, this electrical trade directory contains the names and addresses of members of the electrical trades and allied industries all over the world. The 1908 edition consists of four sections—British, Colonial and General, Continental and United States—with a total of 33,553 names. Each section is again subdivided into an alphabetical and classified section, and in the case of the British a geographical section has been added. A thumb index simplifies the turning up of any part desired.

The alphabetical sections include telegraphic addresses and telephone numbers and codes and many financial particulars regarding British limited liability companies. Lists of all electricity undertakings in the United Kingdom, British Colonies and some other countries are given, showing the nature of the supply, system of distribution, capacity of plant, voltage and chief engineer's name, and in the case of alternating current the phase and periodicity also appear.

The Copper Handbook (a manual of the Copper industry of the world). Vol. VII. By Horace J. Stevens. Houghton, Mich.: Horace J. Stevens. 1907. Pp. (5¾ by 8½ inches), 1228. Price, $5.

The new edition of the Copper Handbook contains about 180,000 words of new material. It has 25 chapters treating of copper under the headings of History, Geology, Chemistry and Mineralogy, Mining, Milling, Concentrating, Hydrometallurgy, Pyrometallurgy, Electrometallurgy, Alloys, Brands, Grades, Uses, Substitutes, Terminology, Geography, Copper Deposits, Copper Mines and Statistics. The treatment given the subject in 1228 pages is encyclopædic in scope, but the logical and orderly arrangement of the great mass of facts presented, coupled with a table of contents, full index and alphabetical arrangement of districts, countries, mines, minerals and glossary, render it possible to ascertain any given fact with ease.

The book supplements all other technical books on copper, and for the average reader its pages devoted to the scientific and technical features of the subject will be found to cover all points of interest. The language is plain throughout, and the layman, whether miner or investor, will find the clear and understandable exposition of scientific facts a great aid.

THE LATE WILLIAM A. KREIDLER.

Tributes to the Memory of the Founder of the Western Electrician.

F. B. Badt, electrical engineer, Chicago: Mr. Kreidler's sudden death was a great shock to me, as it was to a great many of his old friends. I had been connected with Mr. Kreidler socially and in a business way ever since 1882, and for a time I was actively connected with the Western Electrician writing articles and arranging for the publication of my electrical hand-books. I always considered Mr. Kreidler one of my best friends, and I sincerely regret his death, more especially as he was a comparatively young man and was thought by me to be good for at least twenty or thirty years more.

E. M. Barton, president Western Electric Company, Chicago: Mr. Kreidler left college to come to Chicago to take a place in the offices of the Western Electric Company as stenographer, he having previously become proficient in the art which he followed. His work brought him into relation with myself, and I could not fail to observe his excellent memory and orderly habit of mind.

He became interested in newspaper work at first by acting as Chicago correspondent of an eastern paper, and following his tastes, which developed in that direction, he came to give up his position with our company, much to our regret, in order to devote himself entirely to the new work, in which his success has been conspicuously recognized.

George P. Barton, patent lawyer, Chicago: I wish to express something of my appreciation of the life and work of Mr. Kreidler. He accomplished what he undertook. Having gained experience in the newspaper business, he determined to establish the Western Electrician in Chicago. His friends gave him such encouragement that he did not hesitate to stake everything upon the success of his journal. He had well learned that advertising in a first class independent home journal is most profitable to the advertiser. It was nothing less than such a paper that he proposed when he talked over his plans with me 21 years ago.

He did not permit favoritism or personal prejudice to find expression upon his editorial page. This being understood as the policy, there was no restriction upon his associates, or with respect to the news that was furnished. Whatever would be of interest to the electrical worker in any field was sought for and published. In this way he lived up to his original ideals, making his paper a fair and impartial news-gatherer and news-giver—a truthful and representative spokesman for all the competing and conflicting electrical interests of the Northwest.

As he came from the University of Rochester, and was there a member of the same fraternity as myself, I in this way became well acquainted with him when he first came to Chicago. He remained loyal to his friends and early associates, and in his death we have suffered a personal loss.

Charles L. Benjamin, Cutler-Hammer Manufacturing Company, Milwaukee: I regret to learn of Mr. Kreidler's sudden death at Augusta, Ga. I am glad to note that the passing of the founder and principal owner of the Western Electrican will involve no changes in editorial or business policy or in the personnel of the staff.

Charles A. Brown, patent lawyer, Chicago: For 25 years or more I knew Mr. Kreidler, for much of that time intimately.

His high qualities of mind and heart made him many friends, but none esteemed him more than those who had known him longest.

He had a strong and rugged personality, keen penetration and unerring judgment. It was delightful as well as profitable, in consultation with him, to hear his terse and accurate expressions of opinion.

In essentials he was positive and uncompromising, but he was broadmindedly tolerant and considerate of the opinions of others.

His integrity was unquestionable.

He was without affectation.

While his shrewdness, his candor and his humor made him attractive in social intercourse, his real kindness of heart and genial disposition made him deep and lasting friendships.

He had the high moral quality of never taking an [illegible] Kreidler.

[illegible]

Rodman Gilder, Crocker-Wheeler Company, Ampere, N. J.: We regret very much to note the death of Mr. Kreidler, president of the Electrician Publishing Company.

William Goltz, president Haller Sign Works, Chicago: We note, regretfully, the sad news of the death of your president, Mr. William Ainsley Kreidler, on March 26th ult., at Augusta, Ga., and we desire to tender to you our sympathies.

Holophane Company, New York: It is with extreme regret that we learn of the death of Mr. Kreidler. Without doubt he did a great deal of work and was of inestimable value to the electrical industry.

James W. Johnson, assistant western manager, General Electric Company, Chicago: I beg to express my warmest sympathy with you all in Mr. Kreidler's death.

Lewis B. Lüders, secretary, Phosphor-Bronze Smelting Company, Philadelphia: We very much regret to learn of the decease of your president, Mr. W. A. Kreidler, and wish to convey to you our sincerest sympathies.

W. F. Osborne, New York: I cannot begin to tell you how shocked I am and the sincere sympathy I feel for you at this time. Mr. Kreidler always desired that justice and truth obtain between him and all connected with him in business. His kindness and material aid, of which many a one I know could speak, testified to the warmth of his friendships.

Francis W. Parker, patent lawyer, Chicago: It was a great shock to learn of the death of my old-time friend. We had many views and tastes in common, and I feel that I have been deprived of many happy hours which we should have spent together as the growing years made life less strenuous. You have my warmest sympathy.

Charles W. Price, editor Electrical Review, New York: Kindly transmit to Mr. Kreidler's family and your staff sincere sympathy of myself and associates.

B. E. Sunny, vice-president, General Electric Company, Chicago: W. A. Kreidler will be best remembered by the fraternity as the creator of the Western Electrician.

Several of us who have been long residents of Chicago and long connected with the electrical work enjoyed a pleasant association in the days when Mr. Kreidler was getting his enterprise under way. The Western Electrician is so strong now and so firmly established among a vast following in a line of work which 20 years ago was new and crude and only partly formed that it is difficult to realize now, and only a few of us do realize, the industry, patience and courage that Mr. Kreidler put into it.

It must have been a great gratification to him, as it is to us, that his efforts were so successful.

His high character, his conservatism and splendid judgment shone out through the publication from its beginning, and have made an impress that must always influence its conduct and policy.

F. S. Terry, first vice-president National Electric Lamp Company, Cleveland: It is with much regret that I learn of the death of Mr. Kreidler. I had been looking forward to the pleasure of seeing him again soon.

C. A. Tupper, Allis-Chalmers Company, Milwaukee: We are very sorry indeed to learn of the death of Mr. Kreidler. Please accept this as an expression of our sincere sympathy. We have always had a very high regard for Mr. Kreidler and know that his demise will be felt as a distinct loss by the entire electrical world.

Universal Manufacturing Company, Chicago: We regret to hear of the death of Mr. Kreidler and wish to extend to you our sympathy in your loss, together with hope and best wishes for your continued success.

Steam-turbine Power and Transmission Plant of the Moctezuma Copper Company, Nacozari, Sonora, Mexico.

[illegible]

[illegible] the motors in parallel. The change from the series to the parallel [illegible] the bridge method, which does not open the circuit, [illegible]

[illegible] their resistance is so proportioned that with a light load, such as two or three men, the acceleration [illegible] controller is reached.

Compound instead of series motors were employed to allow the motors to be used as generators and act as brakes when lowering men into the mine. Although series motors would also act as generators under the same conditions, they would have to attain too great a speed before "picking up," and then would give a too quick retardation. When used as generators the shunt winding of the motors is excited from the outside circuit, and the current generated by the motors is passed through their series winding to excite the field in the same direction as the shunt winding. This is done so that if the outside current fails while lowering, the cage accelerates a little, but is not completely deprived of electric brake. The current generated by the motor is passed through the starting rheostats. There are seven steps on the controller; on the first one the motors are short-circuited without rheostat, then the resistance is gradually increased to a maximum, the increased resistance corresponding to an increased speed. The maximum resistance is such as to limit the lowering speed of a full cage of men to a set maximum speed which cannot then be exceeded. The first step of the controller gives a speed of about 60 feet per minute with a cage full of men.

The lowering of men into the mine is the most important work of this hoist; its operation is the reverse of the ordinary steam hoist. With a steam hoist the men are lowered "on the brake" and the steam kept as a reserve to stop the hoist in case of accident to the brake, while with the electric hoist the hand brake is kept in reserve.

When changing the hoist from steam to electricity, all but one of the operating levers were kept the same as before, even the reversing lever of the engine being used to operate the reversing switch of the controller. The lever operating the controller was the only one changed from the one operating the throttle, but the controller was made to operate with a regular lever as nearly as possible the same as the throttle valve instead of the regular controller handle. This was done to prevent as much as possible false motions on the part of hoisting engineers.

This hoist has been in operation for three years and has worked very successfully. Outside of a set of new pinions, armature bearings and controller contact fingers there have been no repairs to the electrical equipment, the commutators not even having been turned once. The acceleration is very smooth and the electrical braking is a marked improvement over the hand braking. These results are, to a great extent, due to the use of motors and controlling apparatus of generous size for the work to be done.

It may be interesting to give some tests of running efficiency of this hoist, obtained from the electric input of motors to total load lifted. The gears on the hoist itself are cast gears uncut, but worn smooth by several years of service. The weights given are only approximately correct, but error is not over three per cent. The tests were taken when running unbalanced; the efficiency would be somewhat lower when running balanced, the friction being greater for the same total load lifted.

Total Load. Pounds.	Hoisting Speed Feet per Minute.	Electrical Input E. H. P.	Efficiency Per Cent.
1,300	656	46.6	55.3
1,450	653	48.3	59.4
1,900	634	60.0	60.8
2,100	622	66.6	59.4
4,100	586	107.0	68.0

With average care in starting, such as given by the Mexican hoisting engineers, the starting current does not exceed the running current by more than 25 per cent.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker.

Part II.

The Meter Installation (*Concluded*).

Figs. 1 to 6 are reproduced from photographs of actual meter installations in various places and under different local conditions, and may serve to exemplify some features of modern meter-installation practice. In all of these installations the maximum stability and safety are obtained, i. e., all defects that might by any possibility cause interruption of the service, or fire, are eliminated. It should be borne in mind that, owing to its usual out-of-the-way location, the meter is liable to be subjected to rougher usage and conditions, and is more often surrounded by inflammable material than electrical apparatus in any other part of the building.

Meter installations are nowadays made in better and more permanent shape than formerly, as it is [illegible] invite trouble and tampering, and increase the cost [illegible]

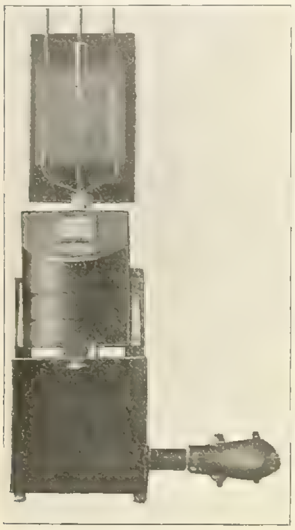


FIG. 1. TYPICAL METER INSTALLATION IN CELLAR.

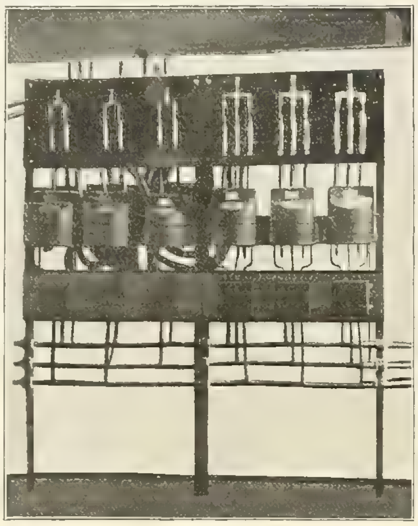


FIG. 2 DEPARTMENT-STORE METER INSTALLATION.

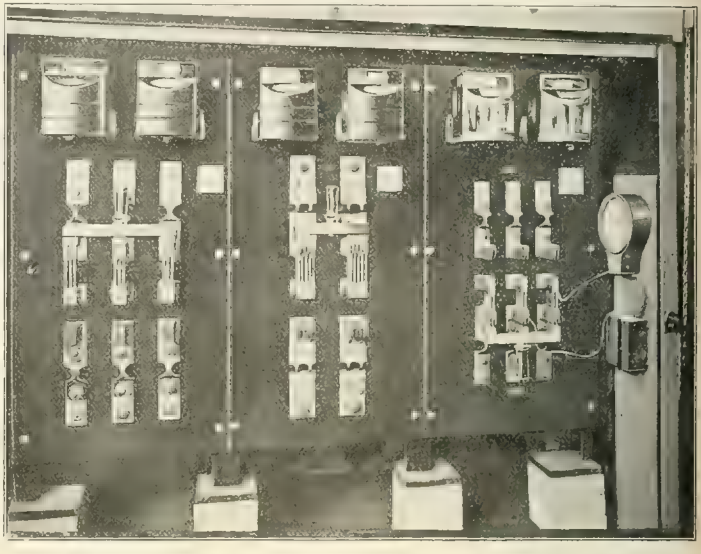
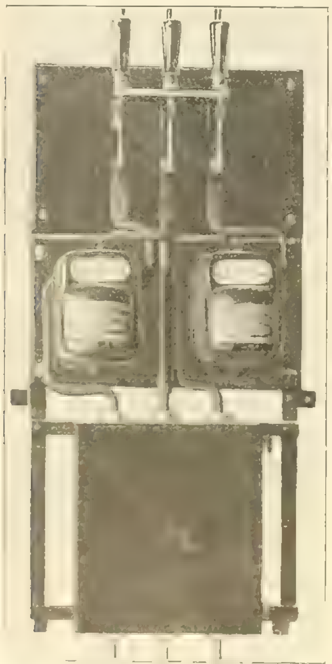


FIG. 3. METER BOARD FOR FAIRLY LARGE CURRENTS.



[illegible]

ters should be good workmen, preferably men who have had enough test-room and inspection experience to have a fair knowledge of the electric meter. The best materials should be used, as meters are frequently located in cellars where the service enters the house and where local conditions—dampness, dirt, and extremes of temperature—are generally worse than in other parts of the building. Standardization is often followed to the extent of having a line of standard meter boards and a definite plan of installation adapted to the various sizes of meters that are employed by the company, and in this way when any given installation is discontinued the meter board and other appurtenances can be used over again. In such layouts special devices and wiring methods are sometimes employed in making the installation, to facilitate the work of the meter tester; and the meter boards may be equipped and wired up in the repair shop ready for use, thereby effecting economy and minimizing the actual work of installing the meters.

An approved method of laying out the wiring at the meter installation is by employing two cut-outs, to facilitate the testing of the meter. One cut-out is put in by the central-station company, and the other put in by the consumer, under the supervision of the company, i. e., at the meter location selected by the company, the layout enabling the consumer's load to be supplied without interruption, over jumpers.

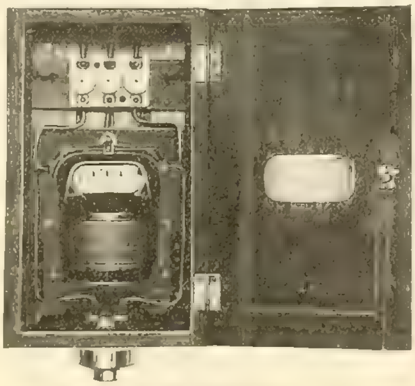


FIG 5 METER INSTALLED IN BOX

The service meter, of commutator type, should always be cut in between the line (main) switch and the load, to insure the continual excitation of the armature circuit and avoidance of "warming-up error." In motor installations the meter should be cut in between the line switch and the motor switch, so that the "inductive kick" which is caused by shutting down the motor, and which is sometimes severe, may not reach the meter armature. When properly poled, the disk will rotate to the right on the load, when viewed from the front of the meter—i. e., counter-clockwise to one looking at the disk from above.

Fig. 1 is a view of a typical cellar installation for meters of capacities up to 75 amperes. The meter and a sealed iron cut-out box are mounted on a single meter board nailed to the brick outer wall of the building, and the service switch is mounted on a separate board immediately above. No wiring is exposed between the service and the house switch.

Fig. 2 shows a department-store installation of one two-wire and three three-wire meters for lighting, two two-wire meters for power, with cut-outs and house-service switches having enclosed fuses, mounted on an iron and slate frame.

Fig. 3 is a slate panel installation for metering fairly large currents. The two meters on the left-hand panel are each of 1,200 amperes capacity, for 110-volt lighting service; the two on the center panel are of 600 and 1,200 amperes capacity, for 220-volt power service, and the two on the right-hand panel are of 800 amperes capacity each, for 110-volt lighting service.

Fig. 4 is a slate-base and wrought-iron frame installation lagged to a brick wall, and consisting of sealed iron cut-out box, two induction meters for a two-phase, three-wire circuit, and a three-pole interlocking house switch.

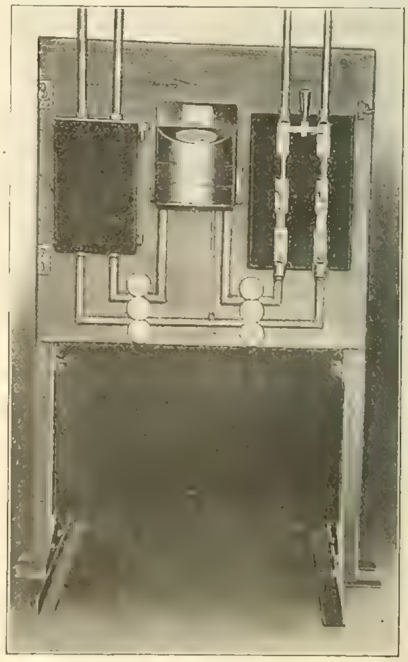


FIG. 6. A PORTABLE METER BOARD.

Fig. 5 is a type of installation adapted to residences, halls, etc., where an ordinary meter board would be objectionable, or where it is desired to seal the entire meter layout. To facilitate testing, the box is made so that when the door is opened the entire front of the box—door and four sides—may be removed as one piece, leaving the meter and all connections perfectly accessible. The door has a catch that can be sealed, and the meter dials

are ordinarily read through a glass window without having to open the door.

Fig. 6 shows a portable meter board mounted on a frame or stand of angle iron, adapted for quick installation and yet sufficiently permanent in character to remain in service indefinitely. The board and its entire equipment may be assembled in the repair shop, and held in readiness for installation at short notice.

After the backboard is up and the wiring ready for the meter, the meter should be hung by its top lug or hanger on a lag bolt or heavy screw driven into the backboard, and then leveled approximately to locate the places for the two remaining lag bolts. In most meters the hole in the top lug is keyholed, and the lower right-hand lug is slotted, to facilitate the mounting and leveling of the meter. The jewel should not be put into place until all three lags are screwed up nearly tight, all hammering and similar work in the vicinity of the meter are completed, and the meter connected in circuit.

The meter should then be leveled up accurately and tested on the load. Before doing so, however, it is well to "saw" a piece of clean cotton tape back and forth between commutator and brushes (in commutator meters) and around the commutator, and to twirl the shaft with the fingers while pressing the brushes lightly on the commutator. This operation will remove any dust that may have lodged on the commutator during shipment, and that would cause sparking if allowed to remain.

Before putting on and sealing the cover, the entire meter should be given a general looking over to see that all dirt or other foreign particles are removed, especially from the disk (or "cup"), the jaws of the magnets, and from the commutator in commutator meters. See that the cover is clean inside and that it fits the meter base properly, with the felt gasket or other fitting device not displaced or jammed.

[*To be continued.*]

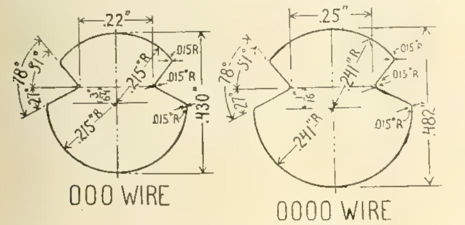
QUESTIONS AND ANSWERS.

Gauge of Trolley Wire.

E. B., Marytown, W. Va.: How is figure 8 and grooved trolley wire gauged? Is there a standard gauge as with round wire?

ANSWER.

Trolley wire is drawn in three forms—round, grooved and figure 8. Three sizes are used—No. 00, No. 000 and No. 0000 B. and S. gauge. The grooved and figure 8 forms are drawn to have a cross-section equal to that of the standard round wires. The shape of the figure 8 wire varies slightly with different manufacturers. It is not much used at present, as it has been practically superseded by the grooved wire, which has all its advantages and none of its disadvantages. The grooved wire has been made standard, although



GROOVED TROLLEY WIRE.

no standard gauge for testing it seems to be on the market. Its diameter can be gauged with a micrometer caliper. The diameter should be according to the following table:

Size. B. & S.	Area. Circ. Mils.	Diameter. Round.	Diameter. Grooved.
00	133,100	0.3648 inch	0.392 inch.
000	167,800	0.4096 "	0.430 "
0000	211,600	0.4600 "	0.482 "

The accompanying drawing shows the dimensions of the two most common sizes of standard grooved wire now used. These have replaced nearly everything in the trolley line.

Meaning of "Tip" and "Sleeve" in Telephone Work.

M. A. L., South Bartonville, Ill.: Please give the meaning of the "tip" and "sleeve" sides as used in telephone work.

ANSWER.

When a telephone operator connects a line with a subscriber she puts a plug attached to a connecting cord into the subscriber's spring jack. The plug has two terminals, the extreme end or "tip" [illegible] the "sleeve" of the plug is said to be on the "sleeve" side of the line.

Regulations Relating to the Use of Electric Power in English Factories.[1]

[From the London correspondent of the Western Electrician.]

London, March 27.—The inquiry instituted by the Home Office into the regulations which it is proposed to enforce in connection with the use of electricity in factories and workshops, and all places coming under the Factories Acts, was concluded yesterday, and the industry now awaits the report of Mr. James Swinburne, the commissioner who held the inquiry.

Generally speaking, the regulations only prescribe details of construction and operation which are already observed in all well-conducted factories and places coming within the scope of the proposed regulations, but at the same time there have been several points of contention which involve more than this, and it is around these that practically all the discussion has raged.

The regulations stipulate that any system involving alternating currents below 65 volts or direct currents below 130 volts shall be exempt from compliance. Upon this much discussion took place as to what is a safe voltage, the objectors in a body taking the view that the present Board of Trade limit of 250 volts for both alternating and continuous current was the better standard. Against this the Home Office brought evidence of many accidents below 250 volts, and a series of experiments carried out by some of the Home Office witnesses to the point of being obliged to let go of copper contacts with the hands rather tended to prove that even the limits laid down in the proposed regulations are too high. One speaker, on behalf of a power company, argued that, even as it was possible to drown a man in six inches of water, so it was possible to be killed by a very low voltage, and the analogy drawn was that if it is necessary to have regulations for very low pressures, then it would be equally necessary to place a life-belt at every roadside puddle.

The next bone of contention was as to the height and width of switchboard passageways. Originally it was laid down that both for existing and new work the width of the passageways on low-pressure and medium-pressure boards should be three feet and the height seven feet, while on high-pressure and extra-high-pressure boards the respective dimensions were to be four feet and eight feet. So far as old work is concerned, it was only natural that there should be the most emphatic objection to this, as practically none would comply with the regulation. Eventually the dimensions were withdrawn in relation to existing work, but will apply to new boards, with the alteration that the width of high-tension and extra-high-tension boards shall be three feet six inches, measured from the bare conductors.

Considerable concession was also made by the Home Office on the question of fitting a no-volt release to all motors above one-third horsepower, whether alternating or direct. Many instances were quoted in which there would be absolutely no need for these, as, for example, in the case of a pump which was automatically stopped when a float in the tank reached a certain height. In such cases, of course, no possible harm could be done by the current going off and then suddenly starting. In fact, as was also pointed out, the general result of a motor being re-started with full load on is that the fuses would go, thus providing a means of safety if it were needed. Consequently, the Home Office agreed to the insertion of the words "where necessary to prevent danger," while a further provision that one release might do for a group of motors also appeased the objectors to a large extent.

Another point of principle, the discussion of which occupied much time, was as to whether the regulations should be retrospective in their entirety. Nobody wanted them to be so, except the Home Office. The objectors worked hard for the insertion of a clause that no one should be prosecuted for a breach of the rules unless there had been [illegible] present staff. This point had to be left over for the decision of the commissioner, as did the one as to whether, when a factory inspector certified that certain alterations should be made in order to comply, there should be an appeal to an expert arbitrator. For some reason, the Home Office has a most rooted objection to this, the most cogent reason put forward being that there is no such [illegible] of regulations issued by the department in respect of other industries.

One other point strenuously argued by the objectors was that, as matters stand under the new regulations, anybody could initiate a prosecution against a factory owner for non-compliance with the regulations, and in the present position of trade unionism here it is not impossible to conceive good use being made of this power, should necessity arise. The Home Office sees this difficulty, but feels unable to accede to the request that it should be clearly laid down that only that department should be able to prosecute, for a fear that this would interfere with rights of other departments which at present they wot not of. And so the position in this respect has remained unchanged.

The report of Mr. Swinburne should make interesting reading, for he was one of the leading figures in a deputation to the president of the Board of Trade several years ago asking for the removal of certain legislative restrictions which then, and even now exist. Therefore, the argument so strongly put forward that these regulations will still further tend in that direction should have a particular interest, although there is little reason to fear that anything of a really restrictive character is likely to be the outcome of the proceedings just terminated.

1. See Western Electrician of March 21, 1908, p. 231, and April 4, p. 276.

Locking Sockets to Prevent Theft of Lamps.

While the theft of current from electric-lighting companies by dishonest meter connection, etc., has received considerable attention, comparatively little has been said of another source of trouble of a similar nature, viz., the stealing of incandescent lamps from their sockets. Central stations whose policy it is to make free renewals find that there is a continual demand for new lamps without the exchange of burned-out lamps being offered in return; factories, hotels and public buildings are often mulcted by their employes and patrons. The majority of the lamps are probably stolen for use by the thieves, but several instances have been uncovered where a regular trade was carried on in the second-hand lamps. The advent of high-efficiency filaments, with the greatly increased value

LOCKING SOCKET WITH KEY

of the lamps, has given this traffic much more importance in central-station economics, and the device shown in the accompanying illustrations has been perfected to protect the companies from this loss. This ingenious device was first described and illustrated in the Western Electrician of August 17, 1907, shortly after the patent was issued; the present account shows it in its commercial form.

In appearance, the locking socket is similar to the ordinary key or keyless socket, the only difference being a small keyhole. The screw shell in the socket, however, swivels freely until it is locked by a key inserted in the keyhole. To place a lamp in the socket or to remove one from it, it is necessary to lock the interior shell by use of the key before the lamp can be screwed in or out. As the lamp turns freely at all other times, it will not be broken by a person thinking it is merely stuck in the shell and trying to force it out.

The locking mechanism is safe and simple, and with the exception of the locking feature the socket has all of the characteristics of the ordinary socket and can be installed in the same manner, either on bracket, chandelier, or as a pendant socket. It differs from other burglar-proof devices by being left unlocked, the key being used only to hold the inside shell rigid while the lamp is being inserted or taken out. The socket is made by the General Electric Company, Schenectady, N. Y.

A New Form of Cooper Hewitt Mercury-vapor Lamp.

By F. H. von Keller.

One of the problems that require the serious attention of the engineer in connection with mercury-vapor lamps is the starting. It is with respect to the starting that the terms "automatic" and "non-automatic" have become descriptive of the various types of mercury-vapor lamps now on the market. The mercury-vapor lamp presents in this respect a behavior similar to the ordinary arc lamp. For the inert vapor separating the two electrodes of a mercury-vapor lamp is by no means a conductor of electricity until the current has been established in the vapor path by some special means. In the most extensively used type of mercury-vapor lamp, the so-called "tilting lamp," a conducting connection is temporarily formed between

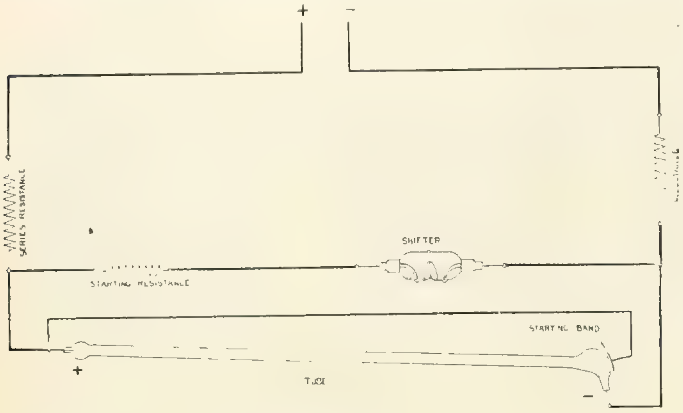


FIG. 1. CONNECTIONS OF AUTOMATIC MERCURY-VAPOR LAMP STARTED BY HIGH-VOLTAGE-KICK METHOD.

the electrodes by tilting the tube in such a way that the mercury is caused to flow along its entire length and form an uninterrupted bridge between electrodes. When the stream breaks the lamp starts. The tube is then allowed to drop back into its original position by gravity.

This operation of tilting the tube is usually performed by hand. In this case it is, of course, necessary that the operator should approach the lamp and pull the chain attached to the lamp-holder for this purpose. In most cases this is entirely practicable, and this type of lamp has gained a wide field of usefulness.

On the other hand, this operation may be performed by means of a solenoid or an electromagnet, which renders the lamp automatic. This method is, however, for mechanical reasons, usually confined to tubes not exceeding 21 inches in length. This type of lamp is known under the name of "automatic tilting lamp," and has also come into the market to a great extent.

In some cases it is important that the lamps be automatic; for instance, in the installations where the lamps themselves are suspended at considerable height, or where for other reasons it is impracticable to have the operator approach each individual lamp for the purpose of starting. Therefore the type of lamp described herewith has been developed. Here the tube, which is 50 inches long, is entirely stationary and subjected to no motion to effect starting.

This lamp is based on the principle that the

[illegible] FORM OF MERCURY-VAPOR LAMP.

[illegible]

the starting resistance and the series resistance. The inductance coil, being magnetized by this current, actuates an armature, which thereupon causes the shifter to break connection and open the starting circuit. The inductance is thereby caused to create a high potential across the tube terminals, sufficient to break down the starting reluctance of the tube and bring about the lighting.

Fig. 2 shows the arrangement of parts. The shifter is here placed in the foreground at the bottom. It consists of a small glass bulb about two inches long, provided with a V-shaped indentation, forming a partial partition, and serving to separate the mercury with two puddles, forming the electrodes. To each one of these puddles leads a small platinum wire making connections with suitable terminals. The bulb is exhausted to a high degree of vacuum.

When the current is first turned on, the shifter is in such a position that the mercury forms a bridge connecting the two leading-in wires together, thus closing the electrical circuit. The shifter is thereupon turned upon its longitudinal axis by the action of the armature, and the partition divides the mass of mercury into two separate puddles, thus breaking the electrical connection.

When the mercury bridge is thus severed, the shifter operates for a moment as a small mercury-vapor lamp started on the tilting-lamp principle. However, the amount of current flowing in the shifter is limited by the starting resistance to about one ampere, and the shifter therefore continues to run only for a fraction of a second and then goes out. At this instant the initial reluctance of the shifter re-establishes itself, and the current is thereby interrupted with such suddenness that the inductance produces a considerable potential rise (voltage kick).

It is established beyond doubt that the starting reluctance of the tube is chiefly due to an inherent characteristic of the electrode serving as negative. This electrode, of course, always consists of mercury. Not only does this reluctance assert itself when the lamp is being started, but it also tends to re-establish itself at intervals in the running lamp, thereby tending to put the lamp out. The frequency with which this will occur increases with decreasing current. The inductance in series with the lamp tube reacts upon these impulses of the negative electrode with a high-voltage kick, which keeps the lamp running continuously at its current 3.5 amperes. This same inductance, however, maintains the current flow in the shifter for only a fraction of a second, the current in this case being only one ampere.

When the shifter current is interrupted, there takes place a shifting of the current from the shifter to the tube, i. e., the tube starts. Hence the name "shifter." To accomplish this shifting it is, of course, necessary that at the instant of current interruption the (re-established) initial reluctance of the shifter exceed that of the lamp tube. Otherwise the induced voltage-kick, if sufficiently high, would now restart the shifter and not the tube. The fact that the tube does start, shows that the (re-established) initial reluctance of the shifter with a separation of electrodes of one-fourth inch exceeds that of the tube with a separation of electrodes 50 inches, and this strikingly demonstrates that not the vapor separating the two electrodes is the main seat of this reluctance, but that the [illegible] located in the electrode (in this case in the negative electrode).

This distinct quantitative difference between the [illegible] reluctance of the latter and initial [illegible] of the tube is brought about by an ingenious device applied to the tube, which reduces the initial reluctance of the latter to a large extent and thus makes the starting possible. This device is called the starting band.

The starting band is a metallic coating painted upon the outside of the condensing chamber at the negative electrode of the lamp, and extending above and below the mercury edge formed inside of the chamber. It is connected to the positive terminal of the tube (see Fig. 1) in such a way that it experiences the full rise of potential against the negative electrode during the starting operation. The starting band thus forms one side of a condenser, the other side of which is furnished by the mercury electrode, the glass serving as dielectric. When the high-voltage kick takes place, minute sparks may be observed jumping from the mercury surface to the glass inside the bulb. As though these sparks had punctured a highly resisting film upon the mercury surface, the main current now issues from one or several of these punctures. This result is of a similar nature as that produced by the contact tilting method, the production of conducting vapor, and thereby a considerable reduction of the negative-electrode starting reluctance.

The successful application of this method presents a great stride forward in the art of mercury-vapor lighting. While the automatic lighting of mercury-vapor lamps may be brought about by

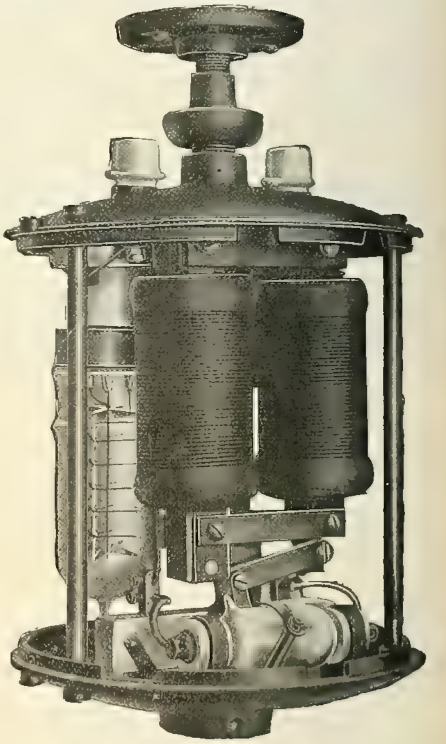


FIG. 2. AUXILIARY PARTS OF NEW MERCURY-VAPOR LAMP.

other means, this method, as far as can be judged today, approaches the ideal most nearly. For this is the only method by which the tube as a whole, as well as every part of it, remains perfectly stationary during the lighting process. The tube itself, naturally the most fragile part of the complete lamp, is thereby submitted to the least possible strain during the starting operation, resulting in decreased breakages and consequently increased life. Moreover, the tube remains comparatively simple in construction, is easily handled and readily shipped.

A lamp employing the above method is shown in Fig. 3. The tube is a straight one-inch tube of 50 inches light-giving length. It is provided with the customary condensing chamber on one end and an iron positive electrode at the other end. All the auxiliary apparatus is contained in a compact round housing, from which the tube holder is suspended.

The lamp yields approximately 800 candlepower at a power consumption of 3.5 amperes at 110 volts direct current. Thus an efficiency is obtained of approximately 0.5 watt per candlepower. The light emitted is highly diffused on account of the great length of tube, while the light source itself is made least offensive to the eyes by a relatively low intrinsic brilliancy. The light is of the familiar greenish blue, characteristic of the mercury spectrum. This lamp is particularly well adapted to all classes of factory work where a large quantity of highly diffused light at a low power consumption is the principal requirement.

It is said that a bill may be introduced in the Illinois Legislature to compel the interchange of passenger and freight traffic between steam and electric roads, when the equipment of the interurban roads will permit of the interchange. People living along the interurban lines are very much interested in such legislation, particularly the farming element.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Lighting Rates in Ohio.

For the benefit of the lighting companies represented in the Ohio Electric Light Association, Mr. D. L. Gaskill, secretary of the association, has gathered data of electric lighting and power rates from all parts of the state. A set of questions was sent to the lighting companies, and 101 answers were received, the wide difference in the form of the answers being such that the results could not readily be tabulated. A selection from the answers of companies in cities of different classes will be of interest.

Of the following answers the first group are from the largest cities in the state, the second group from cities of medium size, and the third from smaller cities.

Cities of 100,000 Population and Over.

Cleveland—Cleveland Electric Illuminating Company.—Has contract for street lighting, 9.6 amperes, 450 watts, 3,760-hour schedule; price, $54.96; coal, $1.75; 1,238 street arcs. Commercial lighting—Maximum lighting rate 12½ cents per kilowatt after 30 hours' use in one month of lamps connected, additional current at 5 cents per kilowatt, operates day current 6¼ cents to 4 cents per kilowatt; population, 450,000.

Cincinnati—Union Gas and Electric Company.—Contract June 1, 1902, for street lights; use alternating-current, series enclosed, four amperes, 300 watts; schedule 3,914 hours; price $60 overhead, $72 underground; 5,500 street arcs. Commercial lighting—10 cents, discount 5 to 70 per cent., depending on quantity used; no flat rate; 24-hour service, on power, 10 cents with discount; furnish only standard lamps, high-efficiencies bought by consumer of supply houses; population, 325,000.

Toledo—Toledo Railways and Light Company.—Has contract for street lighting, made in January, 1907; uses magnetite, 4 amperes, with 320 watts consumption, all night and every night; price per annum, $45 each; coal, $1.80 per ton; 1,600 lamps. Commercial lighting—Residence rate 9 cents; special schedule for other class service; flat-rate lighting signs and arcs only; operate day current, rate depending on character of usage; use high-efficiencies with good results; estimated population, 175,000.

Dayton—Dayton Lighting Company.—Has contract for street lighting, made in 1900; use direct-current 6.6-ampere series-enclosed, 450 watts; schedule 4,000 hours per year; price, $68.50; coal, $2.60 run of mine; 590 street arcs. Commercial lighting—9 cents to 5 cents, depending upon consumption; no flat-rate lighting; has day current; power rate 6 cents to 3 cents, depending upon consumption; use high-efficiency lighting units, 3,000, 50, 125, 187, 250 watts, very good results; population, 120,000.

Cities of 25,000 to 68,000 Population.

Youngstown—Youngstown Consolidated Gas and Electric Company.—Has contract for street lighting, made in 1902; use series alternating-current 7½-ampere, 450-watt consumption; schedule Philadelphia moonlight; price per annum, $64 each; cost of coal, $1.70 per ton; 600 street arcs. Commercial lighting—Two rates, 12 cents for 40 hours' use of demand, 5½ cents for all excess, less 10 per cent. for 10-day payment; do flat rate on window and sign lighting; receive 50 cents for 16-candlepower equivalent per month, dusk to 11 p. m.; operate day current; power rate, 6 to 3 cents per kilowatt based on daily hours' use; use high-efficiencies, Nernst and Gem, very good results; estimated population, 68,000.

Akron—Northern Ohio Traction and Light Company.—Has contract for street lighting, made in 1904 for 10 years; use magnetite lamp which consumes 320 watts; moonlight schedule; receive 2¾ cents per hour per lamp, minimum 2,500 hours in year; coal $1.75 mine run, $1.55 slack; 395 street arcs. Commercial lighting—12 cents first 30 hours' use of lamps connected, 5 cents for all over; no flat rate; day current, 5 cents per kilowatt; use high-efficiency lamps, number used, 150 100-candlepower, 275 75-candlepower, 200 50-candlepower with good results; population, 50,000.

Canton—Canton Electric Company.—Has contract for street lighting; use series direct-current 6.6 amperes, 480 watts; schedule all night and moonlight; price $64 and $60 all night, $44 and $41.50 moonlight; coal, mine run, $1.75. Commercial lighting—11-cent base, 10 to 50 per cent. discounts on from one to five hours' average use, day current at 3 to 6 cents, according to hours used; do high-efficiency lighting, results good; 38,000 population.

Newark—Licking Light and Power Company.—Has no contract for street lighting. Commercial lighting—Less than 10 kilowatts 10 cents gross, 9 cents net; 101 kilowatts to 200 kilowatts 9.5 cents gross, 8.55 cents net; 201 kilowatts to 300 kilowatts 9 cents gross, 8.1 cents net; 301 kilowatts to 500 kilowatts 8 cents gross, 7.2 cents net; 501 kilowatts to 750 kilowatts 7 cents gross, 6.3 cents net; 751 kilowatts to 1,000 kilowatts 6.5 cents gross, 5.85 cents net, 1,001 kilowatts to [illegible] kilowatts 6 cents gross, 5.4 cents net; over [illegible] kilowatts [illegible] cents gross, 4.95 cents net; does flat-rate lighting, 6 cents per 16-candlepower per month; free renewals; operates day current; power rate based on hours' use per day, ranging from 6 cents to 3 cents, depending on number of hours used; use high-efficiencies with good results; estimated population, 25,000.

Steubenville—Steubenville and East Liverpool Railway and Light Company.—Has contract for street lighting, made September 1, 1907; use enclosed arcs 6.6 amperes, 476 watts consumption; schedule all night and every night; price, $67 each per annum; cost of coal $1.25 run of mine, 95 cents slack f. o. b. works; 253 street arcs. Commercial lighting—1 to 30 kilowatts 10 cents, 30 to 150 kilowatts 9 cents, 150 to 300 kilowatts 8 cents, 300 to 700 kilowatts 7 cents, 700 and over, 6 cents; 10 per cent. discount; no flat-rate lighting; operates day current; price same as lighting; use some high-efficiencies with not altogether satisfactory results; estimated population, 25,000.

Cities of Less than 10,000 Population.

Bellevue—Bellevue Illuminating and Power Company.—Has contract for street lighting, made in 1905; use 6.6-ampere; moonlight schedule; $60 per annum; coal $2.10, three-quarter lump; 47 street arcs. Commercial lighting—10 cents first 20 kilowatts and 7 cents each additional; have few old flat-rate contracts, no new ones; receive 50 cents per 16-candlepower; no day current; use Nernst lamps, good results; 5,000 population.

Bowling Green—Lake Erie, Bowling Green and Napoleon Railway Company.—Has contract with city for street lighting, made in 1901; use open arc, 6.8 amperes, consumes 500 watts; schedule all dark hours; $84 per annum; coal, $2.25; 79 street arcs. Commercial lighting—10 cents, no flat rate; have day current; price 6 cents per kilowatt 10 horsepower and under, 5 cents per kilowatt 11 horsepower and over; use 100 high-efficiencies, good results; population, 6,000.

Delphos—Delphos Electric Light and Power Company.—Has contract for street lighting, made in 1903, 10-year contract; use 6.6-ampere enclosed alternating-current, 460 watts; schedule Philadelphia moonlight; price, $75; coal, $2.85 delivered in bins, three-quarter lump; 75 street arcs. Commercial lighting—20 cents per kilowatt, less 20, 50, 60 and 70 per cent., according to quantity used, 1 kilowatt to 10, 11 to 50, 51 to 300, 301 and over; very little flat-rate lighting now; price, 50 cents 16-candlepower per month; operate day current summer time, 500 volts, fans only; flat rate; use tungsten; just started, expect to increase business; population, 6,000.

Ottawa—Electric Light Company.—Has contract for street lighting, made December 1, 1904; use 40-candlepower incandescent, 3.5 watts; moonlight schedule; price, $28 each per annum; cost of coal, $1.65; 81 street arcs. Commercial lighting—Up to 20 kilowatts 10 cents, 21 to 40 kilowatts 9 cents, 41 to 60 kilowatts 8 cents, 61 to 120 kilowatts 7 cents, 121 to 200 kilowatts 6 cents, 201 and all above, 5 cents; does some flat-rate lighting, for three lights or under price 50 cents per 16-candlepower per month; does not operate day current, but expects to soon; use high-efficiencies with good results, with tungsten and Gem, poor with tantalum on account of high-frequency; estimated population, 3,000.

Van Wert—Gas, Electric Light and Power Company.—Has contract for street lighting, made in 1900; use open arcs, 9.6-ampere lamps; moonlight schedule; price, $76.55 per annum each; coal, $2.75; 79 street arcs. Commercial lighting—Rate, 20 cents per kilowatt; discount, 10 kilowatts and under per month, 10 per cent.; 10 to 20 kilowatts, 20 per cent.; 20 to 50 kilowatts, 30 per cent.; 50 to 75 kilowatts, 40 per cent.; 75 to 100 kilowatts, 45 per cent.; 100 to 200 kilowatts, 50 per cent.; 200 to 500 kilowatts, 55 per cent.; 500 to 800 kilowatts, 60 per cent.; 800 to 1,000 kilowatts, 65 per cent.; 10 per cent. additional for prompt payment before the 5th of the month; power rate, 5 to 7 cents per kilowatt; small motors charged as per light; population, 6,500.

The Slogan in Rockford.

The commercial watchwords of the Rockford (Ill.) Edison Company are these:

Live the electric life.
Watch Rockford grow.
Boost for a brighter, bigger, busier Rockford.
All together, all the time.
For everything electrical.

In carrying out this programme, with the planning of which J. Robert Crouse of the Co-operative Electrical Development Association of Cleveland and F. H. Golding, manager of the Rockford Edison Company, had much to do, the general business interests of the city have been interested. A "get-together" banquet was held last month and reported in the Western Electrician of March 7th.

Central-station Opportunities During the Coming Summer.

The approach of [illegible] renewed opportunity [illegible] [illegible] of new business [illegible] [illegible] [illegible] a recent trip through the southern and eastern sections of the country shows that so far there has not been very much done in the way of new-business campaigning for the coming months. The field of service, however, [illegible] demands a more confident attitude on the part of many companies, for the central-station business is intrinsically sound, and in certain lines the coming summer ought to mean a desirable increase in new connected load.

It is reasonably certain that the business conditions of the country will continue to improve during the coming months, and there could scarcely be a better time than the present to push the installation of the smaller devices which later will help in the introduction of the larger equipment. There is room in this country for those articles which increase the convenience and comfort of living, and all through the recent financial troubles the purchase of these appliances has been large, both inside and outside the electrical field. The fact that the cost of living has not materially decreased in the last few months tends to show that the demand for the best devices of civilization can be turned in the direction of the central station in the next four or five months if the business is sought in a systematic way.

Electrically operated household appliances, especially in the line of flatirons, fans, sewing-machine motors, chafing dishes, egg boilers, small heaters and porch lights all deserve the attention of the contract departments and solicitors.

Another direction where the solicitor can work to especially good advantage is in the study of operating conditions where an isolated plant happens to be giving inferior service. It is constantly the work of a progressive organization to be on the watch for opportunities to supply electricity at a lower cost than the customer has previously been paying. These chances for investigation are in many cities only waiting the proper analysis, and there is no time at which the owner of a business listens more interestedly to possible operating economies than when business is recovering from a period of depression.

The direct personal efforts of the solicitor in the next few months will be productive of more business if the company takes the broader outlook and swings over into the column of confidence, realizing that time is needed to secure new customers and adopting a liberal policy in regard to placing small apparatus on its commercial circuits for a thorough free trial. If the force of solicitors has been largely cut down, now is a good time to see if it cannot be set actively at work in the interest of securing a large number of customers who will be welcome users of current in the approaching summer.

H. S. K.

What One Cent's Worth of Electricity Will Do.

According to the Electric City of Chicago, which is the organ of the Commonwealth Edison Company, and therefore ought to know, one cent's worth of electricity, figured on average residence or power user's rate, with discounts—

Will operate a 12-inch electric fan for 90 minutes.

Will operate a six-pound electric flatiron for 15 minutes.

Will operate a sewing-machine motor for three hours.

Will operate a coffee percolator for four cups of coffee.

Will operate an eight-inch disk stove for seven minutes.

Will operate a small luminous radiator for eight minutes.

Will operate a one-quart water heater or baby's milk warmer twice.

Will operate a chafing dish for one rarebit.

Will operate a seven-inch frying pan for 12 minutes.

Will operate a heating pad for two hours.

Will operate an electric griddle for eight minutes.

Will operate an electric broiler for five minutes.

Will operate a massaging machine for 3½ hours' application.

Will operate an electric dental hammer for several operations (90 minutes' straight use).

Will operate a foot-warmer for 15 minutes.

Will carry you across the "Loop" district in an electric brougham.

Will run an electric piano for one hour.

Will vulcanize a patch on an automobile tire.

Will heat an electric curling-iron once a day for two weeks.

Will pump (raise) 250 gallons of water 100 feet high.

Will operate a two-quart glue pot for 30 minutes (or one hour on "power" rate).

Will operate an electric horse clipper for clipping one horse.

Will raise 10 tons 12 feet high with an electric crane in less than one minute.

Will raise a large passenger elevator, loaded, five stories per minute.

Will print 200 copies of the Electric City, in one color, on an electric-driven No. 5 Miehle press.

Will suffice for ironing your silk hat, "while you wait."

Will solder 180 telephone condenser connections, or 90 three-inch oil-lamp reservoirs.

Will brand your name on 150 hams, or brand 200 electrotype bases.

Multiple-conductor Pot Head.

The illustration shows a new porcelain pot head of the multiple-conductor station type. This cable head has been developed to meet the demands for a station bell that is easy to install, low in first cost and reliable. It consists of a porcelain

MULTIPLE-CONDUCTOR POT HEAD.

bowl and cover. The bowl is approximately seven inches in diameter at the top and four inches at the bottom. The bottom of the bowl is fitted with a metal plate provided with a collar drilled and tapped to size to screw upon the cable. The lid fits into the top of the bowl and is provided with the required number of holes and short tubes through which pass the conductors. Owing to the manner in which the inside top edge of the bowl is cut away the lid can be sealed into the bowl, thus excluding dust and moisture from the inside of the bell. The cut shows a three-conductor head assembled.

The use of porcelain, an insulator, in place of metal for the compound retaining part of a bell, has the advantage that the workman can separate the conductors better and make up a joint in less time, owing to the fact that it is not necessary to keep the conductor from the side of the bell. It is said that metal sides are not necessary in a bell as a static discharger, as the metal cup at the bottom is sufficient for this purpose. The device is made by the G. & W. Electric Specialty Company of Chicago.

New Tree Insulator and Wire Guard.

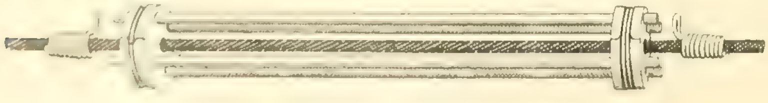
A decidedly new type of tree insulator and wire guard has recently been developed and will no doubt prove of interest to central-station managers operating plants in towns having large numbers of trees.

As will be seen from the illustration, this guard is of the "squirrel-cage" type, consisting of two split-porcelain circular end frames, serving as mounting supports for the guide or guard rods, which are made of specially treated wood, of great toughness and strength. The line conductor is by this method of construction entirely surrounded by a flexible protecting cage, which prevents damage being done to the line insulation coming in contact with limbs, guy wires, poles, buildings, etc. As the guard will freely swing with the line conductors, the danger of strains is minimized, a feature of [illegible]

To mount the guard in position, it is only neces- [illegible] around the [illegible] rod; then a small binder wire is run around in grooves on the [illegible] simply twisted together.

[illegible] guard, the [illegible]

This new guard, which is being marketed under the name of "Kirby Guard," is placed on the market by the Central Electric Company of Chicago.



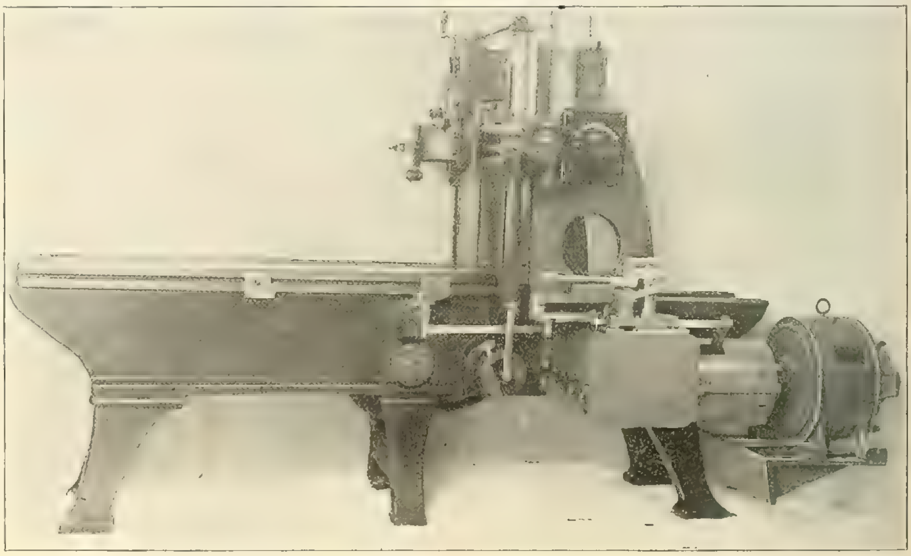
[illegible] WIRE GUARD.

A Compact Mechanical Reversing Device.

In many cases of machine driving it is necessary to reverse the driven machine without reversing the driving machine. This is, of course, particularly true when the latter is a prime mover or motor driving a number of individual machines. Even in the case of individual drive, it is desirable to avoid reversing the driver. The most common way this has been done is by the familiar belt drive with one straight and one crossed belt. The slippage and other deficiencies of this drive have led mechanics for many years to seek an improved reversing device.

After some seven years of costly experimental work by men experienced in the mechanical line, a device of this kind has been perfected by the Conkling Company of Chicago. A new principle has been applied in the invention of this device that results in its operation without producing any shocks to the driven or driving machine. The device is applicable to any machine that requires a smooth and positive reverse while permitting the motive power, whether it be steam, gas or electric, to run in one direction. Thus the field of its adaptability is very broad. Among the first uses for the device is the operation of planers and shapers.

In the illustration herewith the appliance is shown attached to a planer in the shops of the Conkling Company at Ninety-sixth Street and Erie Avenue, South Chicago. It is direct driven by a Westinghouse electric motor at a speed of 1,325 revolutions



REVERSING DEVICE FOR ELECTRIC MOTOR OR OTHER PRIME MOVER.

per minute. At this speed it runs with very little noise and reverses the platen of the planer without shock either to the motor or the planer itself. In fact, it reverses the platen very much easier than can be accomplished by the old belt drive. Ordinarily the platen of a planer, which is belt driven, runs on the backward stroke at about 2¼ to 1, and 2½ to 1 is about the maximum speed which can be procured. With the new reversing device the platen of a planer can be run on the backward stroke very easily 4 to 1, and with much less shock on either the platen or the planer than when running by the old-style belt drive.

The reverser mechanism is enclosed and runs in oil, thus insuring practically frictionless running of the bearings and gears. It is at all times under the control of the operator; and with the lever shown he can either stop or start it at any given point of the cut or reverse instantly in much shorter time than can be accomplished by present methods. The device itself is compact and is constructed on approved mechanical lines and has all the strength required to take any cut on any sort of a job that the planer or motor would stand. It has a positive movement, no hesitation whatever on the return stroke on account of slipping of belts, lost motion, etc., which was always the case with the belt drive.

As the device is efficient in operation, as well as economical of time, its use materially increases the output of such machines as planers and shapers and reduces their wear and tear. As it does away with one of the last excuses for belting, its use will doubtless result in the adoption of electric driving in many cases. The device is covered by American and foreign patents granted and pending, all of which are controlled by the Conkling Company.

Electricity in Warships.

The contract for the electric turret-turning gear of the U. S. S. Delaware, now under construction at Newport News, has been awarded to the Cutler-Hammer Manufacturing Company of Milwaukee. This company designed and built the electric turret-turning gear installed in the port after turret of the Indiana, the crew of which holds the world's record for marksmanship—10 shots in 2½ minutes, all hits. Every modern war vessel is equipped with a complete electrical plant, the specifications of some of the newer battleships calling for generators having a combined output of 800 kilowatts. In addition to illumination, radio-telegraphy and interior signal systems, electricity is used on shipboard in connection with the refrigeratng plant, ventilating fans, forced-draft blowers, and for operating ammunition hoists, boat cranes, deck winches, etc.

Westinghouse Machine Company Out of Receivers' Hands.

Under date of April 1st George Westinghouse, president of the Westinghouse Machine Company, issued the following circular letter:

"I have much pleasure in being able to notify the clients and other friends of the Westinghouse Machine Company that the receivers appointed October 23, 1907, by the Circuit Court of the United States for the Western District of Pennsylvania, were on March 31, 1908, discharged by the same authority. All of the matters which made a temporary receivership expedient have been satisfactorily arranged, and the company's position is greatly strengthened from every standpoint.

"All contracts made by the receivers for the sale of the company's product, or for the purchase of materials or merchandise, will be carried out as though made by the company's own officers.

"I take this occasion to announce the election of Mr. William H. Donner as the vice-president of the company in direct responsible charge of all of its activities, and to give the assurance of the continuance and accentuation under Mr. Donner's administration of that steadfast policy whereby the clients of the Westinghouse Machine Company have become friends as well as customers."

This announcement is in line with the generally improving conditions in the business world, and will be received with pleasure.

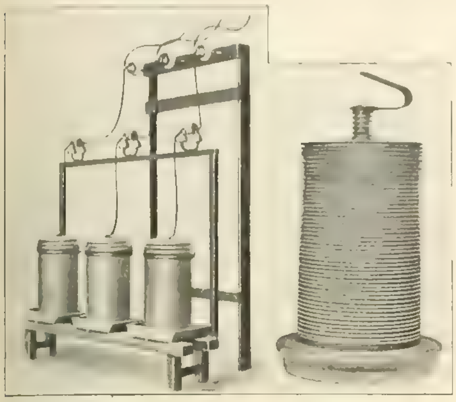
Three-cent Fare Question in Cleveland.

Announcement was made by representatives of the Cleveland city administration on April 6th that in all probability the local street-railway controversy will be settled by the adoption of a rate of fare of three cents flat with an extra cent for a transfer. Negotiations for settlement have produced a holding company for the Cleveland Electric lines and the existing three-cent lines. This holding company is to lease all the lines and combine them into one of the best systems in the country. A security franchise has been prepared which runs for 50 years, with an option for an additional 50 years. There are forfeiture clauses and protection for the original companies.

The Elgin, Woodstock and Lake Geneva Railway Company is being formed to build an electric railway from Elgin, Ill., to Fox, Twin and Powers lakes and north to Lake Geneva. Heavy summer traffic is expected.

Electrolytic Lightning Arresters.

The electrolytic lightning arrester shown in the accompanying illustration consists of a number of aluminum plates pressed into tray form so that when set one within the other, separated by small insulating washers, they may be built into a column capable of withstanding high voltages and still retain the safety-valve characteristics of a single plate. These columns are made in two sizes, one



Indoor Mounting. With Case Removed.
ELECTROLYTIC LIGHTNING ARRESTER.

for voltages between 4,000 and 7,500, the other for voltages between 7,500 and 15,000. The columns are enclosed in substantial stoneware jars. The jars may be mounted one upon the other to form arresters for any desired voltage. A gap on the line side of the electrolytic elements, which will withstand the normal voltage of the system, breaks down with over-voltage and permits the surge to discharge through the electrolytic units.

The electrolyte is dissolved in pure water and poured into the top of the arrester unit. It thus fills the first tray and runs over into the second, and so on through the column, the surplus escaping through a hole in the bottom of the containing jar through the next jar, if there be more than one, to the pan at the bottom.

The electrolyte fills only the trays and not the jar, so there is no opportunity for the current to pass except from tray to tray. Each unit when placed in the pan or on another unit automatically makes contact.

The electrolytic solution causes a very thin film to form on the aluminum plates. This film has an apparent resistance of very high value when moderate voltages are impressed upon it, but when the voltage reaches a certain value, it breaks down in myriads of minute punctures, making almost a short-circuit. As soon, however, as the voltage is reduced again, the punctures seal up at once, and the original high resistance reasserts itself. These arresters are arranged for installation either indoors or out, as suits the convenience of the user. They are made by the Westinghouse Electric and Manufacturing Company.

A Long Trolley Trip.

An undertaking showing the progress of electric railways from Chicago eastward was the attempt made by Mr. Elliott Flower, representing the Chicago Tribune, to travel by trolley from Chicago to New York city. Mr. Flower made a careful study of all the trolley maps available and selected what seemed to be a route with the smallest number and shortest gaps between the two cities. Leaving Chicago on March 29th he traveled south to Kankakee, Ill., where he had to take a steam road to Lafayette, Ind. From this point he traveled by electric lines through Indianapolis, Dayton, Lima, Toledo, Norwalk, Cleveland, Erie to Westfield, N. Y. From Westfield to Buffalo a steam road had to be taken. A trolley was taken from Buffalo to Lockport, then a steam road to Rochester, trolley again to Clyde and steam to Syracuse, trolley to Little Falls, steam to Fonda and trolley through Albany and Nassau to Hudson. At Hudson the New York Central steam road was taken to Tarrytown and then a number of connecting trolley lines to New York city.

The total distance covered was 1,278 miles, of which about 333 had to be covered by steam roads filling six gaps. The total cost for fares was $23.55 and the time eight days. No attempt was made to save time, the main effort being to travel by trolley as exclusively as possible. The lines in New York state were found to be mostly of a local nature, making little attempt to handle any through traffic on the scale found in Ohio, Indiana and Illinois.

The instrument report of the Chicago Telephone Company for March shows that the net gain in telephones during that month was 3,584, of which 3,278 were placed in the city and 306 in the country. On March 31st the company had in service in the city 164,487 telephones and in the country 47,457, making a total of 211,944.

CORRESPONDENCE.

Continental Europe.

Paris, March 24.—It is expected to secure about 200,000 horsepower for hydraulic plants in the Brescia province of North Italy, by using the streams which flow from the glaciers of the Camonica Valley. Such plants will be located on the Dezzo, the Torbiolle and other streams, according to the present project. On the other hand, plans are now in progress for using the outflow from the Arno Lake, which lies at 1,792 meters altitude. At Fresina will be located a 75,000-horsepower turbine station which will receive the water from the lake by an underground flume, using an 880-meter head of water. After leaving the turbine house the water will pass into a second flume and will there be united with the water coming from the Adame and the Salarno streams. The whole supply will be then taken in a canal to Cedegolo, and at this point a 500-meter head of water is to be used. This latter turbine plant is expected to give 60,000 horsepower. Another hydraulic project in the same region calls for the use of the water flowing from the Salarno Lake, which lies at an altitude of 2,038 meters.

The approach to the St. Lazare railroad station, which is one of the main depots of Paris, has long been unsatisfactory, owing to the fact that the tracks run in a narrow cut, and the traffic is very much encumbered at this point. Besides the main lines of Normandy and the Channel coast, the station is used for a very extensive suburban traffic, and the local lines run through one of the most populous suburbs of Paris. As there are only six tracks in the approach, the lines have been overcrowded for a long time past, and with the present arrangement the system cannot be operated properly. Accordingly work is being carried on in order to widen out the approach and increase the number of tracks, and it is quite probable that electric trains will be used on some of the suburban lines. This has already been found a success on the suburban portion of the Orleans road, where there are four tracks running out for a certain distance, two of them being used for the through trains and two for the suburban electric trains. Should some such arrangement be used at the St. Lazare depot it will be warmly welcomed by the suburban population of that district.

At Burgos, Spain, a syndicate has been formed for building a hydraulic plant on the Ebro River and also on the Rudron, which will afford a good supply of current for the city. A high-tension power line will be run from the plant, which is to be located at Quintanilla, on the Ebro, using a transmission at 30,000 volts on the three-phase system. The distance to be covered in the present case is 30 miles. Just outside of Burgos there will be installed a large sub-station in which the pole line will be received, and thence will be run low-tension mains throughout the city.

Prince Roland Bonaparte has offered the sum of $20,000 to the French Academy of Sciences in order to found an annual prize for encouraging scientific research. The interest of this amount will be used each year to make the award, especially with a view of aiding those who are engaged in original and interesting work which is likely to give rise to important discoveries. Such persons are not to be members of the Academy. A. DE C.

Great Britain.

London, March 27.—It is probable little progress will be made with the three electric-power bills relating to London, which are now before Parliament, just yet. Having rejected the proposal of the House of Lords that the measures should be sent to a joint committee, the House of Commons is rather taken with the suggestion of the president of the Board of Trade that some sort of a conference should be held between all the parties concerned in the problem. Similarly, the companies and the London County Council rather favor this idea, although the attitude of the London boroughs must be classified as uncertain. To some extent they would appear anxious to wish to have the powers join forces among themselves for the mutual development of their undertakings, leaving the companies to do likewise.

A somewhat startling report has been issued upon the London County Council tramway undertaking by a firm of commercial auditors in response to a request at the time of the election of the new council in March last year. This request was actuated purely by political motives, and to that extent the report must be viewed cautiously, especially in view of the fact that the sweeping nature of its comments have somewhat startled the political party responsible for the inquiry which led up to it. The report strongly attacks the principle of allocating a certain proportion of the cost of street improvements to improvement account and rather suggests that the whole cost should be charged to the tramway accounts. The auditors further state that the cost of the horse tramway system, which is taken up as the work of electrification proceeds, should be shown as a loss instead of as a capital charge upon the new undertaking. The figure at which [illegible] able for the relief of rates. The whole question, however, resolves itself into a matter of opinion [illegible] party who initiated the tramway service, for the [illegible] proved by the treasury.

Even with the apparently successful running of the electrobus, as it is called, in London, many people believe that the true solution of the traffic problem in the metropolis lies not that way. Much faith is pinned to the petrol-electric system of driving which is being experimented with to some extent, and in this connection a paper recently read before the Society of Road Traction Engineers in London gives some interesting figures as to the cost of running a petrol-electric system as compared with an ordinary petrol system of omnibuses, and the comparison is the more interesting in that this is, I believe, the first time that the cost of running petrol omnibuses in London has been divulged. The cost of the ordinary petrol 'bus works out to practically 24 cents as against 18 cents per car-mile for a petrol-electric system. The latter costs have been ascertained under actual running conditions in London.

Whereas a short while ago no police station in the metropolitan area was connected with the public telephone service, at the present time out of the 192 stations in existence 59 are so connected, while 123 stations are connected with a special police telephone service.

In connection with the agitation concerning the new telephone charge which is now going on, a permanent committee of the various chambers of commerce throughout the country has been formed to deal with all questions arising under this head.

A tour is about to be started with one of the Electric Vehicle Company's electric cars throughout England for the purpose of testing in a 1,000-mile run the suitability of the modern electric vehicle for touring purposes. The car in question is to be fitted with a single motor wound specially to withstand heavy overloads for prolonged periods without undue heating or sparking. It is rated at only 2½ horsepower. The battery will consist of 40 Tudor cells having a capacity of 200 ampere-hours on a four-hour discharge rate, the total weight being 1,000 pounds. In order to give an equal distribution of weight, 30 of the cells will be carried in front of the driver and the remaining 10 under the back seat. G.

Eastern Canada.

Ottawa, April 4.—Arrangements are being made for lighting the town of Sutton, Que., with electricity.

The Dominion government is arranging to establish a wireless or cable telegraph service between Prince Rupert, B. C., and Queen Charlotte Islands and between various large islands on the Pacific Coast.

Plans have been drawn for an electric railway to start from Ottawa, taking in Prescott, Brockville, Lyon, Athens, Perth, Lanark and other places, and then returning to Ottawa, making a belt line of about 250 miles long.

The city of Belleville, Ont., is seeking the right from the Dominion government to develop electric power at dam No. 2 of the Trent Valley Canal, north of Trenton. It is estimated that from 8,000 to 12,000 horsepower is available at this point. The town of Trenton has preferred a similar request to the government.

The revenue of the municipal electric-light plant of Prescott, Ont., has accumulated beyond an amount necessary for its maintenance, and the commissioners have decided to give $1,000 in cash of the surplus to the town for general purposes, besides abolishing the meter rents, which amount to $700 per year.

The railway committee of the Dominion Senate has thrown out the bill to incorporate the Ontario and Michigan Power Company. W.

New York.

New York City, April 4.—Prominent civil engineers and railroad magnates from various parts of the country were present Thursday night at a dinner given to celebrate the joining of the four Pennsylvania Railroad tunnels under the East River. The hosts were S. Pearson & Son, the English firm of contractors who built the tunnels, and those present included all who have been prominently identified with the gigantic task. The toastmaster was E. W. Moir, vice-president of the firm.

The Public Service Commission has passed a resolution instructing its engineer to prepare plans for the Broadway-Lexington Avenue Subway route which the commission laid out some time ago and which has been approved by the board of estimate.

This means that within seven weeks the matter will be sent to the board of estimate for final action. On July 1st the city's borrowing capacity will be increased by $50,000,000, and it is likely that there will be a large sum available for subway building. The Broadway-Lexington route, it is estimated, will cost about $60,000,000, but if this amount is not available the commission believes work can be done on a part of the line. A prospective bidder on new subways has appeared in the person of S. M. Brower, who represents the Trussed Concrete Steel Company of London, England.

The United States Independent Telephone Company of Rochester, N. Y., capitalized at $50,000,000, has been declared by the New Jersey Court of Chancery in Newark to be insolvent, and Vice-chancellor Howell recommended the appointment of a receiver.

There have been hearings before Public Service Commissioner Eustis on the complaint made by Water Commissioner John H. O'Brien against the maintenance by the New York Central Railroad Company of the high-voltage overhead electrical cables that are part of the road's electrical equipment, which Mr. O'Brien wants put underground. The testimony was entirely technical. Professor Sever of Columbia was on the stand.

Advertisements will appear next week asking for bids for the constructing of the Brooklyn Fourth Avenue Subway. The Public Service Commission decided to go ahead, despite the controller's threat that he would not certify the contracts and the qualified approval given on Monday by the corporation counsel. The subway is planned to run from the Brooklyn end of the new Manhattan Bridge under the Flatbush Avenue extension to Fulton Street, under Fulton Street to Ashland Place, to Fourth Avenue, to Forty-third Street. The work has been divided into six sections, the contracts for which are to be let separately. The estimated total cost is $15,000,000 for construction only, the matter of equipping and operating to be taken up after it has been built.

It was made apparent at the meeting of the board of estimate yesterday that the majority of the board has broken away from the mayor and the controller on all subway questions and that all such projects will be advanced as rapidly as possible until the time arrives for the actual spending of the money, when there must be a "show-down" to determine whether new lines can be built. The majority of the board yesterday called upon the Public Service Commission to present within 60 days detailed plans and forms of contract for the Broadway and Lexington Avenue line. W.

Southeastern States.

Charlotte, N. C., April 4.—Further development in the case of the Whitney Company, recently placed in the hands of a receiver, is the filing of a mechanic's lien against the company by the T. A. Gillespie Company, in Montgomery and Rowan counties, for the sum of $301,000 for services performed. This lien, under the laws of the state, takes precedence over the company's $5,000,000 bonds.

The new plant of the Thomasville (N. C.) Light and Power Company has been started up, supplying the town with lights and also offering a day and night service to manufacturers.

The Carolina Electrical Company has been chartered at Raleigh, N. C., with $15,000 authorized capital. It will take over the business of a bankrupt concern and greatly enlarge its scope. Officers have been elected with N. L. Walker president and C. K. Durfee secretary.

The permanent locating survey for the proposed Asheville-Hendersonville (N. C.) electric railway has been completed, and it is said on reliable authority that the work of construction will be inaugurated during the summer. J. H. Roland of Hendersonville is manager.

The Leaksville (N. C.) Light, Power and Milling Company has been chartered with $40,000 capital stock. E. B. King of Leaksville and J. C. King of Catherines, Ont., are among the incorporators.

Approval of the issuing of $20,000,000 stock and $16,000,000 bonds has been given by the state corporation commission of Georgia in the case of the Central Georgia Power Company, which promises to be the largest concern of its kind in the South. President W. J. Massee left shortly after this for New York to sign contracts whereby construction work might be started. James G. Campbell of A. B. Leach & Co., New York, Chicago and Boston, purchased the bonds. About 100,000 horsepower will be developed.

Power from the Buckhorn Falls on the Cape Fear River, near Fayetteville, is now being delivered to the amount of 1,400 horsepower to the Holt-Morgan, the Holt-Williamson and the Lakeview cotton mills. A total of 4,000 horsepower is practically ready for delivery in the same town. The Electric Bond and Share Company of New York came into [illegible] plant in 1908, and [illegible] has been put into [illegible] E. A. Mitchell and [illegible] of the Bond and Share Company, recently visited the plant. These gentlemen also [illegible] power from

Buckhorn Falls to Raleigh, a distance of about 30 miles, at a future date. The directors expressed their approval of the work done and of the general management of the power plant and the electric-railway system.

The American Motor Car Company of Mansfield, Ohio, has made inquiry regarding the location of a branch in Macon, Ga., and the Chamber of Commerce of Macon has taken up the matter with the company. D. H. L.

Ohio.

Toledo, April 4.—The February report of the Toledo Railways and Light Company is the best made for years. It shows a gross gain of $8,176, with a reduction in operation of $2,857, leaving a net gain of $11,034 for the month.

A receiver has been appointed for the Toledo and Indiana Electric Railway Company. The company made default on the January installment of its $1,650,000 bond issue, but it seems probable that the affair will be straightened out soon.

The Lake Shore Railroad will control its trains between Erie and Buffalo, a distance of 88 miles, by telephone.

T. R. Fishback of the Cleveland Electric Controller and Supply Company delivered a lecture last night before the Toledo Section of the American Institute of Electrical Engineers. His subject was "Lifting Magnets and Their Application," which was illustrated with lantern slides and practical demonstration. It proved very entertaining.

An effort is being made in Toledo to bring about a better quality of gas and electricity, to provide for an inspector, and to abolish the charge of $1 for setting meters. The matter is now receiving the attention of the city's legal department.

Plans are under way for the extension of a trolley line from Port Clinton to Catawba Island. It is being promoted by J. W. Emerick of Toledo. The project will cost about $120,000, a portion of which has already been raised. Bonds to the extent of $75,000 have also been arranged for.

The city of Fremont, Ohio, has ordered the preparation of the necessary legislation providing for the removal of all overhead telephone, telegraph and electric-light wires within the business district of the city. H. L. S.

Michigan.

Detroit, April 4.—The section of the Jackson and Lansing electric railway between Lansing and Mason will be completed this month. The section through Mason will not be completed until the differences between the city and company are settled. The Jackson end of the line may be built before the Mason section.

It is planned to develop the waterpower of the East Jordan River in Charlevoix and Antrim counties and supply current for light and power for a number of towns. W. A. Loveday is organizing a company for this purpose.

The center pier and gates of the Commonwealth Power Company's dam at Plainwell were carried away by floods in the Kalamazoo River. The damage was about $10,000.

Part of the dam of the Washtenaw Light and Power Company at Ann Arbor was carried away by recent floods in the Huron River. The damage was not great, and repairs are nearing completion.

The new plant of the Washtenaw Light and Power Company at Superior has been completed. It is the most modern on the river and also has the largest head. The generators are vertical machines, being direct-connected to the waterwheels. Facilities have been provided for making complete tests by the students of the engineering department of the University of Michigan.

The Detroit, Flint and Saginaw Railway has been ordered sold under foreclosure by the Circuit Court, on petition of the Detroit Trust Company, the trustee of the mortgage and receiver of the road.

Work has been started on the power dam of the Manistee River north of Sherman.

The Kalamazoo, Gull Lake and Northern Railway Company, whose franchise in Kalamazoo expires on May 1st, has been granted an extension of 18 months for the completion of the line within Kalamazoo and until May 1, 1910, for the nine miles of suburban track. D.

Indiana.

Indianapolis, April 4.—The construction and extension of interurban lines has begun in a manner indicating that great progress will be made during the year. J. M. Caulfield, vice-president of the Kalamazoo, Elkhart and South Bend Traction Company, of South Bend, reports that the entire right-of-way and franchises for the construction of 73 miles of interurban line to connect the cities above named have been secured and that the actual work of construction will begin within 30 days. In Southern Indiana contracts were let by the Evansville Terminal Railway Company for the construction of 10 miles of road to connect Evansville and Newburgh. In Southwestern Indiana material was received for the completion of the Patoka extension of the Evansville and Southern Indiana Traction line. In Eastern Indiana great progress is being made in the promotion of a new line from Decatur to Richmond. In Western Indiana the Indianapolis, Crawfordsville and Western Traction Company is planning to construct a line from Crawfordsville to Veedersburg. In addition, arrangements are being made to construct a line from Lafayette to Kankakee and between Logansport and Monticello.

The City Council of Ligonier is asking for bids for constructing and equipping an electric-light plant and system. A. J. Hammond of South Bend is the engineer.

The City Council of Poseyville has granted a 25-year franchise to Frank Seib and others to construct and equip an electric-light plant in Poseyville.

Charles Downey, secretary of the Indiana State Board of Agriculture, states that the idea of erecting an electric-light plant on the State Fair Grounds for lighting the stock pavilion and other buildings has been abandoned and a contract entered into with the People's Heat and Light Company to wire the buildings and extend its line to the fair grounds and furnish the service desired. The extending of the line and the wiring of the buildings will cost nearly $7,000. The contract for the wiring of the building will be let by the Heat and Light company in a short time.

The Light, Heat and Power Company of New Castle has voluntarily reduced its rate 25 per cent. and will also hereafter allow a cash discount for immediate payment of bills when due. The company's officials say the action was taken in order to induce the more universal use of electricity and thereby afford the company an opportunity to dispose of the great volume of electricity which its big new plant is capable of supplying.

The Lebanon Heating and Light Company is the name of a new organization for the purpose of constructing a new plant in Lebanon. Adam H. Felker, Philip Adler and Demetrius Tilotson are the chief promoters of the new enterprise.

The directors of the Washington Light and Water Company of Washington, Ind., have employed S. I. Woodward of Shelbyville, Ill., to take charge of the electric-light plant and superintend the improvement and installation of new machinery and equipment.

The Fort Wayne Engineering and Manufacturing Company of Fort Wayne, capitalized at $1,000,000, has filed articles of incorporation proposing to manufacture engines, boilers, electric machinery and supplies for power and light plants. Henry C. Paul heads the directors.

The Indiana Railroad Commission has ordered a reduction averaging from 10 to 12 per cent. in the rates charged by the express companies doing business in Indiana. The total annual business of express companies throughout the state is about $1,000,000. In the opinion of the commission the companies have been receiving fabulous returns on an apparently small investment. As a part of its opinion the commission promulgates a tariff schedule to be observed by express companies in the future in making rates. The matter may be carried to the courts to determine the commission's power to enforce the reduction. S. S.

Illinois.

Peoria, April 4.—The Illinois Traction Company began to handle express business for the United States Express Company this week. The schedules of the express cars have been changed to conform to the new requirements and to make connections with the other branches of the express company. Trailers will be attached to the regular cars and some of the passenger cars will carry express matter.

The lease of the Illinois Valley Railroad Company to the Chicago, Ottawa and Peoria Railway Company for a term of 99 years for $700,000 was filed for record here this week. The new line will be a part of the Illinois Traction System and will be constructed to connect with the Peoria-Bloomington and the Lincoln-Mackinaw line at Mackinaw. From Mackinaw the line will go north via Streator.

The Illinois Inland Traction Company of Chicago has been incorporated with a capital of $100,000 to build an electric railway from Chicago to Kankakee. Among the incorporators are Ed Doepp and C. W. Rhodes.

Accompanied by several officials of the Illinois Traction System, E. A. McNutt of Montreal, Canada, arrived in this city on a trip of inspection of the lines of the company. Mr. McNutt is associated with the company that financed the Illinois lines, and he will report on the progress that has been made during the year. Mr. McNutt is also treasurer of the Peoria Railway Company.

A. N. Fisher, one of the promoters of the Mattoon-Hillsboro-Pana electric railway, has given out the statement that the line will be built this summer. Much of the right-of-way has been secured and it is said that grading will commence at once. V. N.

Oklahoma.

Oklahoma City, April 3.—The Commercial Club of Muskogee and eastern capitalists are organizing an interurban line to run from Muskogee to Clarks

ville, Coweta, Brown, Arrow and [illegible] distance of 54 miles. Both freight and [illegible] will be installed. The line [illegible] River at Clarksville and [illegible] north side of the river.

The Cherokee Belt and Interurban Railway Company has been chartered for $500,000, with headquarters at Tulsa, to build a line connecting Collinsville, Tulsa and other towns. The incorporators are F. E. Montee, Kansas City, Mo.; C. W. Butterworth, Tulsa, Okla.; J. B. [illegible] and A. F. Leep of Collinsville.

The Canadian Valley Railway Company has been chartered for $2,000,000 to build an electric line from Mutual to Oklahoma City.

The Commercial Club of Durant is seriously considering a proposition to build an electric line to run from Durant to Red River, Utica and Albany. Clarence Walters is promoting the project.

The Oklahoma Street Railway Company, since the "Jim Crow" law went into force, has built six new cars which will be put into operation by April 15th. These cars are 39 feet long with a seating capacity of 44. The company has manufactured since it opened its shops last July 18 cars, which are all in use on its own lines. K.

Northwestern States.

Minneapolis, April 4.—Martin Bros. of La Crosse, Wis., have installed a private electric-light plant in their factory at Main and Second streets.

The construction of a municipal lighting plant is contemplated at Chilton, Wis.

The Rapid Transit Company of Waterloo, Iowa, will construct an interurban line from Chautauqua Park through Westfield, Iowa, to the west side, at an expense of $70,000. A street-car loop to cost $60,000 will also be constructed, two miles long, at Waterloo, to be operated by the Waterloo, Cedar Falls and Northern.

A stock company may be formed in Sheridan, Mont., for the purpose of taking over the electric-light plant.

The Belden-Porter-Gray Company of Minneapolis, dealer in electrical equipment, etc., has incorporated, with a capital stock of $50,000. George A. Belden, W. F. Porter and W. I. Gray are the incorporators.

The project for the construction of the Twin City and Lake Superior electric railway from Duluth to Minneapolis may be carried through shortly. About 36 miles of road is now ready for steel. Grading work has been begun.

The Northwestern Improvement Company of Red Lodge, Mont., has resumed work on the construction of an electric-light plant.

Marinette, Menominee and Chicago persons are interested in the forming of a waterpower company, combining six of the principal powers on the Menominee and Peshtigo rivers, aggregating 25,000 horsepower, at Marinette, Wis.

The Fox River Street Railway and Lighting Association has been organized at Appleton, Wis. N. C. Draper of Fond du Lac is president.

Stoner & Jewett of Blackduck, Minn., have been granted a franchise for lighting the village of Baudette, Minn. They are erecting poles.

E. A. Forbes, C. A. Wilson and A. W. Shelton of Rhinelander, Wis., and E. T. Sherry of Milwaukee have formed the Langlade Power Company at Langlade, Wis., for the purpose of developing 4,000 horsepower on the Wolf River, near Antigo, Wis. R.

Western Canada.

Winnipeg, April 4.—A proposition is before the City Council of Winnipeg for the purchase of the entire holdings of the Winnipeg Electric Company, costing approximately $14,000,000. A motion to this effect was introduced by Alderman Manning as an alternative to the construction of the civic power plant at Lac du Bonnet at a cost of over $3,000,000. It is pointed out that if the civic plant is constructed it will be a competitor of the Winnipeg Electric Company, which now supplies all the light and power in Winnipeg in addition to the gas and street-car service. The matter will be fully discussed at the council meeting to be held on the evening of April 13th.

J. H. Field, recently appointed as manager of the wireless telegraph station at Point Grey, B. C., has resigned through ill health. It is understood that W. James will take charge of the station at once.

The Dominion government wireless telegraph station at Point Grey, B. C., five miles from Vancouver, on March 28th picked up a wireless message being sent from Point Loma, Southern California, to the Mare Island Navy Yard at San Francisco. The operator at Point Grey later exchanged several signals with Point Loma. An hour later Point Grey talked with a Pacific Coast Steamship Company steamer entering the harbor at Juneau, Alaska. R.

Pacific Slope.

San Francisco, April 2.—Notwithstanding the efforts of the San Francisco Gas and Electric Company to convince the owners of new buildings that they will save money by buying electric current [illegible] power [illegible] power for the Claus Spreckles Building, the six-story building adjoining it on Market Street, and probably for several other buildings owned by the Spreckels interests. The original direct-current plant which is now in operation in the annex supplies light and power for the editorial, composing and press rooms of the San Francisco Call.

Specifications have just been sent out by A. M. Hunt, electrical engineer, for a high-duty electric power plant which is to be installed in the basement of the Whitney Building. It is intended to establish a block lighting system. The proposed installation will supply current for a number of other buildings in the neighborhood. The specifications call for two 300-kilowatt direct-current three-wire units of engine type.

The Standard Electrical Works has just completed the installation of an electric-lighting and power plant at the Miller & Lux abattoirs in the suburbs of San Francisco. A two-phase engine-type Warren generator of 150-kilowatt capacity has been installed.

Electrical Workers' Union 537 has adopted a higher scale of wages for employes of the city electrical department. It calls for a monthly wage of $135 for foremen, $150 for cable splicers, $125 for operators, $120 for linemen, $135 for outside inspectors and $120 for battery men. The new schedule has been submitted to the board of electricity, which will consider it at its next meeting.

On March 31st the Snow Mountain Power Company's plant was put in operation for the purpose of lighting the town of Ukiah. Contracts are now being let for the extension of the company's line to Santa Rosa.

Bids are being received by the Los Angeles City Council for the illumination of 34 blocks of the city's streets.

The board of management of the New Mexico territorial prison at Las Vegas, N. M., has contracted for electrical machinery for an electric-lighting plant at the prison.

The Socorro Electric Company has been incorporated at Socorro, N. M., with a capital stock of $30,000 for the purpose of constructing an electric power and lighting plant at that place. The directors of the company are headed by Emmett A. Drake.

On April 13th the voters of Lodi, Cal., will decide upon the proposition of issuing bonds to the amount of $126,000 for the purpose of putting in lighting, water and sewer systems.

The annual statement of the Edison Electric Company of Los Angeles for the year ended December 31, 1907, shows that the gross earnings were $2,206,381 as compared with $1,731,520 for the year preceding; the operating expenses $868,374 as compared with $719,997, leaving the net earnings $1,338,006 as compared with $1,011,523.

In June the voters of Union, Ore., will vote upon a charter amendment that will permit the city incurring an additional indebtedness of $55,000 for the building of an electric-light plant.

The City Council of White Salmon, Wash., has granted a franchise to T. Weyers, Jr., and T. F. Shepler to erect an electric distributing system in that place.

The Bremerton-Charleston Light and Fuel Company has been incorporated at Bremerton, Wash., with a capital stock of $70,000, by F. C. Brewer and T. L. Stiles.

Work will be started in a few days on the double-tracking of the Stark Street line of the United Railroads of Portland, Ore., for a distance of 3,000 feet.

Three extensions of service on its lines were announced by the United Railroads of San Francisco this week. These will not require any new track-laying.

The Los Angeles Pacific Railway Company, operating from Los Angeles to the ocean, put into operation its new standard gauge cars this week. The cars are run in trains of three each. The new cars have side entrances and wide swinging doors at each end, making an open passage way from coach to coach. Each car seats 58 passengers and is capable of making 60 miles an hour.

The Northern Pacific has put into operation a third-rail system on its line between San Anselmo and Fairfax, though steam trains will also be used until the company's new power house is completed, as the present available power is insufficient to support all of the traffic.

Wireless telegraph apparatus is now being installed on the United States gunboat Yorktown at the Mare Island Navy Yard, Vallejo, Cal. A.

A Paris dispatch says that Lee De Forest, on March 31, conducted the final test of his wireless-telephone system on the Eiffel Tower.

PERSONAL.

[illegible]

[illegible]

[illegible] pany.

[illegible] Westinghouse Electric and Manufacturing Company, has returned to his San Francisco headquarters [illegible] other eastern cities.

Mr. George E. Richardson, electrician in charge of the power plant of the Lancaster Mills at Clinton, Mass., has resigned his position to go with the sales department of the General Electric Company at the Boston office.

Mr. William H. Donner, the new vice-president of the Westinghouse Machine Company, is one of Pittsburg's prominent young men. He is reported to be closely affiliated with H. C. Frick and to have accumulated a large fortune by operations in the tin-plate and steel industries.

Mr. J. F. Collins, who for several years has been the superintendent of the Toledo Railways and Light Company, has accepted an invitation to become general manager of the Saginaw Valley and Bay City traction, gas and light company, and will be located at Bay City, Mich. It is understood that Mr. J. N. Enright will succeed him.

Mr. William S. Taussig, formerly sales manager of the power department, Western Electric Company, and Mr. Fred. R. Babcock, lately a member of the firm of Geo. H. Rowe & Co., consulting engineers, Chicago, have left these positions to form the firm of Taussig & Babcock. They have opened an office in the Marquette Building, Chicago, where they are conducting a western agency for a number of manufacturing concerns. Among their special lines are direct and alternating-current machinery and electrically driven machine tools. Both these men are graduates of Armour Institute of Technology, where they were classmates in the electrical engineering course. Although young in years, they have had extensive experience in the electrical business and are well known for ability and energy.

Mr. James W. Johnson, who is to succeed Mr. B. E. Sunny as manager of the Chicago office of the General Electric Company, as noted last week, is a native of Waverly, N. Y., but has been a resident of Chicago since boyhood. His father, Rev. David S. Johnson, D. D., now deceased, was a prominent Presbyterian clergyman. He began his electrical career with the old Bell Telephone Company of Illinois, and in this company he commenced his long business association with Mr. Sunny, who was operating superintendent of the company. In 1885 Mr. Johnson resigned his position as cashier of the then Chicago Telephone Company to become a partner in the firm of Johnson, Holland & Co., composed of C. N. Fay, Claire Holland and himself. This firm was organized to exploit the storage-battery business under patents owned by the Electric Accumulator Company. It made a number of important contracts, and was succeeded by the Northwestern Electric Accumulator Company, of which Mr. Johnson was made manager and treasurer. The storage batteries of that day were not the commercial successes they are now; the depreciation was excessive, and the consequent expense for experts to maintain installations made it early apparent that the profits would be wiped out; consequently, on the manager's recommendation, the company was honorably liquidated long before other similar companies met with disaster. In 1888 Mr. Johnson entered the employment of the Thomson-Houston Electric Company in its Chicago office on the same day that Mr. Sunny did, and a year later was made manager of the isolated lighting department upon its organization. He continued in that capacity until the company was succeeded by the General Electric Company, and afterward, until made manager of the lighting department of the Chicago office of the General Electric Company. After the World's Fair Mr. Johnson left the General Electric Company and was for a time western agent for the United States Fire and Police Telegraph Company of Boston. He re-entered the service of the Gen-

JAMES W. JOHNSON.

eral Electric Company in 1897 to look after municipal contracting, and a year or two later was appointed manager of the power and mining department, Chicago office, which has been his special charge until the present time. During the last two years or more he has been assistant manager of the Chicago office also. Mr. Johnson is a member of the Union League Club and an associate member of the American Institute of Electrical Engineers. He has an extensive acquaintance among electrical men, and is noted for business capacity of a high order as well as exceptional tact and urbanity and the ability to dispatch a surprising amount of work with unruffled serenity and without apparent effort.

ELECTRIC LIGHTING.

Hartley, Iowa, has issued bonds of $12,000 for an electric-light plant.

The Coos Bay Gas and Electric Company is installing a power plant at Coos Bay, Wash.

The Childress (Tex.) Ice and Light Company has been incorporated with a capital stock of $40,000.

The State Electrical Company has begun business in Lincoln, Neb., and will make wiring its specialty.

It is proposed to bond the city of Omaha, Neb., for $5,000,000 to build a power canal in the Platte Valley.

The electric-light plant owned by the village of Orion, Ill., was almost totally destroyed by fire a few days ago. The loss is about $8,000; no insurance was carried.

C. H. Martin of Domphan, Mo., and others are about to establish a dam and power house on the North Fork and transmit the current to West Plains, Mo., a distance of 20 miles.

An ordinance granting a franchise to a new electric-light company at Omaha, Neb., is being drawn. The company, if granted a franchise, proposes to supply the city with arc lights and lamps at $50 a year.

The Council of Spirit Lake, Idaho, has granted a franchise to the Spirit Lake Land Company to construct electric-light circuits in the city. The Interstate Telephone Company was also granted a franchise for a telephone system.

The Water and Light Commission of Fairmount, Minn., which has charge of the city lighting, has bought a complete electric cooking outfit for the purpose of testing it as to utility and cost, and if it proves the success that is claimed for it the outfits will be recommended to the public and put in wherever wanted.

The Rochester (N. Y.) Railway and Light Company and its subsidiaries will be represented at the Chicago convention of the National Electric Light Association by General Manager R. M. Searle, Assistant General Manager J. T. Hutchings, Assistant Treasurer C. A. Tucker, Attorney D. M. Beach, Superintendent F. A. Willard, commercial department; Superintendent T. H. Yawger, electrical department; Purchasing Agent J. B. Eaton, Electrical Engineer J. C. Parker, all of the Rochester Railway and Light Company; Superintendent Stephen P. Cobb, Ontario Light and Power Company, Canandaigua; Superintendent George L. Colgate, Eastern Monroe Gas and Electric Light Company. The company sends its representatives to the convention as a matter of business and pays all of their expenses. It believes that what the various officials and employes observe and learn at the convention will be of service to the public in Rochester, East Rochester and Canandaigua.

ELECTRIC RAILWAYS.

At the annual meeting of the Chicago and Milwaukee Electric Railroad Company A. C. Frost was re-elected president, P. G. Beach secretary, and W. O. Kilman treasurer. H. C. Osborne was elected vice-president, succeeding Gordon Ramsey. The property is now in the hands of receivers.

The Gallatin Valley Electric Railway Company of Bozeman, Mont., has incorporated, with a capital stock of $100,000. The company proposes the construction of 30 miles of rural trolley lines through Gallatin Valley. The incorporators are W. H. Winfree of Spokane, Wash., and Hartman Bros. [illegible]

Traffic on three of the Chicago elevated railways in March increased slightly from February, although, while the North and South Side lines are showing gains, due to their extensions, it is evident that business shows some falling off when compared with [illegible]

[illegible]

POWER TRANSMISSION.

Part of the dam of the Commonwealth Power Company of Jackson, Mich., at Plainwell on the Kalamazoo River went out a few days ago as a result of the heavy storm. The damage may reach $10,000, it is said.

The bill to incorporate the Ontario and Michigan Power Company, which desired to develop waterpowers in the Pigeon, Nipigon and Sturgeon rivers and to export power to the United States, was defeated by the state railway committee in Ottawa, Ont., on April 1st. The Ontario government protested that the bill infringed provincial rights.

Mortimer Everest of Albany is promoting a project for developing the available waterpower along Garoga Creek in Fulton County, N. Y., and the erection of electric power plants. The Garoga Valley Electric Light and Power Company will be organized to carry out the project. Power will be transmitted to Amsterdam, Schenectady and other cities.

PUBLICATIONS.

"Jeffrey Mining Equipment" is the title of a circular issued by the Jeffrey Manufacturing Company of Columbus, Ohio, in which are illustrated 14 Jeffrey specialties of interest to mining engineers.

The Cutler-Hammer Manufacturing Company of Milwaukee in a little folder shows a few of its controllers, regulators, starters, etc., and offers to assist those engaged in any branch of the electrical industry in the solution of any problem involving electrical control.

Another of the cleverly designed monthly calendar cards has made its appearance from the F. Bissell Company, Toledo, Ohio, dealer in wholesale electrical supplies and machinery. This one is for April and bears an unmistakable sign of spring. These cards will be forwarded as issued upon request.

The Zenco Electrical Supply Company, 94 West Van Buren Street, Chicago, has just issued the 1908 edition of its catalogue. A complete line of standard electrical supplies is listed. The arrangement is good, and nearly every article is illustrated. The company is manufacturer and jobber of electrical supplies and has facilities for supplying all wants in the electrical line.

Bulletin No. 4570, recently issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the General Electric tungsten lamp for 100 to 125-volt circuits. The lamp is made in 40, 60 and 100 watts, and has a life of approximately 800 hours when used on either alternating or direct current. Some of the illustrations show the tungsten incandescent units combined with standard Holophanes, which can be used to excellent advantage in this manner.

The Habirshaw Wire Company, 253 Broadway, New York, has issued a very convenient price list of National Electric Code standard wires and cables for voltages up to 600, inclusive, also for such telephone wires and special cables as have become standardized. The lists and "addition tables" cover a range of prices sufficiently wide to give them permanent value. Careful perusal of the instructions for use of these addition tables will prove their value. Information is also given by which mistakes may be avoided. Some convenient copper gauges are given.

In a new bulletin, No. 4573, the General Electric Company describes the graded shunt resistance multigap lightning arresters for 1908. The bulletin also contains detailed descriptions of low-voltage arresters, static dischargers, constant-current horn arresters, disconnecting switches, choke coils, and type M, form D-2 direct-current arresters for voltages up to 6,000. The bulletin discusses briefly the theory upon which the arresters operate and their details of construction. Tables of general data regarding the apparatus, with connection and dimension diagrams, etc., are included.

Catalogue No. 107, just issued by the H. W. Johns-Manville Company of 100 William Street, New York city, treats of asbestos wood. This product is a fireproof substitute for wood, slate, marble and fiber. It was developed by Prof. Charles L. Norton of the Massachusetts Institute of Technology, after long and laborious research. It is mineral in composition, being made principally from asbestos fiber, but has the physical characteristics of ordinary wood; it can be cut, nailed and screwed into as well as or better than wood. A large number of its uses and applications are described in this catalogue.

The April number of Graphite, issued by the Joseph Dixon Crucible Company of Jersey City, N. J., contains valuable information on the subject of graphite dynamo brushes. Dixon graphite brushes were first used as an experiment in the electric-light and power plant of the Dixon company shortly after it was built in 1900. Since then [illegible] graphite brushes are used with excellent results on about 100 motors throughout the plant. These brushes are finding [illegible] on the market. They have many good qualities, and anyone interested will do well to read the April Graphite to learn where and how to use them to the best advantage.

SOCIETIES AND SCHOOLS.

The annual business meeting of the American Institute of Electrical Engineers will be held in New York city on May 19th. The general proposal list for officers, compiled from the nomination forms returned by members, has been issued. Mr. L. A. Ferguson of Chicago is the directors' nominee for president.

The proceedings of the twelfth annual convention of the International Association of Municipal Electricians have been published in the usual substantial book form. The interesting papers and reports of the meeting, held at Norfolk, Va., August 7th, 8th and 9th, are included. Mr. Frank P. Foster, Corning, N. Y., is secretary of the association.

The Lewis Institute Branch of the American Institute of Electrical Engineers will present an illustrated lecture on "Comparison of Series and Induction Motors for Hoisting Purposes," Wednesday, April 15th, at 8:30 p. m., at the Lewis Institute auditorium. The lecture will be given by Mr. R. M. Gaston, who is chief engineer of Geo. P. Nichols & Brother. A large attendance is expected.

The next meeting of the Utah Society of Engineers will be held in the rooms of the Commercial Club, Salt Lake City, on April 21st. It will be the occasion of the annual banquet and as planned will be a particularly memorable affair. The entertainment committee declares it will be the biggest and most enjoyable gathering of its kind ever held in engineering circles west of Chicago. To help the good fellowship, "all diners will be searched and those armed with slide rules or compasses will be given 45 degrees."

The fourteenth annual convention of the Ohio Electric Light Association will be held at Hotel Victory, Put-in-Bay Island, August 25th, 26th and 27th. No charge will be made the associate members for exhibitors' space, and ample facilities will be provided to exhibitors. Particular attention has been paid to the entertainment for the ladies, and it is confidently expected that the association will have the pleasure of entertaining double the number attending any previous convention. The papers presented will be entirely by central-station men, and the question box will be made a particular feature of the sessions. Mr. D. L. Gaskill, Greenville, Ohio, is secretary.

At Sibley College, Cornell University, Ithaca, N. Y., a radical step has been taken in the department of electrical engineering this year in offering to all juniors a uniform course of a general nature. Accompanying this has been the junior laboratory electrical course administered by the department of experimental engineering. In the senior year the electrical engineers have followed the programme, under which the subject is studied by the experimental, the analytical and graphical methods. As far as possible computations are made in a large room under careful supervision. This feature of the work has been so successful that it is to be extended next year, and it is to be supplemented by a two-hour recitation course throughout the year.

On April 1st the Pittsburg Section, American Institute of Electrical Engineers, held a successful meeting in the lecture hall of Carnegie Institute. The topic of the evening was electrical operation of rolling mills. Papers were read by W. A. Dick on "Application of Motors to Rolling Mill Work;" R. C. Reed on "Characteristics of Motors for Shear Work," and by James Farrington on "Relative Advantages of Various Methods of Operating Reversing Mill Tables." Mr. Dick's paper dealt with the general problem with special mention of some of the newer applications. The other papers took up specific problems in rolling mill work. After the reading of the papers there was a general discussion. Preceding the meeting the members of the section and their friends met at the University Club for an informal dinner.

TRADE NEWS.

Mr. Fred K. Potter, for many years connected with the Capell Fan Engineering Company, has been appointed manager in the Pittsburg district for the Sirocco Engineering Company. Mr. Potter's offices will be in the Keenan Building, Pittsburg. It is only recently that the Sirocco fans and blowers have been manufactured in the United States at the new plant of the Sirocco company at Troy, N. Y.

Sealed proposals are invited by the Sanitary District of Chicago and will be received by the clerk at room 1500 American Trust Building, Chicago, Ill., until noon, April 15th, as follows: Division A, 15,000 feet of four-duct sectional conduit; division B, 50 manhole collars and covers; division C, 50,000 common brick. All the material must be delivered within 21 days after the award of the contracts. All proposals must be delivered at the office in a sealed package, addressed to "The Board of Trustees of the Sanitary District of Chicago,"

and indorsed, "Proposals for District A, [illegible] feet of four-duct sectional conduit, district B, [illegible] manhole collars and covers; district C, [illegible] common brick."

It has been announced that the new Singer Building, New York, will require some 25,000 lamps to fill the sockets, and the first shipment of 10,000 lamps has been made. Columbia 230-volt lamps will be used, the contract having been secured by the Central Electric Company of Chicago.

Mr. F. Bissell, president of the F. Bissell Company, the well-known supply concern of Toledo, Ohio, passed through Chicago last week. Mr. Bissell reports that business conditions have very much improved within the last few weeks and that the Bissell company is doing a very satisfactory business.

Some improvement in the industrial and commercial situation of the country compared with January is shown by the February report on internal commerce, just issued by the Bureau of Statistics of the Department of Commerce and Labor. While the volume of leading commercial movements in most cases was smaller than a year ago, the coal, iron and building trades report better results for the month as compared with the first month of the year. The traffic activity of the railways for the first time since last October likewise shows a slight change for the better.

Frank MacGovern, formerly vice-president and general manager of Rossiter, MacGovern & Co. of New York, announces the formation of the new firm of MacGovern, Archer & Co. of 114-118 Liberty Street, New York city, which will continue the same character of business as the old firm, viz., the handling of electrical and steam machinery. Mr. Archer—J. Warren Archer—was formerly manager of the sales department of Rossiter, MacGovern & Co. The new firm, with commendable energy, has already issued a list of machinery offered for immediate delivery. No doubt this "bargain sheet" will be sent to anyone on request.

The management of the Weber Steel Concrete Chimney Company of Chicago announces that on account of increasing its field of activity to take in other kinds of plain and reinforced-concrete construction work, in addition to chimneys, the name of the company has been changed to the Weber Company, general offices as before, 929-934 Marquette Building, Chicago. The company is now prepared to carry out contracts for all kinds of concrete and reinforced work, including foundations, walls, buildings, sewers, chimneys, etc., and already has some large contracts in the different lines under construction. The company now has branch offices in New York, Atlanta, Cincinnati, St. Louis, Houston, [illegible] Angeles, San Francisco, Seattle and in London, [illegible]

[illegible] March 13, 1908, in the United States Circuit Court, [illegible] inghouse company. These bills allege that the flaming arc lamp made by the Beck company infringe these patents.

Prof. William H. Bristol writes that he has bought control of the Bristol Company of Waterbury, Conn. Professor Bristol assumed active charge of the management of the business on March 28th and now owns the majority interest. The company has been manufacturing his inventions since its organization in 1889. The business which has been carried on under the personal name of William H. Bristol at New York will hereafter be combined with the Bristol Company, and by this consolidation of interests the Bristol Company will have one of the most complete lines of recording instruments in the world for pressure, temperature, electricity and for a great variety of other applications. In the last two years William H. Bristol has developed many new inventions, including the William H. Bristol electric pyrometers and patented smoked chart recorders. He has taken out a large number of patents during the last three years on new instruments. One of these, which will be soon put on the market, is the long-distance electric thermometer, designed especially for indicating and recording refrigeration, atmospheric and drying temperatures. The combined line of recording instruments to be hereafter manufactured by the Bristol Company will make it possible for the company to co-operate better than ever before with its customers in giving them satisfactory service.

BUSINESS.

The Youngstown Sheet and Tube Company of Youngstown, Ohio, recently awarded contracts for three 500-kilowatt Allis-Chalmers synchronous motor-generator sets, intended for operation in connection with two Allis-Chalmers steam turbines and generators, each of 1,500 kilowatts capacity, ordered some time ago. The contracts include two induction motor-driven exciter sets, with balancer and transformers.

Dossert & Co., 242-44 West Forty-first Street, New York, state that the rapid advance of the Dossert solderless connectors in the trade is shown by the [illegible] bleeder, from the Chicago City Railway Company, [illegible] Company.

[illegible] than ordinary interest. This contract comprised an equipment for converting copper matte into blister copper, consisting of two electrically operated converter stands with six converter shells, for the Yampa Smelting and Refining Company, Bingham, Utah. The contract includes the furnishing of all accessories, such as copper molds and cars, ladles, tamping machinery, a complete silica-crushing plant for converter lining, with electric motors, and a cross-compound blowing engine for furnishing the blast to the converter.

DATES AHEAD.

Iowa Electrical Association (annual meeting), Savery Hotel, Des Moines, April [illegible] and [illegible].

Iowa Street and Interurban Railway Association (annual convention), Savery Hotel, Des Moines, Iowa, April [illegible] and 24th.

Missouri Electric Light, Gas and Street Railway Association, Marquette Hotel, St. Louis, April [illegible], [illegible] and [illegible].

Omaha Electrical Show, Auditorium, Omaha, Neb., May 4th to 9th.

Nebraska Electrical Association (annual meeting), Omaha, Neb., May 6th and 7th.

Missouri Independent Telephone Association, Kansas City, May 6th and 7th.

Southwestern Electrical and Gas Association (annual meeting), El Paso, Tex., May 7th, 8th and 9th.

National Electric Light Association (annual convention), Auditorium Hotel, Chicago, May 19th to 22d.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 20th and 21st.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay Island, August 25th, 26th and 27th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 31, 1908.

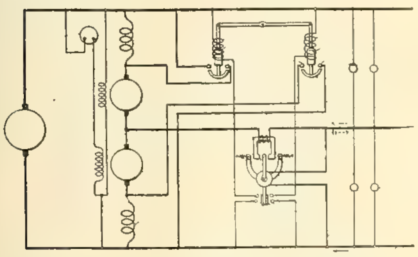
883,170. Electrode for the Recovery of Metals from Solutions by Electrolysis. Samuel B. Christy, Berkeley, Cal. Application filed March 10, 1906.

The cell contains a number of pervious electrodes arranged in series, the inner ones having a cathode surface on one side and an anode surface on the other. The anode faces are made of wires, with a peroxide of lead surface stretched on wooden frames.

883,181. Electric Street-railway Switch. John P. Dowd and Thomas P. Dowd, Cedar Rapids, Iowa. Application filed September 30, 1907.

Electromagnets are mounted immovably on each side and in advance of the carwheel flange. An electric switch closes the magnet circuits alternately so as to operate movable switch rails.

883,195. System of Distribution. David Hall, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed February 7, 1906.



NO. 883,195.—THREE-WIRE BALANCER SET.

A balancer set for a three-wire system consists of two direct-connected compound machines provided with automatic cut-outs for the series fields. This cut-out acts on that machine which operates as a motor and thus changes it to a shunt motor driving a compound dynamo. (See cut.)

883,200. Controller for Electric Motors. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 16, 1906.

The controller comprises a field rheostat, an armature-reversing faceplate member, a single operating handle, a rheostat contact arm rigidly connected to the handle, and a contact arm for the faceplate member having a lost-motion connection with the handle.

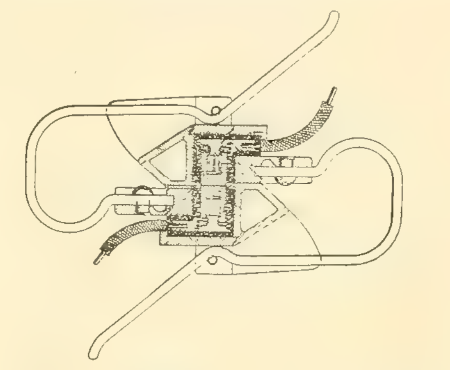
883,201. Terminal Connector. Harry T. Johnson, New York, N. Y. Application filed March 22, 1906.

In combination with a contact member is an apertured plate provided with flexible projecting arms, offset therefrom, and with portions intermediate the arms which project beyond the offsets, and a conductor terminal held by the arms between the intermediate portions and the arms.

883,217. Automatically Tripping Trolley-pole Mechanism. Thomas H. Mars, Chicago, Ill. Application filed April 5, 1906.

The pole is pivoted on a turret member so as to be drawn down by a spring and trip lever when the pole rises to an abnormal angle.

883,225. Coupling Apparatus for Electric Circuits. Nicholas F. Niederlander, St. Louis, Mo., assignor to the Westinghouse Automatic Air and Steam Coupler Company, St. Louis, Mo. Application filed September 2, 1902.



NO. 883,225.—COUPLING FOR ELECTRIC CIRCUITS.

The opposing carrying members have spring contact studs mounted thereon, hollow posts slidably mounted on the studs, springs for holding the posts in advanced position and guiding means for causing the ends of the posts to slide over and into engagement with each other. (See cut.)

883,226. Fire-alarm and Signaling System. John D. Nolen, Toledo, Ohio, assignor to John E. Shepherd, Chicago, Ill. Application filed September 15, 1905.

There is a line circuit leading from a central office to a series of circuit-controlling sub-stations, two sets of make-and-break mechanism at each station and means for limiting the movement of the associated make-and-break mechanism, also means for removing the limiting means and effectively changing the control of the circuit from one of the make-and-break mechanisms to the other simultaneously.

883,227. Insulator. Edward F. Padden, Chicago, Ill. Application filed September 23, 1907.

A support having a threaded hole through the same and a slot communicating with the hole has an insulator with a threaded cylindrical integral body screwed into the hole. A longitudinal groove in the side registers with the slot. A tap in the side of the body at the groove has a screw extending through the slot and tap and into the groove to hold the conductor therein.

883,241. Wireless Receiving Instrument. Frederick G. Sargent, Westford, Mass. Application filed May 22, 1907.

A coherer comprises a steel electrode, a carbon electrode and a loose dry mechanical mixture of zinc filings and carbon between the electrodes.

883,242. Attachment for Trolley Harps. William F. Savage, Columbus, Ohio. Application filed May 3, 1907.

In combination with an ordinary trolley wheel and harp is a pair of plates secured to the sides of the trolley harp, inclined shafts projecting from plates, upturned horns carried upon the outer ends of the shafts, and conical spirally grooved members mounted upon the shafts between the plates and the horns.

883,246. Dynamo-electric Machine. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 3, 1906.

The wheels mounted on an electric locomotive axle have annular sets of chambers. A two-part sleeve or quill surrounds the axle and has flanges or radial arms at its extremities and bosses that project therefrom into the chambers in the wheels. The axle carries an electric motor comprising a rotatable core member and a supporting structure therefor that is mounted upon the quill and is of smaller external diameter than the radial arms.

883,247 and 883,248. Supporting Structure for Dynamo-electric Machines. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 3, 1906.

The patents cover further details and modifications of the one above.

883,272. Combined Fused Connector and Lightning Arrester for Electric Wires. Frederick C. Woods, Galesburg, Ill. Application filed February 27, 1907.

A metallic container has foramens passing therethrough, insulating material within the container, centrally disposed contact members embedded in the material, and radial pins projecting from the members through the insulation and foramens.

883,273. Time Switch. Charles E. Avery, Jersey City, N. J. Application filed August 1, 1906.

A clock controls a rotating cam and a lever. A push-button switch having a button for closing and a button for opening has a support upon which the switch mechanism is reversible to bring either one of the push buttons into operative relation with the lever.

883,276. Electromagnetic Motor. Arthur H. Beard, Memphis, Tenn. Application filed January 31, 1906.

One battery supplies a pair of stationary electromagnets. Another supplies a pair of movable electromagnets through a pole-changer. The latter magnets move between the stationary ones and actuate a lever that drives a shaft.

883,280. Lightning Arrester. Millard Berry, Fayetteville, Ark. Application filed October 18, 1906.

The arrester is secured to a base plate mounted on a distributing board frame and consists of a set of carbon blocks and fuses held by metallic clips. Connections are made on the back of the base plate.

883,303. Security Lightning Arrester. William E. Drake, Grand Island, Neb. Application filed February 21, 1907.

A number of conductors have their ends grounded to anchor plates with serrated edges. A number of brackets straddling the conductors carry needles.

883,308. Egg-testing Device. Frank W. Gaylor, White Plains, N. Y. Application filed December 16, 1907.

An egg-testing device comprises a box with an electric light mounted thereon, a hood hinged thereto at one side of the light. The light and hood are in an electric circuit which is closed by fully closing the hood and opened by opening the hood.

883,310. Trolley Harp. Edward J. Harrison, South Bend, Ind. Application filed June 10, 1907.

A contact spring for trolley heads or harps consists of a bowed body portion having one end bifurcated and its opposite end provided with a locking element.

883,311. Electrical Smelting Furnace. Karl A. F. Hiorth, Christiania, Norway. Application filed November 20, 1906.

In combination with a number of annular furnaces is a magnet, its core and means to complete the magnetic circuit between the ends of the core, the means passing through the centers of the annular furnaces.

883,335. Electric Theft-alarm System. John J. O'Connor, St. Paul, Minn. Application filed September 26, 1907.

This alarm system has a main circuit containing an alarm device and a separable loop adapted to be passed through articles to be displayed, and a shunt circuit for cutting the loop out of the main circuit so as to permit the loop to be separated without operating the alarm.

883,346. Inductor Electric Generator. Parnell Rabbidge, Neutral Bay, near Sydney, New South Wales, Australia. Application filed October 31, 1906.

A horseshoe field magnet has a core and a cylindrical casing concentric therewith, both attached to one of the poles of the magnet. Coils are wound upon the core between the core and casing. Projections at regular intervals from the edge of the core and from the edge of the casing alternate with one another. An inductor is adapted to rotate between the projections and the other pole of the magnet for the purpose of closing the magnetic circuit alternately inside and outside the coils.

883,350. Combination Signal and Train-stopping Apparatus. Alfred L. Ruthven, Topeka, Kan. Application filed June 15, 1907.

A series of sectional conductors is arranged along the track. An automatically operable pole-changer in the circuit has means at intervals along the track for automatically shifting it. A visual signal is operated by the closing of the circuit and a target is thrown in front of the visual signal each time the circuit is closed and the [illegible] is shifted.

883,366. Electric Switch. Arthur L. White, Cresco, Iowa. Application filed November 21, 1907.

In combination with a support are a number of metallic devices connected to and extending beyond the support and carrying brushes, and insulating sections having short sides interposed between the metallic devices and the support and comparatively long sides extending beyond the support and the first-mentioned sides and disposed between the metallic devices.

883,389. Switch Clip. John Clay, New York, N. Y. Application filed August 20, 1907.

[illegible] and secured thereto consists of a pair of perforated lugs and a pair of con[illegible] the clamp, the clips [illegible] clip upon the closing [illegible].

[illegible] Walter T. Goddard and John S. Lapp, Victor, N. Y., assignors to the Locke Insulator Manufacturing Company, Victor, N. Y. Application filed July 29, 1907.

This insulator consists of a pair of attaching devices [illegible] element surrounding the rope.

883,409. Sectional Outlet Conduit. John L. Kruger, New York, N. Y. Application filed March 27, [illegible]

[illegible]

883,416. Electric Alarm for Locks. Frank M. Merrill, Los Angeles, Cal. Application filed June 11, 1907.

A door lock with key-operated controlling means has associated with it an electric burglar alarm comprising an alarm circuit, a circuit controller connected thereto and responsive to the opening of the door, and means for disabling the circuit controller responsive to the movement of the key-operated means.

883,437. Receiver for Space-signaling Systems. Leonard D. Wildman, San Francisco, Cal. Application filed July 24, 1906.

This wireless receiving apparatus consists of an antenna, conducting surfaces in close proximity to each other and relatively movable, a self-restoring liquid film separating the surfaces and adapted to be punctured by the oscillations received on the antenna and an oil bath in which the conducting surfaces are submerged.

883,447. Call Box. Henry S. Bullock, Jr., New York, N. Y., assignor to the American District Telegraph Company, New York, N. Y. Application filed December 15, 1906.

A signal transmitter comprises two transmitting devices and operating mechanism arranged to operate these successively, and in alternation a greater or less number of times at will, and a mechanical cut-out for one of the transmitting devices for throwing it out of operation during the last round of signals.

883,484. Amusement Device. Herbert N. Ridgway, Boston, Mass. Application filed March 1, 1906.

In this device there is a runway having a portion of the floor thereof movably mounted, in combination with electrically charged hand rails adjacent this portion of the floor.

883,490. Water Heater. Adolph W. Schramm, Riverton, N. J., assignor to the Electro Dental Manufacturing Company, Philadelphia, Pa. Application filed November 14, 1907.

The heater has a base, a cup structure movably mounted thereon, an electrical heating device for the cup structure and a regulating device controlled by the movement of the structure relatively to the base.

883,530. Telegraph Repeater. Stephen D. Field, Stockbridge, Mass. Application filed June 20, 1907.

A number of lines have separate relays therefor and a number of repeating sounders respectively operated by the relays. Means are provided for closing a local metallic circuit around each of the sounders when the armature thereof has been attracted.

883,537. Harvesting Sugar Cane. Henry G. Ginaca, Honolulu, Hawaii, assignor of two-fifths to Abraham Gartenberg, Honolulu, Hawaii. Application filed September 16, 1905.

An apparatus for harvesting sugar-cane comprises a railway track, a car movable thereon, an engine and electric generator mounted on the car, a cane-cutting and conveying machine provided with a motor-driven mechanism for propelling it over the surface of the field and for operating the cutting mechanism, and a flexible insulated cable for transmitting power directly from the generator on the car to the motor on the machine.

883,539. Annunciator. Stephen J. Heinrich, Bellevue, Pa., assignor to the American Electric Alarm Company, Pittsburg, Pa. Application filed March 14, 1906. Renewed February 15, 1908.

The annunciator has an actuating shaft carrying a dial, a stationary contact bar, a number of contact fingers and a supplemental contact finger all normally engaging the contact bar, a single magnet in circuit with the supplemental contact finger and a controller drum mounted on the same shaft as the dial and having contact pins for each contact finger.

883,549. Fitting for Electric Conduits. Allan R. Lakin, New York, N. Y. Application filed June 29, 1907.

An outlet device for conduits consists of a shell with an opening and provided at one side with a nipple which serves as a wire inlet, and a cover having two sides at an angle with each other and provided with a rabbeted edge which extends continuously around it and having wire exits in one side only, the cover being adapted to fit over the opening in the shell in either of two positions.

883,550. Brush and Brush Holder for Dynamo-electric Machines. Frederick H. Loring, London, England. Application filed November 4, 1907.

The brush holder has a brush-carrying arm provided with a taper socket, a brush having a correspondingly tapered head fitting the socket and a device on the arm co-operating with a portion of the brush exteriorly of the socket to prevent rotation of the brush in the socket.

883,554. Sparking Device. Henri Maillard, Paris, France. Original application filed January 30, 1905. Divided and this application filed October 24, 1906.

In this electromagnetic sparking plug there is a two-membered iron core, one being stationary and the other having a yielding connection with the first, a rod having an outer surface of non-oxidizable metal and a core of rigid heat-resisting metal carried by the movable member and a cone-shaped tip of platinum terminating the rod.

883,580. Electrolytic Production of Pure Tin. Adolphe J. M. Thirot, Bourges, France, assignor to himself and Louis Auguste Mage, Avignon, France. Application filed March 22, 1907.

The method consists in treating the tin compound with boiling caustic soda, purifying the resulting sodium [illegible] and subjecting the solution to electrolysis.

883,594. Process of Obtaining Metals and Alloys by Reduction. Emilien Viel, Rennes, France. Application filed October 31, 1906.

[illegible]

a cooling zone before it leaves the furnace. The reduction of alumina to aluminum is particularly referred to.

883,595. Apparatus for Obtaining Metals and Alloys. Emilien Viel, Rennes, France. Original application filed October 31, 1906. Divided and this application filed October 29, 1907.

A furnace adapted to the previous process has a crucible with a steeply inclined sole, down which the ore charge moves by gravity, oppositely disposed and adjustable electrodes mounted above the sole and in line of the moving charge, hinge-supported electromagnets having the axes of their coils in planes at right angles to the vertical plane through the electrodes and adapted, when energized, to blow the arc toward the sole of the furnace.

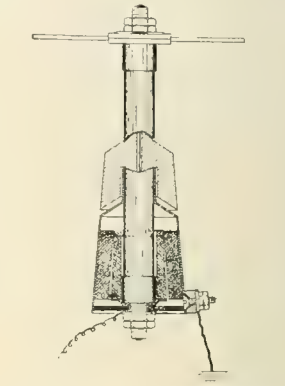
883,613. Lightning Arrester. Henley V. Bastin, Lancaster, Ky. Application filed October 12, 1907.

A coil adapted to form a part of an electric circuit has a ground cylinder surrounding the coil and a line cylinder in connection with the circuit and surrounding the ground cylinder.

883,625. Cable Terminal. Frank B. Cook, Chicago, Ill. Application filed July 12, 1907.

A number of protector mounting sections are mounted vertically on the base, thus forming two rings and a number of radially extending flange portions. The protective apparatus is mounted on the outside of the rings and the conductors on the inside.

883,626. Electrical Line Protector. Frank B. Cook, Chicago, Ill. Application filed September 26, 1907.



NO. 883,626.—LINE PROTECTOR.

This protector device comprises a fuse adapted to be suspended from a line wire, an annular metallic casing enclosing the lower end of the fuse, a lightning arrester comprising annular electrodes inserted within the casing around the fuse, an annular drip carried by the fuse above the casing and means for connecting the fuse and lightning arrester as protectors for the circuit. (See cut.)

883,646. Safety Device for Electric Point Shifting, Signaling, Locking, and Switching Apparatus. Lorenz Kottmair, Munich, and Rudolf Zwack, Nordendorf, near Augsburg, Germany. Application filed June 9, 1904.

In a switch and signal-operating apparatus there is a shifting device to be secured in safety position, an electric circuit having a contact which is closed by operation of the shifting device, and a safety switch device which is automatically operated by the closing of the contact, the circuit between the shifting device and safety switch being automatically broken when the latter is operated.

883,651. Electrolytic Production of Chromic Acid. Max Le Blanc, Karlsruhe, Germany, assignor to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. Application filed January 31, 1906.

This is a process for making chromic acid continuously by electrolytically oxidizing a chromium compound of a lower degree of oxidation by treating an acid solution of the compound with an electric current while continuously passing the solution into an electric cell in such strength and quantity that the liquid treated at the cathode remains acid.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 7, 1908:

449,655. Telegraphy. F. Anderson, Peekskill, N. Y.
449,660. Automatic Switch for Electric Motors. W. Baxter, Jr., Baltimore, Md.
449,661. Electrical Hoisting Machine. W. Baxter, Jr., Baltimore, Md.
449,662. System of Operating Electric Elevators with Landing Switches Only. W. Baxter, Jr., Baltimore, Md.
[illegible] Multiplex Telephony. W. W. Jacques, Newton, Mass.
449,690. Non-interference Electrical Signaling Apparatus. A. Newman, Brooklyn, N. Y.
[illegible] Propelling Mechanism for Electric Motor Cars. S. H. Short, Cleveland, Ohio.
[illegible] Electric-arc Lamp. E. Thomson and E. W. Rice, Jr., Lynn, Mass.
[illegible] Electric Searchlight. B. B. Ward, New York, N. Y.
449,721. Electric Connector. G. K. Wheeler, Chicago, Ill.
[illegible] Automatic Electric Block System. J. A. Carlton and H. F. Johnston, Atlanta, Ga.
[illegible] Electric-motor Car. H. P. Brown, New York, N. Y.
[illegible] Overhead System of Electric Railways. J. N. Brownler, Detroit, Mich.
[illegible] Stamp Actuated by Electromagnets. W. B. Martindale, Kenosha, Wis.
449,774. Commutator for Electric Motors. H. Duenner, Boston, Mass.
449,780. Circuit-breaker for Incandescent Electric-light Systems. F. Muller and J. G. Greene, Elizabeth, N. J.
449,797. Electric Railway. R. M. Hunter, Philadelphia, Pa.
449,880. Electric Valve Controller. G. E. Turner, Marion, Ohio.
449,897. Telegraphy. R. G. Brown, Brooklyn, N. Y.
[illegible] A. T. Treguntha, Everett, Mass.
[illegible] Electrical Lock. H. [illegible], Oberhausen, Germany.
[illegible] Electric Railway. R. M. Hunter, Philadelphia, Pa.
450,[illegible] Electrolytic Apparatus. [illegible] A. LeSueur, Ottawa,

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Under-river Transportation for New York City.

By Harold Whiting Slauson.

Manhattan Island has, in the last quarter century, presented one of the greatest transportation problems with which engineers have had to contend. On its lower portion nearly all of the business of Greater New York is transacted, and hundreds of thousands of the men and women who occupy its large office buildings, factories and stores, must pass daily to and from their homes located across the East River on Long Island, or on the other

A VIEW IN A M'ADOO TUNNEL BETWEEN NEW YORK AND HOBOKEN, N. J., SHOWING TUBE CONSTRUCTION, CABLE CONDUITS AND SIGNALS.

side of the Hudson, in "Jersey." Up to the beginning of this year the only transportation facilities connecting this part of New York with Brooklyn and the New Jersey suburbs were a half-dozen ferry lines across the Hudson, and two bridges and a few slow, irregular ferries forming the Manhattan entrance to Long Island. One day early in January, however, New Yorkers awoke to the fact that a part, at least, of the transportation problem had finally been solved by the completion of the East River tunnel, and that its connection with the subway, which had been in operation for some time, furnished a means of traveling from the northern extremity of Manhattan or the Bronx to the very heart of Brooklyn without scarcely once seeing daylight.

The novelty of being able to pass under the East River had hardly worn off when it was announced that the first section of the McAdoo tunnels had been completed, and the New Jersey commuter soon found it as natural to dive down underground and "scoot" over to Hoboken in the "tube," as it is for a scared ground-hog to take to his burrow. New York is indeed becoming a "city of moles," and in a short time, apparently, the typical business man will be able to get out [illegible] occasional glimpse of daylight, particularly when the Belmont tube and the new Pennsylvania tunnel and terminal are completed and in operation.

The McAdoo and Interborough tubes have been in operation a sufficient length of time to prove that many engineering difficulties have been successfully overcome, and that this means of local travel is destined to be an important aid in the solution of New York's transportation problem.

The project of a tunnel underneath the Hudson River has been before the public for 25 or 30 years, at which time work was first begun on a tube which was to connect Manhattan Island with the New Jersey side of the river. After considerable time and a large amount of money had been spent on the scheme, the work was abandoned, and the completed half-mile of the tube remained unused for the next 12 or 15 years. This old section of the tunnel, however, forms a part of the first of the two McAdoo lines to be completed, and the substantial brick masonry points back to the time, a few years ago, when the steel-tube method of tunneling was unknown, and stands as a monument to those who first conceived this great scheme, which remained for others to carry out. It was the desire to make use of this old tunnel which accounts for the somewhat circuitous route taken by the completed tube on the Hoboken side, as shown on the map, and which enabled this section to be finished before the lower, or Church Street, route.

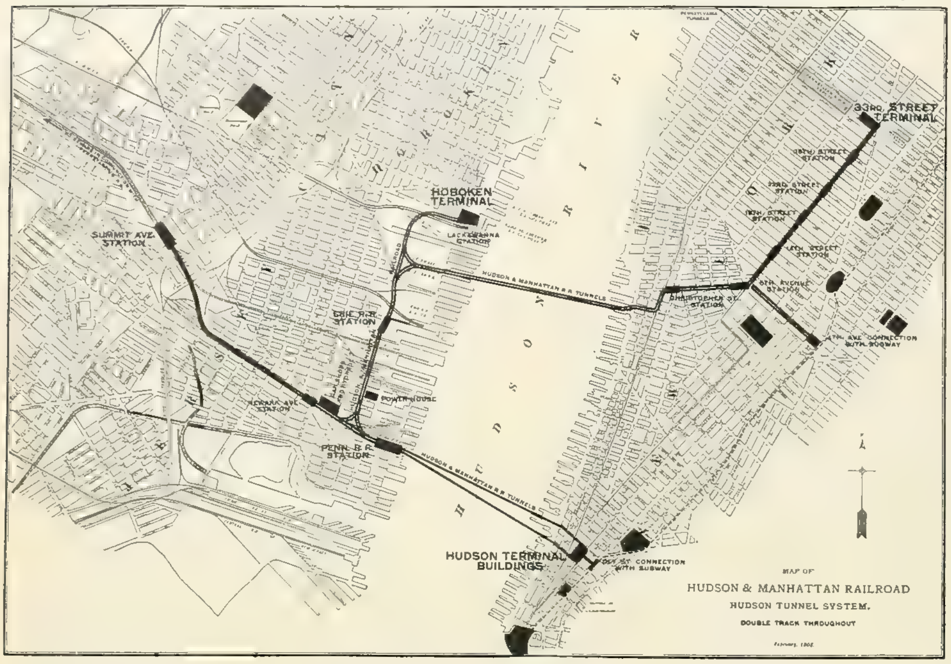
These tunnels are 15 feet 3 inches in diameter, and are in pairs, each containing a single track of standard gauge, so that trains moving in opposite directions pass through entirely separate tubes. The completed section extends from the Delaware, Lackawanna and Western Railroad station in Hoboken [illegible] two miles [illegible]

It has been found that the [illegible] to 20 minutes [illegible] from Hoboken or Jersey City to Manhattan, even when the ferries are running under the best of conditions, and it is to be supposed that [illegible] will be materially increased when the boats are fog-bound or delayed by congested river traffic and floating ice. When to this is added the fact that the tunnel trains can be run during the rush hours on a 1½-minute headway, when it is impossible for the ferries to load and unload at intervals of less than five minutes, it will be seen that the tubes are able to handle as many passengers per hour as several lines of ferries. The passenger who crosses in the tube for the first time will notice, after the first few moments, a glare of red, white and blue lights at one section of the tunnel, but before he has time to realize that this marks the middle of the river, and consequently the division line between New Jersey and the Empire State at a point 95 feet below the bottom of the Hudson, he will find the train at a standstill and his journey of three or four miles ended. In order to obtain this speed and facility for handling passengers, electrical equipment, safety devices, and signal apparatus of the highest order are required, and a brief description of the methods and systems employed in these departments will probably be of interest to electrical engineer and layman alike.

Much time is saved by the trains in leaving stations by reason of the rapid acceleration of which they are capable. Each car is equipped with two 150-horsepower electric motors, and as there are no trailers, trains of three to eight cars can attain their maximum speed as quickly as could a single

car. The power house generates 11,000-volt alternating current, and at this potential the energy is conducted to the sub-stations, where it is converted, by means of rotary transformers, to 600-volt direct current.

From the sub-stations, the power is carried directly to the feeders and the third rail. This third rail is placed just outside of the track in the same relative position as that occupied by the contact



MAP OF PARTS OF NEW YORK, JERSEY CITY AND HOBOKEN, SHOWING M'ADOO TUNNELS IN OPERATION OR NEARING COMPLETION.

rails of the "L" and Interborough subway in New York. It is a special channel-shaped section, weighing 75 pounds to the yard, and is of a composition low in carbon and manganese—a combination giving a conductivity equal to about one-eighth that of copper of equivalent section. The contact rail is covered by a continuous plank of a special kind of wood noted for its very slow burning qualities and its inability to support combustion by itself. This is known as jarrah wood, and is obtained in Australia especially for this purpose.

The tunnels are illuminated with electric lights placed at frequent intervals, and the current for these is obtained from a separate circuit, so that, even though the power from the third rail is shut off, the tubes will not be left in total darkness. Each car is illuminated by 30 16-candlepower incandescent lamps, using current direct from the third rail, and in addition there are four lights to each car operated by storage batteries, so that the interior will not be left in darkness if occasion should arise to turn off the current from the power house. There is probably nothing more conducive to a panic among the passengers on a subway train which has been stalled between stations than for the cars to be left in total darkness, and this provision for illuminating the trains at all times should go a long way toward keeping the crowds calm and collected, even during a more or less serious accident.

The cars of the McAdoo tunnel system are probably the most substantial and best designed of any in use on any subway, and are apparently rendered so fireproof by reason of their construction and the thorough insulation of the wires, that it seems as though it would be impossible for any fatalities to occur by fire.

Each car is provided with six doors—two at each end and one in the center of each side. Since the cars are of steel throughout, including roof, headlining, and doors, the problem of providing side entrances without weakening the construction was a serious one. In order to provide for the [illegible] with five panels, the center door occupying the middle panel. In this construction, the introduction of the side door does not lessen the strength of [illegible] beneath the car floor.

[illegible] of the Hudson cars was loaded with 190 workmen, and the resulting deflection was found to be less than one-sixteenth of an inch. When it is remembered that the seating capacity of each car is 40 persons, and that the space allotted to "straphangers" will not accommodate more than twice that number, thus bringing the full quota of passengers in each car to about 120, it will be seen that the trains are amply able to carry a full load so far as the strength of the cars is concerned. The floors are of carborundum cement laid on steel plates, and it would seem impossible to injure a car, so strongly constructed; but "when Greek meets Greek" would hold good in case of a collision of two of these trains, and in order to prevent the questionable result of "two indestructible bodies meeting with irresistible force," wooden buffers have been riveted to the steel castings on the end of each car, so that the force of the impact will be absorbed in crushing this timber.

The smooth and even slowing down of the trains as they come into the stations is a noticeable feature of a trip through the McAdoo tunnel, and this easy deceleration is brought about by a "graduated air release," with which all of the cars are provided. By this device the motorman may apply the air as strongly as he desires, and then release it by degrees—instead of throwing the pressure completely off and then on several times, as is the case with most of the air brakes. The controllers are of the Sprague-General Electric multiple-unit type, and operate on all of the motors in each car of the train.

Each tube is divided into sections or blocks, and no two trains can be in the same section at the same time. The entrance to each block is marked by two signal lights, one above the other, and these are automatically operated by the train as it passes into that section. The signals are operated entirely by electricity in the Hudson tube, while the East River tunnels use the combination electric and pneumatic system.

By means of the two lights for each signal, which is known as the double-overlap system, the condition of the traffic for two blocks ahead may be determined. When a train enters a block, the two lights change to yellow, and a second train following cannot enter that section until the upper light has changed to green, showing that the block immediately ahead is free. When there is no train in either of the two blocks, both lights will show green, and it is then safe to proceed at full speed.

Briefly stated, then, two green lights indicate safety; a green and a yellow, caution; and two yellow, danger. In case the motorman fails to heed the danger signal, or is unable to stop his train, a trip, placed near one of the rails, comes into action with a lever on the forward car and operates on the emergency air brakes, thus bringing the whole train to a stop automatically in a very short distance. An idea of the power exerted by the brakes when applied in this way may be obtained by considering the fact that the current is not turned off from the motors when the emergency air brake operates, although the train is brought to a stop almost as quickly as though the cars were "dead." The emergency stop also acts if a train breaks in two, and each section will be brought to a standstill almost instantly.

Although the signal and safety appliances of the tubes are entirely automatic, the chief dispatcher is able to ascertain at any moment the exact location of every train in the entire system, and, in case the power is turned off, he may determine at a glance just what trains are stalled under the river, what ones are near stations, etc. This apparatus consists of a miniature "layout" of all the tracks and tubes, and, corresponding to each train of the system, there is a movable light which shows the relative position of every train. This same device is used in the Brooklyn tubes, and should prove of great value in case of a tie-up in the tunnels.

The problem of handling "rush-hour crowds" does not find its solution so much in providing sufficient power and a suitable signal system for allowing trains to run at short intervals, as it does in furnishing a satisfactory means for the rapid loading and unloading of the individual cars at the terminals. In order that the cars shall be filled and emptied in a minimum length of time, it is necessary that the streams of incoming and outgoing passengers shall not meet. This is provided for at the intermediate stations, where the exchange of passengers is not so great, by using the middle doors for exits, and the two end doors of each car for entrances. The terminal stations are constructed on a somewhat different design, with three platforms and two incoming tracks. This makes two side platforms and a center or "island" platform for each terminal, and consequently by using the two side landings as exits and the center stage for entering, two trains may be unloaded and loaded at the same time.

A train comes in on one track, the doors on the exit side are opened, and when the passengers are discharged these doors are closed and those on the entrance side are opened, allowing the passengers to fill the empty train. Before this train

[illegible] HOBOKEN TERMINAL STATION OF M'ADOO TUNNELS.

leaves, another may arrive on the next track, and after discharging its passengers on the other exit platform, takes its incoming crowd from the same platform as did the first train.

The doors on each train are operated by compressed air, controlled by the guard. These doors slide into pockets in the side of the car, and are supported by ball bearings. The valves which admit the air to the cylinders are so designed, that, as the door closes, a sufficient amount of air is left in the exhaust side to form a cushion, and the movement of the door during its last four inches of travel is so easy and gentle that there is no danger of fingers or clothing being pinched or held fast. The edges of the door are also covered with rubber hose to further prevent the possibility of injury to passengers.

With eight-car trains running on a 1½-minute headway, nearly 40,000 passengers an hour can be carried by one pair of the McAdoo tubes.

The Brooklyn tube at present extends from Bowling Green in Manhattan to Borough Hall in Brooklyn, a distance of about two miles, one mile of which is laid under the East River. In general, its construction is similar to the McAdoo tunnels, except that its equipment is the same as that used in the Interborough subway, which has been in operation for several years. These two pairs of tubes have already demonstrated the future which awaits the development of real estate on Long Island and in New Jersey, and it seems that at last New York is in a fair way to solve the problem of how to live in the suburbs and do business in the city without spending a couple of hours in traveling.

Type of Car Used in McAdoo Tunnel System.

Interior of Tunnel Car. No Cross-[illegible] but Plenty of Gra[illegible]

UNDER-RIVER TRANSPORTATION FOR NEW YORK CITY.

The Situation at Panama.

Thos. G. Grier, one of Chicago's well-known electrical men and a traveler of no mean repute, has returned from a trip to the Isthmus of Panama, where he spent three weeks in a careful and systematic study of the work proceeding on the interoceanic canal. Mr. Grier was much impressed by the ability, thoroughness and energy displayed in the conduct of this great work by the United States government. To a representative of the Western Electrician he said:

"The work of excavating on the Panama Canal is proceeding with vigor. A greater number of steam shovels is at work than at any previous time, and the average amount of earth removed per day per shovel in February of the year 1908 was more than three times as great as in February of 1906. Each month has shown an increase in efficiency in the work of the organization, and everyone seems to be endeavoring to excel his neighbor in the amount of work accomplished.

"All of the quarters, both for the bachelors and the married men, are lighted by electric incandescent lamps, the current being furnished from the several plants operated by the Panama Railroad Company and the Isthmian Canal Commission. Coal is expensive, and the introduction of oil for fuel is being carried out extensively. The Union Oil Company of California has made a contract with the government to supply oil, and a pipe line is extended across the Isthmus.

"The machinery at the locks will be electrically operated. At present plans are under way for an extensive electric generating plant. But it will probably be over three years before any of the electrical machinery will be required for the locks, unless it is necessary to have some apparatus for the construction work."

Gasoline versus Alcohol in Power Production.

[illegible] technologic [illegible] Geological Survey [illegible] Holmes, has recently completed an elaborate series of tests on the relative value of gasoline and alcohol as producer of power. [illegible] number, probably represent the most complete and exact investigation of the kind that has been made either in this country or abroad, and include much original research work.

Prof. R. H. Fernald, engineer in charge of the gas-producer section and professor of mechanical engineering in the Case School of Applied Science, Cleveland, Ohio, was in general charge of the tests. Mr. R. M. Strong, formerly connected with the engineering department of Columbia University, had personal supervision of the work. He was assisted by a corps of specially trained men.

These tests were conducted at the fuel-testing plant of the Geological Survey at Norfolk, Va., and show the following results in regard to the comparative fuel consumption of 73° specific gravity gasoline and commercial completely denatured alcohol per unit of power.

Correspondingly well-designed alcohol and gasoline engines when running under the most advantageous conditions for each will consume equal volumes of the fuel for which they are designed. This statement is based on the results of many tests made under the most favorable practical conditions that could be obtained for the size and type of engines and fuel used. An average of the minimum fuel consumption values thus obtained gives a like figure of eight-tenths (0.8) of a pint per hour per brake horsepower for gasoline and alcohol.

Considering that the heat value of a gallon of the denatured alcohol is only a little over six-tenths (0.6) that of a gallon of the gasoline, this result of equal fuel consumption by volume for gasoline and alcohol engines probably represents the best comparative value that can be obtained for alcohol at the present time, as is also indicated by Continental practice. Though the possibility of obtaining this condition in practice here has been thoroughly demonstrated at the government fuel-testing plant, it yet remains with the engine manufacturers to make the "equal fuel consumption by volume" a commercial basis of comparison.

The gasoline engines that were used in these tests are representative of the standard American stationary engine types, rating at 10 to 15 horsepower, at speeds of from 250 to 300 revolutions per minute, while the alcohol engines were of similar construction and identical in size with the gasoline engines.

The air was not preheated for the above tests on alcohol and gasoline, and the engines were equipped with the ordinary types of constant-level suction lift and constant-level pressure-spray carbureters. Many special tests with air preheated to various temperatures up to 250° F., and tests with special carbureters were made, but no beneficial effects traceable to better carburation were found when the engines were handled under the spceial test conditions, including constant speed and best load.

The commercial completely denatured alcohol referred to is 100 parts ethyl alcohol plus 10 parts methyl alcohol plus one-half of one part benzol, and corresponds very closely to 94 per cent. by volume, or 91 per cent. by weight, ethyl alcohol (grain alcohol).

No detrimental effects on the cylinder walls and valves of the engines were found from the use of the above denatured alcohol.

The lowest consumption values were obtained [illegible]

Eighty per cent. alcohol (alcohol and water) for [illegible] the denatured alcohol in order to compete with it. The minimum consumption values in gallons per [illegible] hol is approximately 17.5 per cent. greater than for the denatured alcohol used or for gasoline. A series of tests made with alcohol of various percentages by volume ranging from 94 per cent. to 50 per cent. showed that the minimum consumption values in gallons per hour per brake horsepower increased a little more rapidly than the alcohol decreased in percentage of pure alcohol. That is, the thermal efficiency decreased with the decrease in percentage of pure alcohol. This decrease in thermal efficiency or increase in consumption referred to pure alcohol is, however, comparatively slight from 100 per cent. alcohol down to about 80 per cent. alcohol. Within these limits it may be neglected in making the calculations necessary to compare the minimum consumption values for tests with different percentages of alcohol.

The nearer the alcohol is pure the greater the maximum horsepower of the engine. The per cent. reduction in maximum horsepower for 80 per cent. alcohol as compared with that for denatured alcohol used was less than one per cent., but the starting and regulating difficulties are appreciably increased.

With suitable compression, mixtures of gasoline and alcohol vapors (double carbureters) gave thermal efficiencies ranging between that for gasoline (maximum 22.2 per cent.) and that for alcohol (maximum 34.6 per cent.), but in no case were they higher than that for alcohol. The above thermal efficiencies are calculated from the brake horsepower and the low calorific value of the fuel, which for the gasoline was 19,100 British thermal units per pound and for the denatured alcohol was 10,500 British thermal units per pound.

As has been previously stated, alcohol can be used with more or less satisfaction in stationary and marine gasoline engines, and these gasoline engines will use from one and one-half to twice as much alcohol as gasoline when operating under the same conditions. The possibilities, however, of altering the ordinary gasoline engine as required to obtain the best economies with alcohol are very limited; for the amount that the compression can be raised without entirely redesigning the cylinder head and valve arrangement is ordinarily not sufficient, nor are the gasoline engines usually built heavy enough to stand the maximum explosive pressures, which often reach 600 and 700 pounds per square inch. With the increase in weight for the same sized engine designed to use alcohol instead of gasoline comes an increase in maximum horsepower of a little over 35 per cent., so that its weight per horsepower need not be greater than that of the gasoline engine and probably will be less.

The work was taken up to investigate the characteristic action of fuels used in internal combustion engines with a detailed study of the action of each fuel (gasoline and alcohol) as governed by the many variable conditions of engine manipulation, design and equipment. These variables were isolated, so far as possible; their separate and combined effects were determined, worked out under practical operating conditions, and lead up to the conditions required for minimum fuel consumption. The results show the saving that can be obtained over conditions for maximum consumption and also establish a definite basis of comparison

under conditions most favorable to each fuel. This latter is a point of much commercial interest, and a study of the comparative action of gasoline and alcohol may be of great service in solving some of the general internal-combustion-engine problems where other than liquid fuels are used.

A large number of fundamental tests were necessary in order to clearly define conditions and interpret results. In a way they follow the work conducted by the Department of Agriculture, supplementing to a certain extent but not duplicating Bulletin 191, which gives much data of general value.

Many tests of internal-combustion engines have been made, but most of them, especially in this country, were by private concerns for a specfied purpose, and the results are not generally available. Furthermore, as is generally recognized by those familiar with gas, and especially gasoline engine operation, the conditions influencing engine performance are so numerous and varied as to make the value of offhand comparison very limited and oftentimes misleading, exact comparisons only being possible under identical conditions or with reference to the actual known differences in all conditions that influence the results.

Automatic Signaling on Locomotives.

[From the London correspondent of the Western Electrician.]

During the last year or two much attention has been devoted to systems of signaling upon railroads in which an indication is given to the driver upon the cab of his locomotive of the position of the semaphores along the track. Inasmuch as all the systems that have been developed hitherto are electrical to a more or less degree, the following notes have been compiled from information supplied by the owners of the respective patents.

The first railroad company to give a system a practical trial was the Great Western Railway Company, the system in question having been designed and worked out by members of the staff under the direction of the company's signal engineer. Fig. 1 is a diagrammatic illustration of the connections. At each point in the line where it is desirable to give the driver an audible signal, a ramp (R), consisting of a bar of T-iron, suitably mounted and insulated on a timber base, is fixed in the center of the running rails. By means of the switch (S^1) a battery (B^1), normally disconnected, is electrically connected with the ramp when it is desired to give the "all-right" signal.

The ramp may be made of any length, as it is a fixture, not requiring to be moved to give either "danger" or "all-right" signals. The length usually adopted is 60 feet for fast lines and 40 feet for slow. Its highest point above rail level is four inches. On each engine a shoe (L) is fixed, designed to rub over the ramp and be lifted up in its passage over it. Its normal position is 2½ inches above rail level, and when passing over a ramp it is invariably raised 1½ inches. The shoe is insulated from the mass of the engine.

In its normal position the shoe serves to complete an electrical circuit on the engine, but when the shoe in passing over a ramp is raised, if only half an inch, the engine circuit is broken. The result of the breaking of this circuit is the liberation of a steam whistle previously held closed by the circuit, and this is accomplished in the following manner:

The steam whistle (Fig. 1) is constructed on the safety-valve principle, and requires considerable permanent power to keep it closed. This power is [illegible] [illegible] magnets (E) when the engine circuit is intact, the armature (K), in conjunction with which the valve [illegible] circuit, thus de-energizing electromagnets (E) and liberating armature (K), and with it the whistle, [illegible] by the driver lifting lever (L^1), and thus restoring the armature (K) to its normal position, when it is again held by electromagnets (E), provided the engine circuit has been completed by the shoe regaining its normal position.

The foregoing explains what takes place when the engine runs over a ramp and the signalman desires to communicate the danger signal to the driver. When it is desired to give the "all-right" signal the method is as follows: (B^1) is a battery in the signal box, and (S^1) is a switch, also placed in the signal box. A wire from this battery is connected with the ramp (R). When the signalman desires to give the "all-right" signal he closes switch (S^1) (usually by pulling his distant-signal lever). This has the effect directly the engine passes onto a ramp of completing a circuit from (B^1) to ramp (R), through the shoe (L), electromagnets (E^1) and through the mass of the engine to earth.

It will be seen, therefore, that although the lifting of the shoe has broken the engine circuit, and thus de-energized electromagnets (E), the signal-box circuit, being completed by switch (S^2), has energized electromagnets (E^1), thus continuing the necessary electric power to retain armature (K) in its normal position and restrain steam whistle (W).

It remains to be explained in what manner the signal-box circuit causes an electric bell to sound. In the circuit of the electromagnet (E^1) there is included one winding of a polarized relay (P). When current is picked up from the ramp, it will, in addition to energizing the electromagnet (E^1), [illegible] energize the polarized relay, the armature of which will close a local circuit comprising battery (B^2) and the bell (A). The second winding of the polarized relay is for the purpose of keeping the local bell circuit closed until the driver acknowledges the signal by operating push (C), thus breaking the circuit. The line battery (B^1) consists of about 16 No. 2 Leclanche cells, the engine battery (B) of two large dry cells, and the engine battery (B^2) of four small dry cells.

An interesting device is fitted whereby battery (B) may be switched out of circuit when the boiler pressure falls to about 20 pounds and under. Switch (D) is connected with a steam valve, and the steam automatically closes the switch when the pressure rises above 20 pounds and opens it when it falls below. When the maintenance of a number of batteries is to be considered, this is a point of some importance.

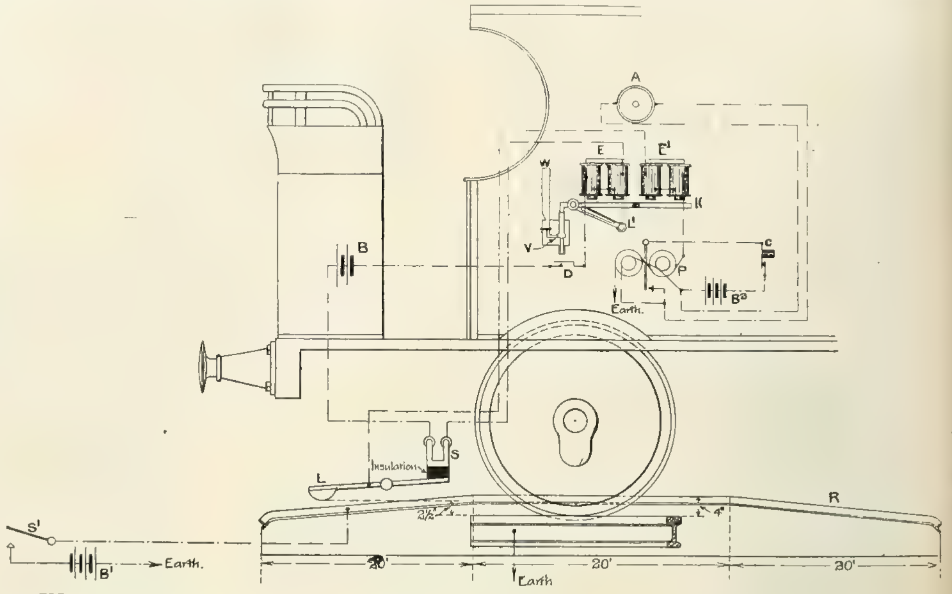


FIG. 1. DIAGRAM OF CONNECTIONS OF GREAT WESTERN RAILWAY AUDIBLE SIGNALING SYSTEM.

This system has been installed upon the Witney and Fairford line of the company and has been approved provisionally by the Board of Trade as a substitute for the semaphore distant signal.

Another system which has been in experimental use upon the Northeastern Railway for two years was dealt with exhaustively in a paper before the Institution of Electrical Engineers a short while back. This apparatus has been designed by Mr. Vincent Raven, the chief assistant mechanical engineer to the company, and the modus operandi is

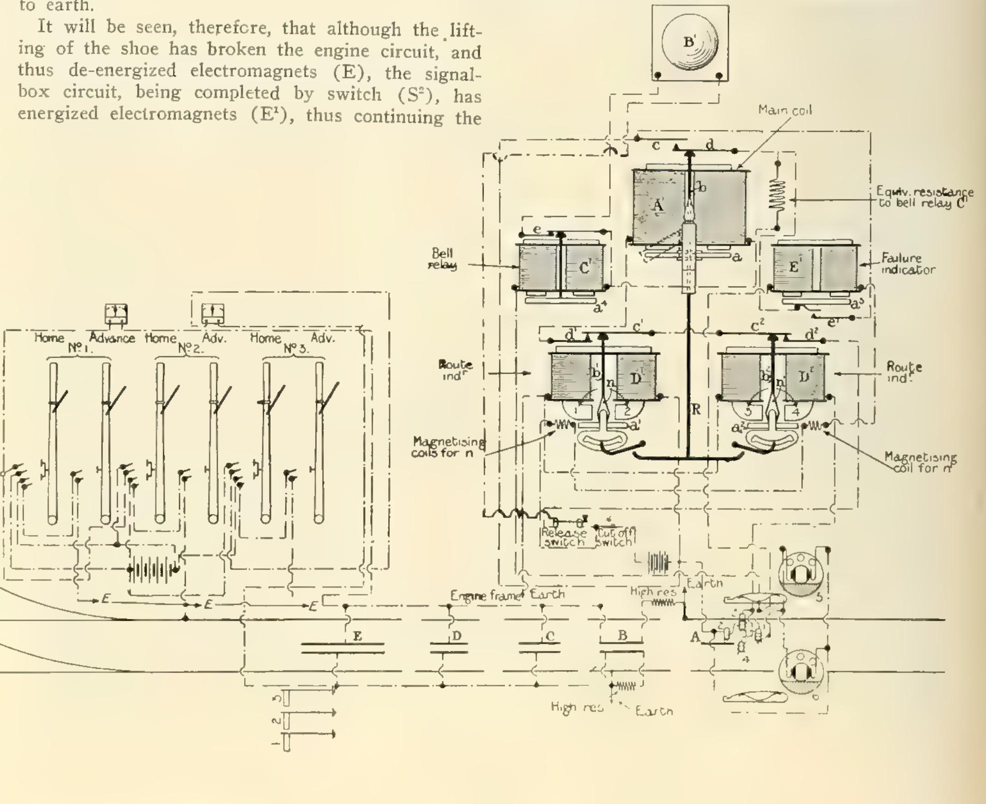


FIG. 2. DIAGRAM OF RAVEN'S SYSTEM OF SIGNALING ON LOCOMOTIVES.

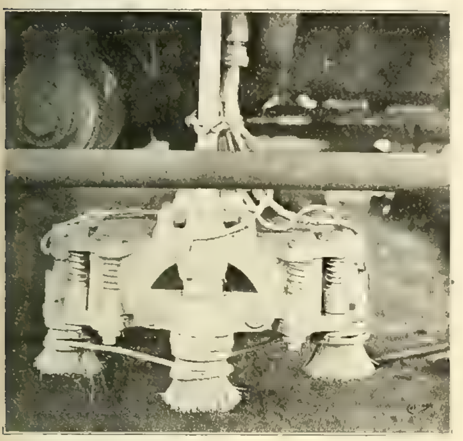
to collect the indications by the rubbing of metallic brushes carried on the engine over metallic bars placed on the line. This method of collection is not essential to the system, however, since it is capable of being operated equally well without contacts, by using electromagnets on the line to influence magnets on the engine. As used in practice hitherto, however, the former method only has been used.

This system, like that previously described, uses both visual and audible signals on the cab of the locomotive. The visual signals are (1) a small semaphore arm by which the "condition of line" signals are given, and (2) two small pointers showing 1-2 and 3-4, respectively, which are the "route" indicators. The audible signals, which are of the nature of "call attention" signals, are given by a bell. Besides these indicators, the instrument carried on the engine includes a visual "failure" signal, by which the condition of the apparatus can be judged.

The following is a description of what takes place in a typical instance, and for this purpose the diagram (Fig. 2) should be followed.

Assume that an engine is approaching the junction shown, and that line No. 1 has been prepared for it to pass forward. The "home" and "advance" signal levers No. 1 are both in the "off" position and the battery in the cabin is connected positive to line. All the bars (E), (D), (C), (B) are connected to the battery. Bar (A) is never connected to the battery and is in no way under the signalman's control. When brushes (1) and (2) are on bar (A), the current from the engine battery passes through (c^2), (d^2), (c^1) (d^1), (A^1) and (C^1), brush (1) and brush (2) and to the battery. At practically the same instant the same circuit is separately established by the rotary switches (5) and (6). The semaphore arm is put to danger, and as soon as the brushes are clear of the bar the bell commences to ring. Ordinarily the time occupied in passing over the bar is from one-third to one second, so that the bell practically begins to ring simultaneously with the raising of the semaphore arm. The visual and audible indications given at bar (A) continue until the brushes, or brush (2) comes into contact with bar (B). A current then passes from bar (B) to brush (2), thence to the coils of (D^1), and the engine frame, and the rails, etc., to the battery in the cabin. The armature of (a^1), (D^1) is raised and breaks the circuit through the springs (c^1), (d^1), lowering the semaphore arm and causing the bell to stop ringing. At the same time the polarized needle (n) is deflected, so that its pointer indicates (1), and a wire loop, dropping into a depression, locks the pointer in the position it has taken up.

The visual and audible signal given at bar (A) is a "warning" signal, indicating locality with reference to the signaling point being approached; the reversal of the "warning" signal is the "off" signal. If the further passage of the train on its journey to the "home" signal be followed, it will be found that the bell will ring momentarily at the instant the engine passes over each of the bars (C), (D), (E), but no change is made in the character of the visual indication. The indicator now shows the "off" position of the semaphore arm, and route (1) by the pointer. These indications continue until the next signaling point is reached, and are a reminder of the last signal received. The "failure" indicator circuit is independent of the other apparatus, and when the battry of this fails the disk or grid in the cab shows red.



Steel Wire Brushes Carried on Engine, Showing "Failure" Indicator Circuit Wire Wrapped Around Brushes.

FIG. 3. RAVEN'S SYSTEM OF SIGNALING ON LOCOMOTIVES.

Distance between Center Bar A and B [illegible]

FIG. 4. RAVEN'S SYSTEM OF SIGNALING ON LOCOMOTIVES.

Fig. 3 shows the locomotive steel wire brushes and Fig. 4 the track bars of Raven's system.

So satisfied has the Northeastern Railway Company been with the system, that it has arranged for the equipment of 20 more of its express engines and of about 14 miles of its main line between Newcastle and Durham.

The Jefcoate system of audible signaling, which has been experimentally adopted upon the Wirral Railway, is somewhat more of a mechanical system, but the indications upon the engine are given electrically. The equipment of the track upon this system consists of three plain T-bars running parallel with the line and at varying distances from it. They are placed (1) "distant on" (slightly sloped) at the distant signal; (2) "home on" (level); and (3) "home off" (slightly sloped) at the home signal. These bars, mounted on cranks, are connected to a spliced wire attached to the ordinary signal wire, the signalman pulling the lever as far as the existing semaphore. To each engine are fitted three plungers, one for each of the three bars. These are mounted on ball bearings and are only called upon to rise half an inch to complete the electrical contact which is given on the engine. In addition to the indicator reproducing the proper light and position of the signal arm, an alarm bell with a distinctive note for each separate signal is given in the cab. The equipment of the permanent way is purely mechanical, while the indicator box on the cab of the locomotive, which is divided into three compartments for the three signals, is lighted with incandescent electric lamps from a battery.

Telephone Auxiliary for Burglar Alarms.

The value of a burglar alarm is often lost when the alarm is sounded in any place out of hearing of any individual or when it is heard by anyone incapable of summoning assistance. An alarm system that can automatically call the proper authorities without an elaborate system of separate circuits is therefore of interest. Such a system, making use of the telephone circuits already installed,

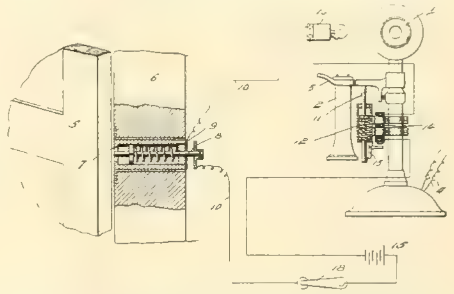


FIG. 1. OPEN-CIRCUIT BURGLAR-ALARM SYSTEM.

has been invented by Milton R. Ney and Samuel S. Ullman of Washington, D. C., and was patented a few weeks ago.

In the two drawings herewith is shown diagrammatically the application of such an alarm system to an ordinary desk telephone set. Fig. 1 shows an alarm normally on open circuit and Fig. 2 one that is normally on closed circuit.

The apparatus shown in these diagrams is arranged to be operated by the opening of a door; however, any of the contact devices customarily used in burglar alarms and other similar protective [illegible] contact piece and so does not close the circuit.

[illegible] producing instrument, such as an electric bell or [illegible] transmitter, and at the same time the hook of the [illegible] transmitter with the telephone circuit, cause the attention of the telephone operator to be attracted and to transmit the sound produced by the bell or other instrument to the operator.

For raising the hook a sliding rod (11) is provided in convenient proximity to the hook, and a spring (12) which, when permitted to do so, will raise the rod and with it the receiver hook. The rod is normally held down by a detent pin (13) arranged to be retracted by a magnet (14) in the local circuit. When this circuit is completed by contact of pin (8) with contact piece (9) and magnet (14) is energized, the detent is withdrawn and the rod caused to raise the receiver hook, so connecting the telephone transmitter with the telephone circuit in the ordinary manner.

At the same time the bell (16) is caused to operate, the sound being transmitted by the telephone

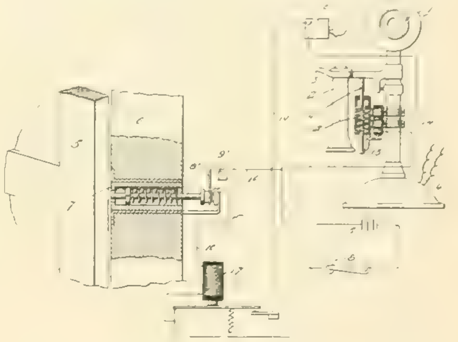


FIG. 2. CLOSED-CIRCUIT BURGLAR-ALARM SYSTEM.

to the central-station operator. It is assumed that the telephone system is the customary central energy telephone system, so that the raising of the receiver hook drops a shutter or lights a signal lamp or operates some other calling device under the observation of the central-station operator, the same as if the telephone were operated for an ordinary call; and the operator, then plugging into the circuit of that transmitter, will hear the sound of the bell and, knowing that the burglar-alarm mechanism has been operated, will notify the proper persons.

In some cases it is preferred that burglar alarms shall operate upon a normally closed circuit. In such case the arrangement shown in Fig. 2 may be used, in which a relay (17), controlled by the normally closed circuit (10'), in which is included a normally closed contact device comprising pin (8') and contact piece (9'), controls the circuit (10) of the detent magnet and bell.

In many burglar-alarm systems circuits are led through panels which a burglar is apt to cut through or break, or screens or gratings containing electric conductors which will be ruptured, brought into contact with other conductors, or short-circuited, are provided. Such circuits when so operated are caused to control a relay or other electromagnetic device. It is obvious that any of these usual devices may be employed for operating the detent magnet (14) directly or through the relay (17). Also, any other contact device in a protective circuit, such, for example, as a thermostat designed to indicate a fire, may be employed for operating the local circuit detent magnet and bell either directly or through a relay. In other words, the system above described is not restricted to burglar alarms, but is equally applicable for other classes of alarms or signals.

The Assembly committee on gas, electricity and water supply of the Legislature of the state of New York has reported favorably the bill of Assemblyman Wainwright which would extend to telegraph and telephone companies and ferries and stage lines the jurisdiction of the Public Service commissions.

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[illegible] established at each of the 48 land-grant agricultural colleges of the country. Representative McKinley, the interurban-railway "magnate" of Illinois, intro- [illegible] of the University of Illinois, appeared in Washington to advocate it.

It is perhaps unlikely that the bill will be passed, but if the excellent work done at the experimental station at the university of this state may be accepted as a guide to what would be done at the land-grant colleges under like conditions, the proposal is worthy of very serious consideration. There cannot be too much original research work in the scientific principles that underlie agriculture and engineering, and if Congress will set aside the money to provide the necessary facilities it will undoubtedly give an impetus to a movement that will have a far-reaching effect for good.

FORTUNATELY, no one has yet charged, so far as we have seen, that the disastrous fire in Chelsea, Mass., on April 12th was of electrical origin; but this great conflagration, with its estimated property loss of $6,000,000, brings very clearly to mind the appalling fire waste suffered in the United States year by year. Some fires are unavoidable, as in the case of that at San Francisco in 1906, but it is safe to say that 90 per cent. are due to carelessness and could be prevented. The property loss in the United States due to fires in the year 1907 was estimated at $214,000,000, of which $128,000,000 fell on the insurance companies. The average gross fire loss for the last ten years, disregarding the great San Francisco fire following the earthquake, was about $170,000,000 a year. This is a tremendous drain on the resources of a country, even though it is as rich as the United States. It is a patriotic as well as economic duty to lessen it. The need of exercising constant vigilance to prevent fires or to extinguish them promptly if started rests upon all of us, and might well be taught to the children in the schools.

Managers of electric-light, electric-railway and telephone plants, especially, should take every reasonable precaution to prevent fire. In the case of these properties the insurance money, after adjustment, will not pay for lost earnings of the plant, nor will it restore public confidence, shaken by interruption of service. W. H. Blood, Jr., former president of the National Electric Light Association, puts the case well in a recent article: "Regularity of service, and through it dependence on that service, being destroyed, earnings will not return to their old figures till some time after the plant is rebuilt. Competition, also, may have sprung up in the meantime to further menace the earnings. Any way you look at it, the property loss is the least of all. It is highly essential that everything should be done that can be to prevent the occurrence of a fire, for if one occurs it is likely to be a catastrophe affecting not alone stockholders and bondholders, but, though in a different way, perhaps, still none the less seriously, the general public as well."

Let us all do what we can to diminish this shameful fire waste, which gives the United States such an unenviable pre-eminence among the countries of the globe.

AFTER A YEAR'S test, the traction-settlement ordinances adopted in Chicago are giving general satisfaction. Even the perfervid municipal-ownership men—and there are not so many of these as two or three years ago—have nothing to criticize in the practical working of an arrangement by which the city gets over half of the net receipts of street-railway operation, the amount paid into the municipal treasury for the first year amounting to over a million and a half dollars.

In his annual message, dated April 13, 1908, the mayor of Chicago gives some interesting figures. During 1907 the Chicago City Railway Company expended $6,235,292 on reconstruction and rehabilitation, and, although the Chicago Railways Company (successor of the Union Traction Company) did not accept its ordinance until January 29, 1908, there was expended on the North Side and West Side lines $1,809,172, making a total expended on surface-car lines betterments of $8,044,464. The Chicago City Railway Company in 1907 built 31½ miles of new track, and the Chicago Railways Company (or the Union Traction Company as it was) built 22 miles, a total of 53½ miles of new track. The Chicago City Railway in 1907 put into service 300 new pay-as-you-enter cars of modern type, remodeled 120 more, and now has about 800 double-truck cars of modern type in operation.

The two companies have planned to spend approximately $15,300,000 this year on reconstruction and rehabilitation. The Chicago City company has made arrangements for building 60 miles of new track this year, and the Chicago Railways Company for 65 miles, or a total of 125 miles of new track for the year. The Chicago Railways Company has also ordered 350 new double-truck cars of modern type, and will probably increase the order to 600.

During the first year under the traction ordinances the city has received in compensation $675,702.76 from the Chicago City Railway Company and $881,106.95 from the Chicago Railways Company, a total of $1,556,809.71.

Thus the street-railway service of the city, referring to the surface lines, is being satisfactorily and efficiently rehabilitated, while at the same time the city is a partner in the business and receives 55 per cent. of the net receipts. It is true that the ordinance provides that the amount so paid to the city shall be kept as a sinking fund for the purchase and construction of street railways, but this provision is subject to the action of the City Council, and in any event it does not affect the rights or duties of the companies.

The Board of Supervising Engineers is doing work of a high order in directing the work of reconstruction and re-equipment and is proving its fitness for the greater task of supervising the building of a system of subways, to which it must soon turn its attention.

ANOTHER electric interurban-railway company has won a triumph before the Interstate Commerce Commission and has compelled a connecting steam railroad to join with it in establishing through routes and making joint rates for freight. This is the Cedar Rapids and Iowa City Railway and Light Company (complainant), which operates an electric line 27½ miles long between the cities named, while the Chicago and Northwestern Railway Company (defendant), which makes connection with it at Cedar Rapids, is the steam-railroad company which has been brought to book. The electric railway is capable of moving freight in trainloads as well as carloads. In order to be able to take full advantage of its opportunities and to meet the requirements of the several shipping communities along its line, the interurban company requested the Northwestern to join with it in establishing through routes and joint rates between interstate points on their respective roads. The defendant, however, refused to enter into such an arrangement on the general ground, as stated by two of its officials, who testified in the case, that the complainant is not in fact a "full-fledged" railroad; that it is not the policy of the defendant to make such arrangements with electric lines that cannot reciprocate in the matter of the exchange of equipment; that such arrangements with small lines that are unable to furnish their percentage of equipment constitute one of the chief causes of the inability of the larger carriers to meet their demands for cars; and that the usual result of such arrangements is that the larger carriers are compelled to furnish equipment for the entire traffic of such lines; and this the defendant does not consider a good business proposition.

But after going into the merits of the case carefully, the Commission decided that the petition of the electric railway, backed as it was by statements of shippers along the route, was well founded, and it therefore ordered the steam road to come down from its high horse, as it were, and join with the electric line in making through routes and joint rates for freight. "In case no agreement can be reached by the two companies as to the divisions of the joint through rates so established," significantly concludes the report of the Commission, "the Commission, upon suggestion of either of them, will give the matter further consideration and will direct what the divisions shall be."

This is notable and deserved victory for the principle of interchange between steam and electric railroads. If we mistake not, the Cedar Rapids men will be the recipients of cordial congratulations at the Des Moines street-railway convention of next week.

Relation of Direction of Light to Human Construction.

At the April meeting of the Chicago Section of the Illuminating Engineering Society, Mr. John L. Sorber presented an original paper touching on some unusual effects of light which do not arise in every day problems of illumination. The meeting was preceded by the usual dinner in the breakfast room of the Grand Pacific Hotel and was presided over by Chairman J. R. Cravath.

The paper of the evening was entitled "Relation of Direction of Light to Human Construction," and it was rather novel, as its title indicates. Mr. Sorber presented an interesting line of thought, and his unique but plausible method of reasoning was intended to prove his idea of the correct method of illuminating, viz., that found in nature, a large source of light at a great height.

Following the reading of the paper there was an informal discussion, in which the speakers showed their appreciation of the new ideas brought out in the paper, most of which were approved. Those who took part in the discussion were W. R. Bonham, George C. Keech, J. R. Cravath and R. W. Hiett.

Large units hung high producing illumination of equal intensity throughout an office or workroom were considered by those who took part in the discussion to have an advantage, in that they do not injure the eye as do smaller units in the line of vision. Turning the eye from bright spots, caused by direct lighting, or small units, is also bad for the eye.

Contrast is to be avoided. The present-day highly glazed white paper with black print is trying to the eye, and Mr. Sorber questioned whether it would not be better to reverse the custom and print with white ink on black paper. Mr. Sorber passed out a variety of samples of white print on black background which he had clipped from the "ad" pages of magazines, but those present were not ready to decide whether this method is better for the eye than the ordinary method of printing black on white. The most restful effect was a brownish ink on yellowish paper, but this combination might cause a sacrifice of speed in reading small print.

To show the cause of later effects on human construction, Mr. Sorber in his paper went back to the time of the completion of the formation of the earth by the fall of the watery envelope. Before this envelope fell, and while the waters were suspended as vapor in a thick layer about the earth, no direct sunlight reached the surface of the earth. The rays of the sun, striking this vapor, became diffused so much that there was little or no shadow, and in passing through this vapor the actinic or chemical rays were extracted, so that decay was very slow to start. Beneath this the temperature was very even and the supply of moisture liberal. For these reasons vegetation grew a very great time and probably more rapidly, attaining gigantic proportions, but requiring much longer to reach maturity. Thus, also, did it affect humanity. At the present manhood age, men were then but children and they lived much longer.

Fermentation, one of the first signs of decay, was probably unknown. Without fermentation, intoxicants and intoxication did not exist. With direct sunlight, the speaker said, came also speedier development, a shorter and more active life, quicker decay, fermentation and intoxicants. Noah knew nothing of fermentation, and with the slow time-consuming methods he was accustomed to, his grape juice became wine and he got drunk.

This change in the method of lighting the earth from diffused to direct sunlight was very great. Since that time we have had pronounced shadows, and they have become necessary to us in forming correct ideas of shape, distance and color. The present arrangement for lighting the earth, Mr. Sorber said, is simple, but important—a large source at a very great height. Naturally, if our seeing mechanism was not suited to this previous to the flood it gradually adjusted itself to the new conditions, and today this is the correct method. On the contrary, had the Creator ignored harmony by hanging many small suns close to the surface of the earth on as many celestial fixtures, our eyes would no doubt have become adjusted to this method, and we could properly carry this scheme into our homes, business houses and gathering places.

Mr. Sorber pointed out that physically we are so constructed and our ideas are so firmly fixed from ages of living under present conditions, that were the sun obliterated and many small suns substituted, low hanging on fixtures extending down from the sky, the beauty of the sky would be sadly marred and seeing made more difficult.

Another phase brought out in the paper was that the direction of light probably had much to do with enabling man to graduate from the four-footed class and to walk on two legs in an upright position, and also with keeping beasts on four legs. Should the sun through all these ages have been just above the horizon, humanity would wear its face close to the ground and be four-footed. If the sun during its daily lighting period had been just above the horizon, either in the east or west, and had humanity been built as at present, our [illegible] would [illegible] received vertically. It follows, then, the speaker said, that should the times of activity be reversed, the forms would be [illegible] quadruped, and quadrupeds would be [illegible], with a change at least in some degree in relative superiority. Even the fish, active and normally horizontal when the sun is low, would assume a vertical position with conditions reversed. The Esquimaux, who has for centuries received light almost horizontally, is already affected by it. Today he is very short and rather wide [illegible] great factor affecting his shape directly and indirectly.

As another sign the paper directed attention to the common impulse when facing a setting sun to pull the hat down in front, incline the face forward and seek the shadow. This points to a reason why quadrupeds never abandoned the use of fore legs as did man. Being most active morning and evening, when no bodily appurtenance shades the eye, because it would obstruct vision, the quadruped has continued to keep his eyes near the ground for protection from the direct rays of the sun offered at the maximum at that point by shadow of rocks, bushes, trees and hills. The speaker argued that man's activity during the sun's "high period" did not cause him to rise to a vertical position, but that his vertical position determined the time of his activity. It matters little which view we may hold. It is none the less evident that the direction permitted him to raise his eyes relatively higher than the beast, and that were the sun always in a "setting" position, he also would have sought protection in the same way, and this would have thrown the arm into service as a bodily support to maintain equilibrium by keeping the center of gravity of the body within the base of support.

That artificial light has no bearing on form is evident, Mr. Sorber thought, since it is comparatively modern. The architect, engineer and user, knowing that human construction necessitates light from above, and the importance of shadow, should co-operate in applying to interiors the principle found outside. Difficult though this may be, the lack of efficiency can no longer be urged as a bar to its adoption. The co-operation of these three interests seems to have been without sufficient regard to the demands imposed by human construction. Mr. Sorber said that it must be borne in mind that during the evolution of man he was an open-air animal. He lived, grew and was shaped to suit the open. This includes the eye and its setting. Daylight diffusion as we find it today inside played no part in developing the eye, for man's habitation was a hole in the side of a hill, and he went there only for protection. Getting back to nature should be beneficial to the eye as well as for the lungs. Outside proportions where the height of the source is 11,000 times the diameter of the surface lighted obviously cannot be obtained inside, because man is limited in his ability to build interiors, especially in regard to height. He must then modify his light sources, both in size and number. This modification in the past has frequently been extended far beyond the point where judgment tells us to stop, and far beyond the point now necessary.

The paucity of devices on the market was said by Mr. Sorber to be largely responsible for this, but human beings, like sheep, are inclined to blindly follow the beaten path, and for no other reason continue the use, or abuse, of many small light sources, hung low, instead of a small number of large light sources at greater height. An endeavor to obtain starlight effects might justify a great number of small sources, but they, too, should be high.

The paper showed that shadows may be by some considered rather unimportant, because we seem to see about as well in diffused sunlight as in direct sunlight. For our requirements this may be true, but were our requirements greater it probably would not, and at any rate even on days when there is no direct sunlight there is considerable shadow, but there is less sharp contrast between light and shadow, and because the blending is gradual we do not notice it. With perfect diffusion, if such a condition existed, surfaces would appear much too flat.

Were it not that shadows are always present, the work of the architect would not seem so good, exteriors particularly. In interiors, with the numerous light sources and correspondingly complex shadow effects, the problem seems more difficult, but the adoption of the principle found outside will no doubt simplify it. Mr. Sorber then quoted from Ruskin as supporting his views on shadows, and said that the importance of shadow in assisting us to see things is emphasized by the case in which nature minimizes its effect to prevent us from seeing—it is that of the wild fowl—the upper and dark-colored portion in the light and the lower and light-colored portion in the [illegible] health, happiness and progress.

The paper [illegible] confining direction within certain limits, but these limits may not always be the same. For example, the limit [illegible] where head gear is worn than where custom impels us to remove it. In accomplishing this probably a better artificial sky can be obtained. This also is a problem not readily solved. Another point of interest is that the eye has no natural protection from light rays delivered from below, and again artificial protection cannot be interposed, because it would interfere with vision. This indicates that the use of light-colored floors is injurious, and should be discontinued. Snow-blindness supports this view. The speaker said that the application might be carried to table covers, were it not for the fear of inciting rebellion by running counter to good taste. Walls affect direction considerably, and they may be said to be to interiors what the mixture of trees, hills and sky is to the exterior. Therefore a plan modeled on the outside arrangement will suit the eye.

Meter Readers to Deliver Bills in Colorado Springs.

By a new system adopted this month the Colorado Springs Light and Power Company of Colorado Springs, Colo., will distribute its monthly bills through a corps of carriers, instead of sending them through the mails, as heretofore. The person who delivers the bill will be the one who reads the meter, and whose figures the bill is made up from. He will be able to explain to the consumer any question that confronts him as to the time and hour he read the meter, the standing at the time the bill is delivered, if a comparison is desired, and any other questions as to dial reading. By calling twice a month any defects in lighting may be the easier reported and remedied.

By delivery by the same person who reads the meter it is certain that the bill reaches the individual apartment that it is intended to. Changes of name, addresses and the like may thus be kept more accurately and to the wish of the consumer. The change has been granted, despite the extra expense, as a result of the many requests for the change made by consumers, and is solely designed to bring closer and better relations between the company and the public in general.

An Exceptional Contract.

The city of New York has recently installed a high-pressure water-main system for fire protection in the high-building district. Since this is to be used only in case of dangerous fires, a steam-pumping plant would have been impracticable in the matter of quick starting as well as an expensive adjunct both in initial and maintenance cost. Therefore electric pumping was decided on and a contract was entered into with the New York Edison Company for this emergency service. An extraordinary feature of this contract was the size of the penalty imposed on the company if it should fail to have abundant electric power available at the pumping stations within three minutes after being called on to furnish it. This was placed at $500 for each additional minute. The acceptance of the contract with such an onerous penalty clause shows the confidence that the company has in its ability to supply immediate and uninterrupted reliable service.

Electrical Interests in the Chelsea Fire.

[Special dispatch to the Western Electrician.]

Boston, April 13.—The fire which destroyed one-third of Chelsea on Sunday burned out the offices of the Western Union and Postal telegraph companies, the New England Telephone Company's station, the Boston Elevated Railway car house, the Chelsea Gas and Electric Light Company's office; also the George F. Peck Manufacturing Company, O. E. Pettman & Co., Charles H. Johnson & Co., and the Chelsea General Repair Company, dealers in electric supplies.

Motors in Rolling-mill Work.

The April meeting of the Pittsburg Section of the American Institute of Electrical Engineers was held in the lecture hall of the Carnegie Institute on April 1st. Twenty-eight members attended the usual informal dinner at the University Club immediately preceding the meeting. The general subject of the meeting was the application of electric motors to rolling-mill work.

Mr. James Farrington, electrical superintendent of the LaBelle Iron Works, gave the principal paper of the evening, on the "Relative Advantages of Various Methods of Operating Reversing Mill Tables." Mr. Farrington gave complete figures of the amount of power and the speeds required at all parts of various reversing-mill tables, with the weights and inertia of the various rolls, ingots, etc. He compared motors with various gear ratios and tandem arrangement. If the number of accelerations or reversals be increased and the running time in a cycle be decreased, the smaller gear ratio will require less power or kilowatt-hours.

Comparing the results of a test on the 128-inch plate mill at Homestead with a test on the 84-inch plate mill of the LaBelle Iron Works at Steubenville, the following data are secured:

	128-inch Mill.	84-inch Mill.
Gear ratio	1 to 10	1 to 2
	One 75-H. P. Motor.	Two 50-H.P. Motors.
Total inertia of rollers	5,000 lbs.	4,450 lbs.
Total inertia of ingot	950 lbs.	....
Total	5,950 lbs.	4,450 lbs.
Speed of motor	850 R. P. M	160 R. P. M.
Armature accelerating current	340 amp.	275 amp.
Armature running current	80 amp.	185 amp.
Square root of mean square current	147 amp.	207 amp.

This shows that the 84-inch mill tables require 60 amperes more current to operate empty than the 128-inch mill, but its peak loads are smaller.

Mr. W. A. Dick read a paper on the "Application of Motors to Rolling-mill Work." He made mention of the necessity of having rugged motors for this work, which are able to stand a high temperature without burning out. He recommended the open motor for mill work when it was possible to place it in a separate room, free from mill dust. The open motor ventilates better and can be cared for more easily. The direct-coupled motor to rolls is preferable. The motor should have plenty of power, as it is expected to turn out more product than the steam engine. Over 50 per cent. compounding works out best for mill motors.

Mr. B. Wiley of the Westinghouse Electric and Manufacturing Company also read a paper on the "Application of Motors to Rolling-mill Work," and explained the necessity of having flywheels to take up the sudden strains put upon the motors. This applies especially to motors for shearing machines. The time for performing most of these operations is measured in seconds; for instance, the period of cutting two seconds; the period between cuts six seconds. Mr. Wiley showed current and power-consumption curves for various compound-wound motors; also pictures of a number of machines with motor drive.

Mr. W. Edgar Reed, consulting engineer, gave an especially interesting talk on mill motors. He said that even with increased efficiency of steam engines it does not seem possible to bring the cost of power down to that of gas-engine power, because using the gas in this way will give about 2½ times the power that it would if used for firing a boiler and the operating of a steam engine. He thought that a suitable gas engine could be made, or would soon be made, for reversible work and speed regulation to compete with electric drive. Reversing coupling, employing coiling effect of spring, was mentioned.

For reversing steam-engine mills where the head roller can use any desired drafts the engine is built with the hope that it will break down the mill, and the mill is designed with the hope that it will break down the engine, the master mechanic always hoping that neither will break. The general belief was that electric motors built under these conditions would be too expensive to use and that smaller motors would be installed which would be blocked when heavy drafts were taken and that the motors would burn out. Or the general opinion seemed to be that electrical installations would [illegible] smaller motors than steam driven [illegible] control would allow the [illegible] used in a way that they [illegible] burned out until this [illegible].

[illegible] Mr. Friedlaender [illegible] that they had two [illegible] without [illegible] additional [illegible] and [illegible]. The [illegible] diameter.

[illegible] ment used in the South Chicago mill, which re- [illegible]

It was mentioned that a mill for the Tennessee Coal and Iron Company had been built in Wheeling, which was so well controlled that the ingot could be stopped very suddenly and just in the position desired.

The Iowa Conventions.

The eighth annual convention of the Iowa Electrical Association will be held on April 22d and 23d at the Savery Hotel, Des Moines. It is promised that the meeting of this year will be the biggest and best in the history of the association. The association has provided a large hall for the exhibits, and the last available foot of this space was reserved several weeks ago. The Des Moines Edison Light Company and the Des Moines City Railway Company will entertain on Thursday the 23d, at the Majestic Theater. In addition, through the courtesy of the Fort Dodge, Des Moines and Southern Railway, there will be a trip to Ames in the afternoon of that day. George S. Carson of Iowa City is president of the association and W. N. Keiser of Des Moines is secretary. Following is the programme:

Wednesday, April 22, 10 a. m.—Opening business. President's address. Reports of secretary, executive committee, "Facts and Factors" committee, programme committee, co-operation committee and membership committee. Election of nominating committee. Unfinished and general business. Paper—"Popularizing the Use of Electricity," E. L. Callahan, Chicago. Paper—"Fraternalism," Gus Lundgren, Cherokee.

Wednesday, 2 p. m.—Paper—"Tact and System," J. W. Ferguson, Chicago. Paper—"Economical Operation of a 200-kilowatt Station" (indicating devices), Austin Burt, Waterloo. Paper—"Grounded Secondaries," Thomas Sloss, Cedar Rapids. Short talks on best ways to meet gas and gasoline competition, by Gus Lundgren of Cherokee and M. A. Harrison of Nevada.

Thursday morning.—Paper—"Incandescent Lamp Development," F. W. Willcox, Harrison, N. J. Paper—"Electric Motor Characteristics," Prof. A. H. Ford, State University of Iowa. Paper—"The Freight Question," E. G. Wylie, Des Moines.

Thursday afternoon.—Short talks on new-business methods by L. D. Mathes of Dubuque, J. F. Porter of Davenport, E. L. Kirk of Sioux City, A. L. Dodd of Charles City, J. P. Walters of Toledo, C. O. Ingersoll of Marion.

Executive Session, Thursday, 3 p. m.—Statistics, W. J. Greene, Cedar Rapids. Report of treasurer, report of finance committee, report of nominating committee. Election of officers. Adjournment.

The fifth annual convention of the Iowa Street and Interurban Railway Association will be held at the same place on April 23d and 24th. F. J. Hanlon of Mason City is president and L. D. Mathes of Dubuque is secretary of the association. Following is the programme:

Thursday morning.—Address of welcome, Mayor A. J. Mathes of Des Moines; response, C. E. Walters, Toledo. Address of president. Report of secretary and treasurer. Paper—"Reinforced Concrete in Electric-railway Construction," N. M. Stark, Des Moines.

Thursday afternoon.—Paper—"Depreciation," Daniel Royse, Chicago. Paper—"Methods of Handling Claims by Electric Railways," Arthur W. Gross, Omaha.

Friday morning.—General discussion on "Advertising by Electric Railways." Paper—"Handling Fares on Interurban Railways," P. P. Crafts, Clinton.

Friday afternoon.—Paper—"Interstate Commerce Commission—Statistics and Accounts," C. L. Wight, Des Moines.

Executive Session of Friday afternoon.—Report of nominating committee. Election of officers. Adjournment.

New Tube May Eliminate Danger from X-rays.

Prof. Albert C. Geyser of the Cornell Medical College gave a demonstration a few days ago in New York of a device he has produced called the Cornell tube. By the use of this tube Dr. Geyser says the dangers incident to the use of X-rays are eliminated. The tube, which Dr. Geyser's hearers considered a great achievement in electrotherapeutics, is described briefly as being made of heavy lead glass so that no rays are emitted except through a flint glass window which corresponds in size to the lesion to be treated. The connecting wires are encased in glass insulators to prevent sparking on any part of the patient while under treatment. The flint glass window is situated at the end of a projection and must be in direct contact with the lesion thus furnishing a ground and doing away with the air space which would otherwise be the dielectric between the tube and the patient. When the tube is brought into direct contact with the patient only the ionizing effect of the [illegible] is exerted on the tissues, and this effect is [illegible] that [illegible] to furnish the most brilliant therapeutic results.

Preparations for the Chicago Convention.

Energetic efforts are being made by officers and committees of the National Electric Light Association for the Chicago convention of May 19th to 22d at the Auditorium Hotel. Plans are being made for a large and profitable meeting. Last week a number of out-of-town officials were in Chicago to discuss the details of the various convention features. On Thursday and Friday the visitors met with Louis A. Ferguson, chairman of the entertainment committee, and Homer E. Niesz, chairman of the hotel committee. Those at the meeting from out of town were Dudley Farrand, president of the association; Alex Dow, chairman of the general convention committee. F. H. Gale, chairman of the exhibition committee, and George F. Porter, master of transportation. Many subjects looking to the success of the meeting and the comfort and enjoyment of members and visitors were considered.

A schedule of hotel rates and accommodations has been secured from 11 good hotels convenient to and including the Auditorium, where the convention will be held, and the Annex. These hotels are conducted on the European plan and the rates range from $1 a day for single rooms without bath to $7 for extra large rooms for two persons, with bath. Requests for reservations should be made at once to Homer E. Niesz, chairman hotel committee, 139 Adams Street, Chicago.

Immediately upon arriving members should go to the parlor floor of the Auditorium and attend to registration and receive their badges and convention papers. The registration office will be open after 1 o'clock p. m., May 18th. Registrations by mail should be addressed to Edith M. Myers, 55 Duane Street, New York. It is earnestly desired that as many as possible register in advance by mail.

The exhibition to be held by the associate members on the ninth floor of the Auditorium will be inaugurated on Monday evening, May 18th. There will also be a reception at the Annex, under the direction of the reception committee, with music and dancing.

The office of master of transportation will be located on the parlor floor of the Auditorium. Notices will be issued concerning the hours during which the railroad officials will be present.

It is planned, in connection with other excellent features of the programme, to make the Commercial Day programme one of the biggest events of the convention. A former president of the association, Louis A. Ferguson, of the Commonwealth Edison Company, has accepted the editorship of one of the special features for Commercial Day. It will be a paper on the "Relation Between the Engineering and Commercial Departments," and it is plain by the title that Mr. Ferguson is particularly well chosen for its editor, as he is thoroughly familiar with both aspects of the question.

H. J. Gille of the Minneapolis General Electric Company, who made such a favorable impression from the floor on Commercial Day last year, will come before the convention this year as editor of a paper on the "Preparation of a Campaign." This paper has been divided into five sub-titles and will consider (a) field work and other essentials, (b) analysis of customers' accounts, (c) proportion of lamp equivalent lost to lamps connected, showing percentage in cities of varied population, (d) policy of handling complaints, (e) policy of handling collections. A selected corps of able assistant editors will help Mr. Gille in the compilation of the matter for this paper. As these editors have been selected from communities where conditions are widely varying, this paper will be one of the lively issues of a thoroughly alive commercial programme. Thursday, May 21st, will be Commercial Day. C. W. Lee, West Street Building, New York, is chairman of the committee on Commercial Day programme.

Grand Rapids Electrical Show.

Announcement is made of the formation of the Grand Rapids Electrical Show Association in Grand Rapids, Mich. Arrangements have been completed for an electrical show to be held in the Waters Building, May 11th to 16th. The Grand Rapids and Muskegon Power Company, the largest electric power company in the state, will have a very large exhibit. Many large electrical concerns will have attractive exhibits. Ample space is available for show purposes. The booth arrangement and the decoration of the building will be on a uniform plan designed by Grand Rapids architects. Mr. W. J. Fenton is in charge of arrangements for the show.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker

Part III

Conduct of Special and Routine Testing.

It has been for a long time a moot point whether it is better to conduct the special and routine testing of the meters of a central-station system by removing them to the test room or laboratory for testing or by testing them at their places of installation. Some companies have adopted one plan, and some the other.

The first-mentioned plan of testing involves replacing every customer's meter with a freshly calibrated one. Advocates of this plan have urged that it means maximum efficiency of testing, since all meters are tested under controlled conditions and with the complete facilities of the laboratory, and that it means minimum annoyance to the customer, since the length of the meter inspector's visit at each installation is limited to the time required to disconnect and take down the old meter, and put up and connect in circuit the new one.

This plan is not now generally practiced, however, as far as routine testing is concerned, although it is still often resorted to in those cases in which a special test, calling for complete overhauling and recalibration of the meter is required. It is now conceded by many companies that the second-mentioned plan is the better one. The expense of sending an experienced meter tester and a helper from place to place, laden with apparatus for testing, and the positive annoyance to the customer and interruption to his business from the presence of these men at regular and irregular intervals, are recognized; but these disadvantages are considered outweighed by the fact that accuracy of calibration cannot be assured when a meter is calibrated in the test room and then connected to operate, recording revenue-producing electric power, under a set of wholly different conditions of installation as to vibration, temperature changes, moisture, etc.—conditions differing not only from those at the test room but from every other set of installation conditions. The stand is taken that each meter should be tested, and its final adjustment made, under its individual working conditions on the customer's premises. Another practical objection to the plan of replacing the customers' meters with newly calibrated ones is the strong liability of mechanical hardship in transportation, sufficient in many instances to disturb the calibration so that the rate on the customer's load will not be the same as that determined at the central-station test room, irrespective of the conditions at the place of installation.

In many manufacturing towns which have grown rapidly in recent years electric light is very largely used for residence as well as business purposes, but the population is a very shifting one, and a given flat or house may be occupied by several different families in succession in the course of a single year. In pursuance of the plan of calibrating meters on consumers' premises, many central-station companies serving such communities have found it advisable to leave every meter installed indefinitely instead of removing it when the house becomes unoccupied, even under the risk of having the meter lie idle a considerable time. Accordingly, when a tenant moves out, the fuse plugs are removed, but the meter is left in place. The reasons for so doing may be stated as follows, in order of importance:

1. A greater accuracy of registration is obtained by keeping the same meter installed on the same average load, and under the same conditions of vibration, temperature changes, etc. That is to say, when a meter has been calibrated at its place of installation it is found better practice to keep that particular meter in place rather than remove it and put back in its place another meter which may have been calibrated for different local conditions.

2. The leaving of meters in place saves labor, accounting and general expense and depreciation in moving meters back and forth. Under the local circumstances, very few houses or flats remain unoccupied for any great length of time, so that the matter of investment lying idle does not enter in.

3. The fact that the meter is already installed means considerable income to the company, for the reason that when the securing of electric light is merely a matter of putting in fuse plugs, incoming tenants become accustomed to using the electric light immediately, and in most cases continue using it, whereas, if they had to wait for a meter to be installed, in many [illegible] they would not order the electric light put in.

The frequency with which installed meters should be tested may vary from once a month to once a year, according to the capacity of the meter, nature of the load and local conditions.

It is often thought advisable to test large meters once a month, since low registration in them means a relatively great loss of revenue, and any serious trouble, such as an open-circuit in the armature, causes a much greater loss to the central-station company than it would in a small meter. Variable-load installations, or exposure of the meter to excessive vibration, dampness or other unfavorable conditions, make it advisable to follow up the meter's performance pretty sharply to avoid loss of revenue from "running slow." Thus meters installed under good local conditions may be allowed to make five hundred thousand to a million revolutions, or more, between each test; whereas some other installations on loads of the same character may require very frequent inspection.

The length of time a given meter may be allowed to go without testing may be determined by analysis of the results of former tests of the meter, and from a close inspection of the registration as compared with the known character of the load. The result of such observation of the meters' performance may be to transfer the meter from a long-period inspection route to a shorter one, or vice versa. A special test is usually made upon a consumer's complaint of excessive charges, and also when the bills show an apparently abnormal increase or decrease.

Light is thrown on this question by the following note on the practice of the large New York Edison Company in 1904. In the Borough of Manhattan 56,515 tests were made on direct-current meters of all types, ranging from the three-ampere meter for apartment lighting to a 3,000-ampere meter installed in a large manufacturing house (motor load) in the lower portion of the city. Of these, 34,909 were regular "periodic" tests, and the remainder constituted the "first" and "special" tests. About 60 men were employed in this particular line of work. In addition to these tests, 26,837 "inspections" were made during the year. More than 82,000 tests of the regular supply meters in service were made. On the first of January, 1904, there were 39,296 installed meters in the borough for direct-current service, and a year later there were 45,808 meters in service there, so that the average meter installed was inspected at least twice during the year.

Whichever view is taken on the question of routine testing at the laboratory versus routine testing at the consumer's installation, it is generally agreed that an "installation test" should be made on the installed meter, on the premises, shortly after the customer has begun to receive the service. Such a test serves to detect the effects of short-circuits, or electrical or mechanical accidents to the meter, which experience has shown are liable to occur on new installations; and any recalibration of the meter that may be made, as a result of such a test, begins the service history of the latter right.

[*To be continued.*]

Note.—This serial article, begun in the Western Electrician of April 4, 1908, is an advance publication of a portion of a forthcoming book by Mr. Baker on the general subject of "Electric Meters." It will be understood that the present serial refers to watt-hour meters used on customers' premises.

New Postage-stamp Regulations.

The postmaster-general has ordered an amendment to the postal laws and regulations which is interesting to everyone enjoying the mailing privileges to any great extent. It provides for the amendment of section 562, paragraph 4, so that it will read as follows:

"United States postage stamps, to be acceptable for postage, must be absolutely without defacement, provided that, for the purpose of identification only, and not for advertising, it shall be permissible to puncture or perforate letters, numerals, or other marks or devices in United States postage and special-delivery stamps. The punctures and perforations are not to exceed one sixty-fourth of an inch in diameter, and the whole space occupied by the identifying device shall not exceed one-third of an inch square. The puncturing or perforating must be done in such a manner as to leave the stamp easily recognizable as genuine and not previously used. The use of ink or other coloring matter in connection with such puncturing or perforating is prohibited."

The section has been further amended so as to [illegible]

QUESTIONS AND ANSWERS.

Action of Boosters Used with Storage Batteries.

[illegible] teries.

ANSWER.

[illegible] generated in its armature to that of the line. In [illegible] charge the battery. This is necessary, since the electromotive force of a storage battery rises during charge some 25 to 30 per cent. of its normal value. For this service a booster must be capable of generating an electromotive force equal to

Number of cells [illegible]

A booster so used is often called a charging booster. It has its field connected in series with a rheostat and the two shunted across the line, the rheostat being regulated gradually to raise the booster voltage as the charge proceeds.

In some cases the booster has its field arranged so it can be reversed, and therefore it may help the battery to discharge, practically taking the place of counter electromotive-force cells.

Another type of booster used with storage batteries where the load is fluctuating is the non-reversible or constant-current type which has a shunt field aiding the voltage of the generator and line and a series field opposing this. When there is a heavy load on the line the series field overpowers the shunt field and the line voltage is depressed so as to be below that of the battery, causing the latter to discharge and carry part of the load. When the line load is small the shunt field predominates, causing the booster to raise the line voltage and charge the battery. Thus the load on the generator is kept quite uniform.

What is known as the reversible or differential type of booster is used under similar conditions in railway work. In this case the booster armature is connected in series with the battery and series and shunt fields are connected, respectively, in series and in shunt with the line. The action of this machine is similar to that of the preceding one, except that the current through the booster armature reverses with charge and discharge of the battery.

Other types of boosters are used with storage batteries in special cases. These have the booster field controlled by auxiliary regulators responsive to variations in generator current or line voltage. They embody the principles of the types already mentioned.

Test of Dynamo Polarity.

J. H. O., French Gulch, Cal.: How do you determine the polarity of a dynamo when wishing to verify the connections?

ANSWER.

The simplest way is by means of a voltmeter. Run the dynamo on open circuit, i. e., with its main switch open, and connect the terminals of a portable voltmeter of sufficiently high range across the machine terminals of the switch. If the voltmeter reads backward, reverse the voltmeter connections. Having found the positive machine terminal, which will be the one connected to the positive side of line, mark it, say, with a + sign. Now test the line or bus-bar side of the switch, usually directly above. If the two polarities do not correspond, or, in case the machine is to run alone, if its polarity is not what is desired, it must be reversed by reversing its residual magnetism or its connections at the main switch. In case the machine is a compound dynamo that is to run in parallel with another or others, it is necessary to test the polarity at the armature terminals as well, so as to make sure that the series fields are all connected on the positive or all on the negative side of the machine; if some of these fields were on the one and some on the other side of the machines, the equalizer bar would act as a short-circuit.

The Engineer's Relation to Public-utility Problems.

A paper on a subject rather out of the usual line for an engineering society was presented by Henry Floy of New York at the New York meeting of the American Institute of Electrical Engineers on April 10th. It was entitled "The Engineers' Activity in Public Affairs—Public-utility Commissions and Franchise Valuations." A few extracts from the paper follow:

"By reason of the work and position of the engineer in the business and technical world, is it not reasonable to expect that at least one-half of the membership of the public-utility commissions being named from time to time throughout the country should be composed of experienced, broad-gauge engineers? I venture to prophesy that as public-service commissions become more common they will be constituted more and more of men drawn from the ranks of those having practical experience with the work to be undertaken. In fact, I can conceive of no more independent, dignified, influential or beneficent occupation in which an engineer can be engaged, and I believe the honor of the position will ultimately attract to it our most capable men whom now the monetary inducement will not interest."

"With regard to operation, public-utility commissions should restrict their action to general principles; they should not interfere with details, otherwise they will remove the present responsibilities from the shoulders of the directors to their own shoulders, restrict and hamper the efficiency of the organizations, still the incentive to work and destroy the reasons for promotion of the employes—all of which will result in depreciating the service rendered the public and the financial standing of the corporations themselves. As has been well said, 'Regulation should stop where operation begins. Matters of business discretion should be left to the decision of those who are responsible for business results.'"

"A consideration of the rulings of state commissions shows a tendency to place all corporations on the same footing as regards the returns to investors; that is, regardless of whether capital has been invested in a judicious and intelligent manner or in an inefficient way, the precedents established indicate that about the same profit will be allowed in either case. This, of course, does away with all incentive to improve the earnings by cutting down operating expenses, or to decrease the price, or introduce new apparatus or modern methods. It removes the stimulus heretofore existing with the individual, to make the very best showing possible, and hence is a reasonable, valid and practical objection to control by commissions. One method of offsetting this very decided disadvantage has been evolved by the application of the London sliding scale, so-called because originating in London, England, and now in use in Boston. The principle is a profit-sharing one, in which the investors are entitled to a definite rate on their investment with a fixed price for their product to the consumer. Every decrease in price, as, for example, five cents per unit in the case of gas at Boston, entitles the investors to an increase of one per cent. in their rate of dividend. An objection to this plan is that while it may be perfectly fair for a term of years, improvements in methods of manufacturing may so largely reduce the manufacturing costs as to entitle the investors to abnormally large dividends, at which time a readjustment of the base for price of product and rate of dividend would result in seriously depreciating the securities held by the owner at the time of such adjustment. This London scale, however, is at present the best practical method evolved for automatically adjusting profits as between the public and the corporation."

"For purposes of discussion herein, consider a corporation operating in the state of New York, where the legal rate which, at least, will be allowed by the courts as a "fair return" is six per cent. In view of the fact that the capitalist has indicated that he will not be interested at six per cent., but that perhaps nine per cent. would be attractive, are we not safe in assuming that with a New York corporation he would be content with eight per cent. when he knows that his property will be defended from unfair taxes and competition through protection afforded by a state commission? The nature of the business, compared with other enterprises, is such that the return of eight per cent. upon the investment actually made by a public-utility corporation would not seem unreasonable. Now, if the capitalist will accept eight per cent. and the court [illegible] six per cent., we [illegible] of the franchise which the courts have uniformly admitted should [illegible] one-third of [illegible] allowance of six per cent. on the whole, or eight [illegible]

"An examination of the values placed on many franchises in the past for purposes of taxation, cap- [illegible] indicate that perhaps an average valuation of the franchise in each case is not far from one-third of [illegible] the corporation's [illegible] arbitrarily as-sumed, would seem under present circumstances to be both a fair and reasonable one for existing franchises. If it is a middle ground on which the various conflicting interests could meet, we will have an automatic, easily determinable, open and above-board method of evaluating franchises."

An interesting discussion followed Mr. Floy's paper. George S. Coleman, counsel for the Public Utilities Commission, First District, state of New York, opened it. He disagreed with the author of the paper on several points. Public-utility bodies need not be composed of engineers nor of men of any one profession. "You want men who are first intelligent, who are open-minded, who have had some experience in affairs, who are patient, who are thorough, who are industrious and, above all, who have good judgment." Referring to the valuation of franchises, Mr. Coleman said: "You will find reputable gentlemen, not members of the bar, who differ honestly as to the proper way of valuing franchises, and in three different cases, tried one after another, involving different points, a practically different result was reached in each instance. We have no official decision by our courts."

Charles F. Lacombe, chief engineer of the Light and Power Department, Department of Water Supply, Gas and Electricity, New York city, was the next speaker. He thought that a commission dealing largely with engineering subjects, made with a proper representation of lawyers, engineers and business men, would be of more value than one in which either element was left out. Mr. Lacombe quoted several legal decisions relating to franchise valuations.

H. M. Brinckerhoff of New York said, among other things: "It is probably impracticable at the present time to expect matters of this kind to be talked on around the table in a fair, candid discussion, but if such a course could be pursued I am satisfied much better results would be obtained than by the formal, legal methods now pursued. Our commissions would very seldom go radically wrong if they had the real facts placed clearly before them. Two conflicting, cleverly concocted, partisan statements, on the contrary, befog rather than clear the issue." And, further: "We operating men and engineers are too apt to feel we are in a class by ourselves which separates us from general citizenship. That, gentlemen, is the weak point in our national life today. Large classes of educated, intelligent, highly trained brain workers in our land leave great public questions, great economic questions, which really vitally affect themselves, to a few professional politicians and reformers."

Louis A. Ferguson, second vice-president of the Commonwealth Edison Company, Chicago, praised Mr. Floy's paper. "It appears to be a trend of modern legislation," said he, "to take away the power of regulation of public-utility corporations from the various legislative bodies, city councils, etc., and place it in the hands of commissions. This is extremely desirable, not only from the viewpoint of the corporations, but of the public as well. Attempted regulation of public-utility corporations by large, unwieldy legislative bodies, such as the boards of aldermen of large cities, like New York, Chicago, Philadelphia or Boston, is seldom satisfactory, either to the corporation or the public. Such bodies rarely have among their numbers men of sufficient technical knowledge and training to enable them to pass upon the questions involved with any degree of knowledge."

"A review of the returns made upon capital invested in banking enterprises throughout the country shows a very high return of interest upon the capital invested, in many cases running as high as 20, 30, 50, and, in one case at least, as high as 120 per cent. No one will seriously contend that a public-service corporation is entitled to so high a return upon its investment as is referred to in the case of banks; nor, on the other hand, should anyone seriously contend that such a corporation is entitled to, say, only five per cent. return upon its investment, five per cent. being the legal rate of interest in the state of Illinois. * * * It is my opinion that public-service corporations would be and should be satisfied with a lower rate of interest upon their investment where their rates and other business dealings with the community are controlled by a commission, small in number and composed of, say, trained engineers, than they would deem satisfactory if their rates and other business dealings were controlled, as they are now, by state legislature or boards of aldermen."

"It is now rapidly becoming the sentiment of the public that the best interest of the public is served by a properly regulated monopoly. It has been discovered that whenever two or more public-service corporations engaged in the same line of business are serving the same community, they are not likely to remain separate very long. Duplication of plants is a waste of capital, which is not economic, and, if persisted in, necessitates a much greater outlay for cost of operation. If there is bona-fide competition between two such corporations, it means a war of annihilation until the weaker of the companies is forced out of the field. This militates against good service and also prevents conservative capitalists from investing money in public-service corporations doing business in a community where such a state of affairs exists."

Henry L. Doherty, New York: "I look on these public commissions as a sort of intermediate link between the legislative branch of our government and the judicial branch of our government. They seem to me to belong, however, in the major part to the judicial branch of our government; and I think they can best be considered as an original court of equity, subject to review by our higher courts. It seems to me that, for commissioners to become expert in their work, they must be insured long terms of office and freedom from necessity to cater to prevailing opinion. To insure men of proper training and intelligence, the salaries must be highly remunerative. I believe that these bodies should be appointed by the Supreme Court of the state, or the Supreme Court of the United States if a national body. I believe the tenure of office should be not less than eight years. The attention of many engineering bodies can be profitably directed to this subject."

W. C. L. Eglin, electrical engineer of the Philadelphia Electric Company, said that he was glad Mr. Floy had brought up the subject. He suggested that the board of directors of the American Institute of Electrical Engineers be requested to consider the subject of appointing a public-policy committee.

In closing the discussion, Mr. Floy said: "I do not think any argument is necessary to prove that the commissions are handicapped by a lack of practical knowledge of the subjects with which they are dealing. As a matter of fact, they do not understand the terms, they do not understand the language we use, and why such matters cannot be properly and much better handled by men who understand the matters being considered, I cannot appreciate. I do not argue that the commission should be entirely made up of engineers—that would be as wrong as having it made up entirely of lawyers or business men; but I do think that a balanced commission, consisting of engineers, business men and lawyers would make the ideal commission."

Chicago Gets Large Revenue from Street-railway Companies.

The surface street railways of Chicago completed their first year's operation under the traction settlement ordinances on February 1, 1908. The Chicago City Railway Company, operating the lines on the South Side, and the Chicago Railways Company, operating all the old Union Traction lines on the North and West Sides, are required by the new ordinances to pay the city 55 per cent. of the net receipts, and both companies made the remittance last week.

The city's share of the earnings of both companies for the first year, which closed January 31st, amounted to $1,556,809.71. The Chicago City Railway Company reported net earnings of $1,228,550.48 and the Chicago Railways Company $1,602,012.63. The methods of arriving at the amounts due the city were investigated by Arthur Young & Co., the city's accountants.

Following are the figures on which the city's revenue is based:

	Chicago City Railway.	Chicago Railways.
Gross earnings	$ 8,215,106.49	$10,560,571.98
Operating expenses (70 per cent)	5,750,637.54	7,392,400.39
Earnings	$ 2,464,558.95	$ 3,168,171.59
Five per cent. interest, and interest on amount expended for rehabilitation	$ 1,236,008.47	$ 1,566,158.96
Net receipts (amount divisible)	1,228,550.48	1,602,012.63
City's share (55 per cent.)	675,702.76	881,106.95
Company's share (45 per cent.)	552,847.72	720,905.68

The Late William A. Kreidler.

In addition to the tributes of respect to the memory of the late William A. Kreidler, founder of the Western Electrician, published last week, letters of condolence, several containing touching expressions of regard, have been received from—

Homer D. Brookins, New York.
William F. Cochran, legal department, A. Booth & Co., Chicago.
J. R. Floyd, Jr., secretary and treasurer Rossiter, MacGovern & Co., New York.
William J. Hammer, New York.
C. D. Jenney, president Jenney Electric Manufacturing Company, Indianapolis.
M. Lippincott, secretary and treasurer Viennot Advertising Agency, Philadelphia.
N. L. Norris, secretary and general manager Banner Electric Company, Youngstown, Ohio.
Hugo Reisinger, New York.
Chas. D. Shain, New York.
G. B. Sharpe, advertising manager Studebaker Automobile Company, South Bend, Ind.
J. A. J. Shultz, president Shultz Belting Company, St. Louis.

Acknowledging the receipt of these kind letters, the Western Electrician returns its sincere thanks to the writers.

New High-temperature Electric Furnace.

An extended investigation into the suitability of the various types of electric furnace for the production of carbon free alloys has led to the development of a new furnace well suited to this class of work and possessing many good qualities for general high-temperature work. The new furnace is a modification of the resistance type, and is simple and robust in construction, simple in operation,

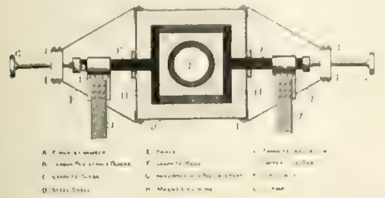


FIG. 1. DETAILS OF CONSTRUCTION OF A CRUCIBLE FURNACE.

close in temperature regulation, economical in current consumption, and has a resister that is durable, and easy and cheap to replace.

The construction of a crucible furnace is shown in detail in Fig. 1, while Fig. 2 shows the general appearance of the complete furnace, including a transformer and an ammeter. A number of carbon or graphite plates are placed face to face along two sides of the furnace, between end plates of graphite, and with these end plates form the walls of the furnace chamber. Graphite rods contacting with the end plates serve to both connect the resister into circuit and to communicate pressure to the resister plates, applied by means of the screws. The resister and end pieces are surrounded by a refractory material, such as magnesia, and contained in an iron casing. The current is carried to the furnace by heavy copper conductors clamped on the graphite rods.

The furnace operates best at from 10 to 50 volts, depending on the size of the furnace. Where alternating current is available, a special transformer is used to reduce the line voltage to that required. An ammeter is connected in the primary circuit as a guide to the control of the furnace. Where alternating current is not available a rotary converter, a 10-volt plating dynamo, or a storage battery may be used. The furnace is started with little or no pressure on the resister plates. By

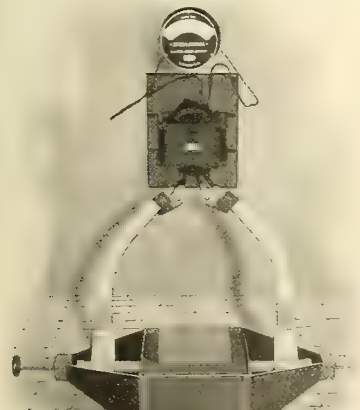


FIG. 2. HIGH-TEMPERATURE ELECTRIC FURNACE, INCLUDING TRANSFORMER AND AMMETER.

increasing the pressure (by simply turning the hand wheel of one of the screws) the current is brought up to the proper value and is indicated by the ammeter. The heat is developed principally at the points of contact of the resister plates, on accoune of the high resistance at these points. The contact resistance being high compared with the resistance of solid carbon, the cross-section of the resister can be made large, and therefore strong and durable. The furnace can be operated efficiently, and the [illegible] The [illegible] number of plates [illegible] [illegible] the [illegible] thickness of the resister plates depends upon the [illegible]

The furnace [illegible] person, and is built to withstand hard usage. The furnace as usually constructed will stand temperatures up to 1,800 [illegible] temperature of 2,000° C. or above. This type can be made as a tube, a muffle, or a crucible furnace. The furnace is suitable for crucible melting of platinum, gold, silver, nickel, cobalt, copper, iron, chromium, steel, etc., for heating the barium chloride used in hardening steels, for determining the melting points of fire clay and similar materials and for general experimental work with refractory materials.

The muffle furnace will not reach the highest temperatures, being limited by the ability of the muffle to stand the heat, but will be found valuable for treating the special steels, for assaying and other work requiring a temperature beyond the safe range of wire-wound furnaces. The tube furnaces will be found useful for a variety of experimental work requiring a uniform and high temperature under perfect control.

These furnaces are being placed on the market by The Hoskins Company, Chicago, and are designated as type 100.

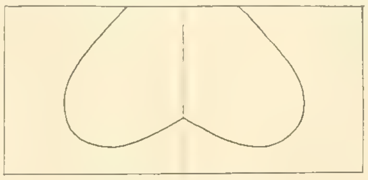
New Holophane Reflectors.

The demand of illuminating engineers and others having to plan or specify lighting installations for reflectors attractive in design yet of approved efficiency, has led the Holophane Company to design and offer a new series of reflectors. These reflectors, here illustrated, are Nos. 2679, 4516, 4526, 4576 and 4676. This design is distinctive, being based upon the French shape, originally brought out abroad. The ready sale of this series of reflectors in European markets, and the wide variety of applications to which they may be put, make them a welcome addition to the Holophane line.

No. 2679. No 4516 No 4526. No. 4576 No. 4676

NEW SERIES OF HOLOPHANE REFLECTORS.

The characteristic distribution of light obtained from the use of these reflectors is shown herewith.



CHARACTERISTIC CURVE OF HOLOPHANE FRENCH SHAPED REFLECTORS.

While the several designs vary somewhat in results given, this curve will serve as a general guide to the series. These reflectors are particularly recommended for use in connection with the smaller frosted-tip tungsten lamps, as they completely protect the eye from the intense rays of the light.

Cost of Chicago Drainage Canal.

The report of the clerical department of the Sanitary District of Chicago, submitted to the trustees, shows that the cost of constructing and maintaining the Chicago Drainage Canal has been $56,616,014.44. The report covers the period from the time the Sanitary District was organized to December 31, 1907. Total receipts during that period were $58,747,233.23, of which $34,707,418.71 was collected in taxes. Among items of expenditure were: Right-of-way, $8,481,823.69; bridge construction, $2,970,707.76; main channel construction, $18.600,195; waterpower development, $3,014,785.79.

For 1907 the expenditures amounted to $5,310,627.55, which included $1,342,000 for maturing bonds and $765,660 for interest on bonds, and $850,014 for the purchase of right-of-way. In construction work $330,788.85 was spent during the year and $1,183,250.09 for waterpower development. The total amount of bonds issued since the district was organized amount to $32,140,000. of which $19,958,000 is still outstanding. The value of property in the district in 1907 was $499,727,415, as compared with $217,458,360 in 1890. During 1907 the total bond issue reached $4,850,000.

Statistics of Curtis Steam Turbines.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Central [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Industrial [illegible]	[illegible]	65	305	[illegible]
Total	314	[illegible]	[illegible]	[illegible]

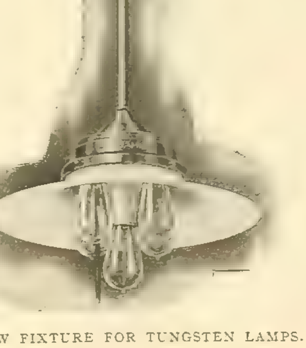
	[illegible]	Average K.W. Capacity per Machine.	Total K.W. Capacity.
Installed [illegible]	[illegible]	857	[illegible]
Order on hand [illegible]	[illegible]	[illegible]	[illegible]
Total [illegible]	[illegible]	[illegible]	[illegible]
Under [illegible] year ended [illegible]	[illegible]	[illegible]	[illegible]

The most noticeable single item is the total capacity sold to December 31, 1907—1,073,695 kilowatts, or about 1,556,000 brake horsepower. This is a strong indication of the advance of the steam-turbine generating unit. That this advance is accelerating rapidly is shown by the amount of the sales of Curtis turbine-generators for the last fiscal year of the General Electric Company, 286,320 kilowatts capacity, or more than 25 per cent. of the total sales since the Curtis turbine was introduced.

Another fact of considerable interest is the large number of plants for which the Curtis turbine has been selected as prime mover. The large range of sizes in which this turbine is sold is probably responsible for the great variation in average sizes of plants in which it is used. The large central stations and electric-traction enterprises, with an average size of 3,778 kilowatts plant capacity, strikingly differ from the industrial plant of 305 kilowatts average capacity.

A New Fixture for Tungsten Lamps.

The rapid advance of the tungsten lamps is well illustrated by the fact that fixtures especially designed for them are now on the market. Such a fixture is illustrated herewith, and the manufacturer says that it combines the best lamps with the best fixture. The fixture measures 25 inches over all. It consists of stem of three-eighths-inch pipe and three-fourths-inch casing, crowfoot, wires, deep canopy, cluster body, and an 18-inch opal reflector. The brass base is provided with conical shape frosted aluminum reflector, which materially increases the reflecting surface of the device. The fixture is furnished with four to six lights, with or without center-lamp opening, and with or with-



A NEW FIXTURE FOR TUNGSTEN LAMPS.

oat pendant switch. It is symmetrical in outline and pleasing in appearance, and offers an effective convenient and economical fixture for public-lighting purposes. The device is known as "Benjamin tungsten arc" and is manufactured by the Benjamin Electric Manufacturing Company of Chicago.

Tests of Fuel in a Producer Gas Power Plant.[1]

The accompanying table shows the results obtained on a wide range of fuels tested by the technologic branch of the United States Geological Survey, under the direction of Joseph A. Holmes, expert in charge, and Robert Heywood Fernald, engineer in charge. These tests were made at St. Louis, Mo., at the fuel-testing plant which was located on the grounds of the Louisiana Purchase Exposition.

Table of Data and Results on Representative Fuels Burned in a Producer Gas Plant at the Fuel Testing Plant of the Technologic Branch, United States Geological Survey.

Fuel	Proximate Analysis. Per Cent.				B. T. U. per Pound of Fuel.		Cu. Ft. Standard Gas Produced per lb. of Equivalent* Fuel Consumed by Producer Plant		B. T. U. per Cub. Ft. of Standard Gas.	Pounds of Equivalent* Fuel per B. H. P. Hour.	
	Moisture	Volatile Matter.	Fixed Carbon	Ash.	As Fired.	Dry.	As Fired.	Dry.		As Fired	Dry.
Florida peat	21.00	51.72	22.11	5.17	8,127	10,299	28.5	36.1	175.2	2.57	2.03
Average of four lignites	35.05	28.96	27.72	8.27	7,164	11,038	26.3	40.3	169.9	2.43	1.73
Average of four Illinois coals	11.51	31.81	43.46	13.22	10,651	12,030	49.6	56.1	153.2	1.66	1.47
Average of four Pennsylvania coals	3.47	19.68	67.31	9.54	13,651	14,136	71.4	74.0	141.6	1.16	1.12
Average of four West Virginia coals	2.47	32.12	60.24	5.17	14,248	14,610	77.5	79.5	149.6	1.03	1.00

*Equivalent fuel includes that used in the producer, and also the amount required to generate the steam necessary for operating the producer.

Of the four Pennsylvania coals tested, two came from the lower Kittanning bed, one from the lower Freeport and the fourth from the Pittsburg bed.

Of the West Virginia coals, one came from the Ansted bed, another from the Eagle, both of these being mined in the New River district; a third from the Pittsburg and the fourth from the Keystone bed.

At the time this plant was erected there were but few gas producer plants in the country burning any class of bituminous coals, and many prominent engineers were in doubt as to the possibility of operating a gas engine on gas produced from coals such as are mined in the Central and Western States.

This branch has done a valuable service to the country in demonstrating the possibility of burning nearly all classes of low-grade fuels with good economy. As will be noted in the table, the poorer coals required a correspondingly greater quantity of the fuel to produce a horsepower.

The equipment used was a 250-horsepower pressure producer with a centrifugal tar extractor and gasholder. A 235-horsepower three-cylinder vertical gas engine belted to a generator produced power which was measured by electric instruments connected with the switchboard. As will be seen, the results obtained are much better than those from steam plants of corresponding size.

Loading Vessels by Electricity.

Many of the grain-carrying vessels which crowd the harbor of Portland, Ore., are given quick dispatch by means of portable electric conveyors. These conveyors, which can readily be adapted to the loading of any ship, are operated by five-horsepower direct-connected motors, driving a cleated belt over 40-foot conveyors, and are capable of delivering into steamers or ships several thousand sacks of grain an hour, up and over considerable elevations.

With these electrically driven machines many thousands of tons of wheat and flour are delivered each season from local docks into foreign-bound steamers and sailing ships. Brown & McCabe, stevedores, are the patentees of this labor-saving utility. Power service from the mains of the Portland Railway, Light and Power Company, which is readily available at all of Portland's important docks, is used to operate the electric conveyors.

Stock Yards Branch of the Elevated Opened.

The South Side Elevated Railroad Company of Chicago [illegible] Stock Yards branch in regular service on April 8th. About 25,000 passengers were carried the first day. The trains [illegible] much needed transportation to the territory cov- [illegible] through the novel facilities it offers visitors to see the "Yards." The first station at the yards [illegible] ter and Exchange avenues; Swift Station, Ex- [illegible] Station, Forty-third Street and Center Avenue.

[illegible]

Failure of the Quebec Bridge.

A Canadian government commission, consisting of Henry Holgate, civil engineer, of Montreal; J. G. G. Kerry, civil engineer, of Campbellford, Ont., and Prof. John Galbraith of the University of Toronto, has been investigating the causes of the recent collapse of the Quebec bridge across the St. Lawrence River. The principal findings of the commission are as follows:

The collapse of the Quebec bridge resulted from the failure of the lower chords in the anchor arm near the main pier. The failure of these chords was due to their defective design.

The stresses that caused the failure were not due to abnormal weather conditions or accident, but were such as might be expected in the regular course of erection.

The design of the chords that failed was made by Mr. P. L. Szlapka, the designing engineer of the Phœnix Bridge Company.

This design was examined and officially approved by Mr. Theodore Cooper, consulting engineer of the Quebec Bridge and Railway Company.

The failure cannot be attributed directly to any cause other than errors in judgment on the part of these two engineers.

These errors of judgment cannot be attributed either to lack of common professional knowledge, to neglect of duty, or to a desire to economize. The ability of the two engineers was tried in one of the most difficult professional problems of the day, and proved to be insufficient for the task.

A New Westinghouse Readjustment Plan.

A committee known as the Merchandise Creditors' Committee, representing a majority in amount of the merchandise debt of the Westinghouse Electric and Manufacturing Company, has proposed a plan for the termination of the receivership as a substitute for the plan of the readjustment committee.

Under the arrangement proposed the issue of mortgage bonds contemplated in the plan of the readjustment committee, announced January 20, 1908, will not be required. Instead the company will be funded by new stock to the amount of $10,000,000, of which $4,000,000 is to be taken by the merchandise creditors and the remainder offered to stockholders at par. Provision for such portion of the bank debt as shall not be converted into "assenting stock" will be made partly by convertible bonds of the existing authorized issue and partly by five per cent. notes, running for an average period of at least five years. The existing issues of convertible bonds, debenture certificates and collateral notes are not to be disturbed.

This plan has the approval of the Westinghouse company, and it is expected that the subscriptions for the new stock will be forthcoming by June 1st. Because of the undertaking of the creditors' committee, the readjustment committee has decided to extend the time for depositing obligations and claims to May 15, 1908.

The circular of the Merchandise Creditors' Committee is dated April 6th. The committee is made up of Joseph W. Marsh, vice-president Standard Underground Cable Company, Pittsburg; F. W. Roebling, president John A. Roebling's Sons Company, Trenton, N. J.; Charles R. Remington, American Electrical Works, Phillipsdale, R. I.; A. Bournonville, representing Alfred F. Moore, Philadelphia, and George M. Verity, president American Rolling Mill Company, Middletown, Ohio.

Mail Carriage in Chicago.

The contract of the Illinois Tunnel Company for transferring mail in Chicago by electric cars in the company's tunnels will expire on July 1st. To renew the contract with the government the company demanded an increase for the service to $300,000 a year. This amount was considered excessive by the Postoffice officials, and the contract has been awarded to other persons, who will do the transferring by wagon for $145,500 a year, the contract being for three years. Protests are being made by commercial interests against the plan to return to the clumsy wagons, which increase street congestion. The tunnel company has made an almost perfect record for doing the work, but the Postoffice officials consider the difference in cost too great.

Mine Drainage in Mexico.

The greatest mining project ever undertaken in Mexico is the boring of a large mine drainage tunnel to unwater the mines of the Pachuca district in the state of Hidalgo, including the rich Real del Monte group. This tunnel when finished will be seven miles long and will have cost several million dollars. Its construction was begun 15 years ago and it will take about four years to complete it. Gabriel Mancera of the City of Mexico is financing the great enterprise, which has the unique feature that the revenue which it will bring to Mr. Mancera is to be used to construct and maintain a home for invalids and orphans of Mexico. Each mine reached by the tunnel will pay an annual charge for use of the waterway in carrying off the surplus water.

Electrical equipment is playing an important part in the construction work, a $100,000 electric power plant being in use for operating the machinery for boring through the rock of the mountains. The Nepton Tunnel, as it is called, is 11½ by 11½ feet in dimension. It has its mouth at the base of the group of mountains upon which the rich mines are situated and the altitude at its entrance is 9,500 feet. It enters the mountain near Atotonilco el Chico and runs southeast, passing under the principal mines of the district and directly beneath Pachuca at a depth of about 1,400 feet below the city park.

The development of this mining district has been greatly retarded by the water encountered in the lower workings. The mines were flooded and the expense of keeping them cleared so that ore extraction could be carried on has been enormous. The tunnel which is now being bored will not only afford a gravity drainage for all the mines but will enable the depths of the workings to be increased, and it is expected that the Pachuca district will take rank with the richest and best of the world when the new drainage system is in operation.

The tunnel will run 1,000 feet below the present bottom of the shaft of El Chico mine, which is the deepest in the district. It is estimated that its completion will lessen the present cost of ore extraction at least 80 per cent. It will lead to the reopening of many mines which have been idle for many years and will cause many new claims to be worked. It is estimated that more than $1,000,000 annually is now expended in draining the mines of this district by means of pumping.

Electric Railroading in Colorado.

Some of the steam roads of Colorado are preparing to equip parts of their lines for electric operation. This is due to the abundance of electric power and comparative low cost made possible by the large electric power companies of the state. The Colorado and Southern Railroad has about completed its electric line from Denver to Boulder, Eldorado Springs and other points. Twelve big new cars are being finished for this service. This electric line will be devoted almost entirely to passenger traffic. The Moffat railroad is now figuring with the Central Power Company for electric power in handling heavy trains over mountain grades.

The "Kelvin" Indorsed.

At a technical conference of the faculty and student officers of the United States Army Signal School at Fort Leavenworth, Kan., held on March 25th, a resolution was adopted indorsing the movement directed toward the adoption of the word "kelvin" as the commercial unit of electrical energy at present expressed by the term "kilowatt-hour," this change being made in honor of the late Lord Kelvin, to perpetuate his services in the advancement of electrical science. Major C. McK. Saltzman is assistant commandant in charge of the Army Signal School.

Electricity on New Haven Railroad.

It is officially announced by the New York, New Haven and Hartford Railroad Company that it has now 83 trains in operation electrically week days between New York and Stamford, and 33 on Sunday. Before the first of July it will have its full complement of new electric locomotives, and then all trains between the two points will be put into the electrical service. The power house at Coscob

is now working to its full contract capacity, but a fourth unit is to be added in order to supply it with power in case of an emergency. All the difficulties met in installing the electric system, the company says, have now been overcome.

Proposed Elevated-railroad Merger in Chicago.

The Blair interests, which control the Northwestern Elevated of Chicago, which own the Union Loop, and which also controls the Chicago and Oak Park company, are said to have determined upon plans for combining their own interests, while provisional arrangements have been made with the South Side Elevated, provided the Metropolitan can be brought into the consolidation. The latter stock is held at a price which the eastern interests have previously refused to pay. A director of the Metropolitan company is quoted as saying that the large interests in the company are just beginning to see daylight in their investment, and it would be folly for them to sell now at a low price. The new company would derive all the benefits that have accrued.

GENERAL TELEPHONE NEWS.

The Sutherland (Neb.) Telephone Company has been incorporated with a capital stock of $2,000.

The Farmers' Hub Telephone Company of Woodward, Okla., has been incorporated with a capital stock of $5,000.

The Independent Telephone Company of Fort Worth, Tex., has plans for the construction of a telephone line to Amarillo, Tex., and one to Hillsboro.

W. H. Crumb and George M. Brill, both of Chicago, the electrical experts chosen to investigate the physical condition of the Indianapolis telephone plant, after working a week, have returned to Chicago to prepare their report.

The Dakota Central Telephone Company of Watertown, S. D., will soon install a new system in accord with the franchise recently renewed there. The company contemplates either a central-energy manual system or an automatic system.

The new telephone directory recently distributed by the Chicago Telephone Company is the largest in the history of the company, and said to be the second largest in the world. The book contains 198,000 names, which is an increase of 10,000. Subscribers in the 16 suburbs instead of being listed simply as "toll" have their addresses printed in the new book.

It is said that something definite may take place soon in the way of separate interests taking over and operating and extending the automatic telephone system of the Illinois Tunnel Company in Chicago. Interests identified with the Independent telephone people who are negotiating with the tunnel company for the lease of the telephone plant have been in the city recently.

R. J. Woods of Sioux Falls, S. D., president of the South Dakota Traveling Men's Association, has filed complaint with the State Telephone Commission, alleging exorbitant rates charged by some of the long-distance lines in South Dakota. Specific instances are cited where rates from certain towns are five cents more one way than the reverse between the same towns, caused by local companies making the extra charge for the use of their instruments.

The new management of American Telephone and Telegraph has issued a report of the company's earnings for the first quarter of 1908, in comparison with those of the corresponding quarter of 1907. The figures show an increase of $1,100,000 in total earnings for the period and an increase of $416,000 in the surplus after dividends. The gross earnings for the first three months of 1908 were $7,113,399, compared with $6,011,860 for the corresponding period of 1907.

As the result of a report by the State Highway Commission of Massachusetts the New England Telephone and Telegraph Company of Boston is about to make a reduction from 10 cents to 5 cents per call on toll service in the metropolitan district for a five-minute conversation. The new rate will affect 23 exchanges in greater Boston. The company also agrees to co-operate in the taking of an inventory of its property and in a study of rate possibilities with a view to reducing the cost of service.

At a recent meeting of the executive committee of the Indiana Independent Telephone Association arrangements were made to hold district meetings in all of the districts except two in the state within the next two weeks for the purpose of formulating reports to be made to the annual meeting of the association, to be held in Indianapolis on May 13th and 14th. This annual meeting, which was formerly announced to be held on May 20th and 21st, will be held one week earlier, and will be closed with a banquet at the Claypool Hotel.

Michigan Telephone Company Makes Gains.

A [illegible] report of the Michigan State Telephone Company for the year ended December 31, 1907, [illegible] $1,090,[illegible] compared [illegible] operating expenses [illegible] $[illegible],911, the [illegible] a [illegible] $[illegible] [illegible] the lower [illegible] operating [illegible] installment of new [illegible] is charged to that account.

The company created a reserve for maintenance by setting aside $271,468, leaving a net surplus for the year of $195,887. The total surplus December 31, 1907, was $[illegible] [illegible] of $183,471 compared with the preceding year. In the opinion of the management it is of vital importance to provide out of earnings for the maintenance of the entire plant in first-class operating condition, and to also provide for the replacement of various parts of the plant as they become worn out. It is proposed during the year 1908 to charge operating expenses for maintenance and reconstruction purposes with an amount equal to $10 per exchange station. Should the actual expenditures exceed this amount, the maintenance reserve account can be drawn on; should the expenditures fall under the amount provided, the surplus will be credited to the maintenance reserve account.

During the year William A. Jackson, president of the company, tendered his resignation, which was accepted, and he was elected chairman of the executive committee for his unexpired term. N. C. Kingsbury, formerly vice-president, was elected to the office of president. J. F. Land tendered his resignation as general manager, and B. W. Trafford, formerly general manager of the Chesapeake and Potomac Telephone Company, was elected vice-president and general manager.

Telephone Notes from Mexico.

The first long-distance telephone line to extend from the City of Mexico to a point outside of the limits of the Federal District was placed in operation on April 2d by the Mexican Telephone and Telegraph Company, in combination with Salvador C. Luque, owner of the telephone exchange in the city of Pachuca. The line runs from Mexico City to Pachuca. The charge for a three-minute conversation is 60 cents, Mexican money, which is equivalent to 30 cents United States money. It is reported that the company will apply to the government for a concession for building other long-distance lines, to radiate out of the City of Mexico to the principal towns.

The severe earthquake shocks which were felt in the City of Mexico recently did very little damage to the underground circuits of the telephone companies. It is stated that of the 3,500 telephones of underground circuit in the city only 25 were injured by the earthquakes. The two companies operating here made a careful examination of the conduits and tested the cables and found that the shocks had caused no break. The absence of serious damage is considered remarkable, in view of the fact that the asphalt pavement was cracked all over the city and there were other evidences of severe earth convulsions.

Telephone News from the Northwest.

An ordinance is before the Minneapolis City Council to increase the severity of the penalty against profane language over the telephone. It is proposed to make it a misdemeanor.

The Produce Exchange of Minneapolis has passed a resolution asking the City Council to limit the charges of the Northwestern Telephone Exchange Company for service to those made by the Tri-state Telephone Company, viz., $48 per annum for business connections, single line.

The Forsyth Electric Light and Telephone Company of Forsyth, Mont., proposes the construction of a telephone line between Forsyth and Miles City.

Manager F. W. Bishop of the Iowa Telephone Company of Muscatine, Iowa, is planning extensive improvements to the telephone service.

The New State Telephone Company of Sioux City, Iowa, has constructed a long-distance telephone service between Omaha, Neb., and Sioux City.

Government Purchases Bell Telephone Properties in Alberta.

The government of the province of Alberta, Canada, has followed the example of Manitoba by buying out the Bell Telephone Company of Canada for $675,000. It is said that the province of Saskatchewan is also negotiating, and when that bill is put through the whole of Western Canada will be "emancipated" from the control of the Bell company, as it does not operate in British Columbia. The Alberta negotiations were concluded in Montreal on April 1st.

CORRESPONDENCE.

Continental Europe.

[illegible] and, following this, the Bussoleno-Modane section [illegible]

[illegible] del coal mines of Westphalia, which are 1,700 and [illegible] which are direct-coupled to Siemens-Schuckert machines. [illegible] ampere, direct-current generators. The present plant is now in successful operation.

The new hydraulic plant of Angst-Wylen, near Bale, is one of three plants which are to be located on the Rhine, between Rheinfelden and the Alsatian frontier. Current from these stations will be used for the city of Bale and the neighboring district. Using a 25-foot head of water, about 30,000 horsepower is secured at this point. The hydraulic work at the dam consists of a masonry dike, upon which is mounted a movable dam of 10 iron gates, the whole length being 530 feet. There is a separate turbine house placed at each end of the dam, and the two are of similar build. Each of the plants contains 10 turbines of 2,000 horsepower, coupled to alternators. One of the other hydraulic plants which are to be erected upon the Rhine will be placed at the mouth of the Birse, and the second somewhat below Birsefelden. Both of these plants will be equipped with machines to the extent of 10,000 horsepower.

A short line of electric railroad will soon be opened for service from Salzburg to Berchtesgaden. It lies partly in Austria and partly in Bavaria. The Bavarian section will shortly be tried. It uses 900 volts direct current on the trolley system, and a turbine plant at Reckenburg supplies the line. Here there is a 28-foot fall, and the plant contains two main turbine sets of 500 horsepower each, which are coupled to direct-current generators working at 1,000 volts. For the Austrian section of the road there are erected two electric stations. The rolling stock consists of trains made up of a motor car and two trailers, the whole containing 120 places seated. The motor car uses two 60-horsepower motors.

A. DE C.

Great Britain.

London, April 4.—It has been definitely decided to open the Manchester electrical exhibition on October 3d and to close it on the 31st of the same month. Arrangements have been made with the Manchester Corporation for the hire of some land on the outskirts of the city, and already the plans of the proposed buildings have been approved.

Electrical engineers are to form an integral part of the new territorial army scheme which has just been put into force, and under which the old volunteer system vanishes. Instead of being known as the Electrical Engineers Volunteers, there will henceforth be attached to the different commands throughout the country wireless-telegraph companies, cable-telegraph companies and air-line telegraph companies. Colonel Crompton, the commanding officer of the Electrical Engineer Volunteers, was on the committee of the War Office which went into the details of the new regime.

An interesting point in connection with the law relating to tramways was the subject of an action in the High Courts last week. The Acton Urban District Council sued for the cost of removing the heaps of snow thrown aside by the tramway company's snow plow during the past winter. The court held that, whereas the tramway company was not compelled to do more than remove the snow from the tracks, yet it had committed an obstruction in throwing it up in heaps on either side of the tracks, and for this a fine equal to the damages claimed for removing the heaps was imposed.

Meetings of creditors of Messrs. Bruce, Peebles

& Co. are now being held, and the true position of affairs is gradually coming to light. The total deficiency is something over $800,000, and it is stated that if a compulsory liquidation is contended for, the unsecured creditors will only receive an amount equal to about one-third of their total claims. The liquidation for the present is taking a normal course, and a committee of creditors has been appointed to confer with the liquidators. The general consensus of opinion seems to be that the crisis has been facilitated by the taking of payment for contracts in shares to too large an extent and to the cut prices for foreign contracts.

The second annual commercial-vehicle exhibition has just closed at Olympia, and, as last year, there were a few points of electrical interest in the shape of petrol-electric systems for driving omnibuses. These were all similar to those exhibited last year and described in the Western Electrician at the time, but there have been a few improvements in details since. An addition to the items of electrical interest this year was a stand by the Electric Vehicle Company, which manufactures the omnibuses now being run in the streets of London by the Electrobus Company. The general features of this bus have been noted, but it is now of interest to state that, in addition to the first "fleet" of vehicles, viz., seven, four more have been added recently.

The wireless-telegraph installation which is being fitted to the roof of the Admiralty buildings in Whitehall for the purpose of communication with Portsmouth, is the forerunner of a large number of such stations throughout the country. The number of naval stations around the coast will receive an addition of 11 within the next few days and provision has been made for a further three during the current financial year. This will bring the total number of Admiralty wireless-telegraph stations, including war signal stations, around the coast of Great Britain, to 167.

At the Institution of Electrical Engineers on Thursday in connection with a paper dealing with high-speed electric machinery, an interesting discussion took place upon the relative merits of smooth-core armatures and metal brushes and slotted armatures and carbon brushes. It arose on a paper by two representatives of Messrs. C. A. Parsons & Co., who, in practically all their machines, adopt the former, whereas there was a very complete consensus of opinion on the part of the chief designers of quite a number of other dynamo makers that the latter was the best practice. G.

New England.

Boston, April 11.—The Edison Electric Illuminating Company of Boston has purchased land on Scotia Street in this city to provide for a contemplated addition to its station there. The estate comprises 2,838 square feet of land and a five-story brick building.

An electrical power plant, capable of generating 320 horsepower, is under construction at Barre, Mass., for the wool plant on Ware River.

The Plymouth, Carver & Wareham Street Railway Company, organized to build a line in the southeastern section of Massachusetts, has decided to abandon the project and dissolve the company. Shareholders will probably receive back only 75 per cent. of what was paid in.

An order was adopted in the lower branch of the Massachusetts Legislature this week, requesting the railroad commissioners to obtain all information possible from official sources as to the date when it will be feasible to electrify the railroads operating trains within the limits of the city of Boston. This is a sequel to an anti-smoke crusade in this city. B.

New York.

New York city, April 11.—The New York Section of the Illuminating Engineering Society held its meeting last Thursday night. Dr. Clayton H. Sharp delivered an address on "New Types of Electric Lamps," confining himself to electric incandescent lamps. He reviewed the various processes of purifying tungsten and forming it into lamp filaments; exhibited lantern slides showing the life performance of various types of tantalum and tungsten lamps, and exhibited various types and sizes of Gem, tantalum and tungsten lamps of European and domestic manufacture.

The appeal of the Interborough Rapid Transit Company has been sustained in the case in which the Public Service Commission sought to restrain the company from receiving its electrical current through ducts built in the Subway, which are owned by the city and leased to the company. The decision grants a new trial, with costs to the appellant to abide the event.

Approval by the committee of the whole of the Public Service Commission of the Interborough Rapid Transit Company's application for the authorization of a mortgage of $55,000,000 and for the issue at present of $30,000,000 in bonds under this [illegible] as security for $25,000,000 in short-term promissory [illegible] Commission's permission for extension of the Interborough Railroad system and betterments for the Subway system.

The exposition of safety devices given under the direction of the American Museum of Safety Devices and Industrial Hygiene will be opened Monday at 231 West Thirty-ninth Street and continue until June. Dr. William H. Tolman is the director. During the course of the exposition there will be illustrated lectures by engineers upon hazardous occupations and methods of safety. All kinds of safety devices will be shown. Several devices for signaling in railroad work will be shown. One of these is for trolley cars, which after a stretch of travel on double tracks encounter a single-track section. The passage of the cars themselves into or out of the single-track section set signal lights. W.

Ohio.

Toledo, April 11.—There is a decidedly better tone to the electrical business here with the opening of the spring season. A number of good building contracts have been awarded recently and many more are in sight. The electric railways have already begun construction work, and the telephone companies are contemplating some extensive improvements.

Several important changes have been made in the offices of the Electric Package Agency recently. W. H. Hymen has been selected as general manager, with headquarters in Cleveland. E. C. Schinness, who has been the Toledo agent, has been appointed superintendent, with offices in Cleveland. C. W. Hamilton succeeds Mr. Schinness as local agent.

F. L. Hay of Defiance has been appointed receiver for the People's Gas and Electric Company of that city. The appointment was made upon the application of creditors of the concern.

During a gale this week a large pole on the roof of the Ohio Building, the property of the Radio-Telephone Company, was torn from its fastenings and plunged down through the big areaway. One end of the pole crashed through the windows and landed in the office of the Toledo-Massillon Bridge Company on the eleventh floor. A portion of the pole broke a panel in the skylight of the Ohio Savings Bank and Trust Company, on the first floor. No one was injured. The pole was used by the wireless-telephone company for demonstration purposes.

The Lima-Defiance line of the Schoepf syndicate will not be "electrified" this summer, as was contemplated, according to a recent announcement of the traction officials. All finances will be turned toward completing in detail the Lima and Toledo and the Lima-Bellefontaine lines this year.

The contractors of the Lima-Bellefontaine branch of the Ohio Electric Railway have placed a night shift at work, and traffic managers are planning on opening service over a portion of the route early in June. H. L. S.

Michigan.

Detroit, April 11.—An injunction restraining the city of Detroit from enforcing the Hally ordinance has been made permanent by Judge Swan of the United States District Court. The ordinance provided that the Detroit United Railway must operate its cars on streets where franchises had expired under the following conditions: Five tickets for 15 cents, universal transfer, the payment of taxes on ad valorem basis and paving between tracks. The injunction was secured by the Fidelity and Guarantee Company of New York, trustee of the bonds, on the ground that the mortgage security would be impaired if the company was compelled to give the rates and service prescribed by the ordinance.

The Board of Commissioners of Traverse City has found it impossible to secure subscriptions for $200,000 of the bonds for the proposed interurban road as required by the Carter Construction Company of Chicago. It is believed that subscriptions for $75,000 can be secured. If the Carter company will not modify its terms, the proposition will be dropped.

Residents of West Houghton have petitioned the village of Houghton to grant a franchise for an electric railway between Houghton and South Range. They believe that the line would build up that part of the town and bring considerable business to the merchants.

The engineers of the Marquette County Gas and Electric Company are considering the proposition of building an electric railway between Ishpeming, Negaunee and Marquette. Preliminary surveys of three routes have been made. The road can be operated from the company's present power station. A decision will be made within 60 days.

The Escanaba Electric Pulp and Power Company will furnish power to the Escanaba Electric Street Railway Company as soon as the new dam at Flat Rock on the Escanaba River is complete. The machinery for the new plant has already been delivered.

The injunction restraining Bay City from contracting for machinery for the purpose of constructing a new electric-light station has been made permanent. The action was brought by the Bay City Traction and Electric Company. Judge Wizner of the Circuit Court held that the proceedings of the Common Council in the matter were irregular, as a resolution declaring the necessity of the new plant was not adopted, while the Board of Estimates had not provided for the necessary expenditure, and the city would be behind financially at the end of the fiscal year if the expenditure were made.

The citizens of Monroe will vote on the proposition of a bond issue of $8,500, which has been made necessary by the installation of service at unremunerative points, the establishment of day service and the fact that the new machinery and wiring cost $25,000 more than was estimated. Many citizens are again talking of the advisability of selling the plant. D.

Illinois.

Peoria, April 11.—The business of the United States Express Company, now carried on the Illinois Traction System, is growing rapidly, so much so that seven or eight new messengers will be added to the force by the first of May. At the present time the company is hauling express on three passenger cars each way daily, besides two express cars that are now run over the lines at night, and a change will be made in the express schedule of the passenger cars that will be of benefit to the express handling.

The interurban gasoline car that has been in service between the cities of Canton and St. David has been taken off, and travel will be suspended till the line is equipped to be operated with electricity. All the material is on the ground, and the iron poles that will be used in Canton will be placed the coming week, so that the road will be in operation as soon as possible.

The Illinois Traction System is installing the McClintick block system on the line across the river, which is the busiest place on the lines. This system is the first of the kind to be operated on an electric line in the state. The system has been used on the electric lines near St. Paul and Minneapolis for some time, and is also in use on several steam roads in the state.

The Consolidated Street Railway Company of Springfield will use its new barns tonight for the first time. The new barns are constructed of brick, concrete and iron, and are fireproof. They are also intended to hold a shop for the repairing of the cars. The welfare of the men has been looked after in the building by placing reading rooms and bathrooms and individual lockers.

General Manager Fischer of the Illinois Traction Company went to Champaign to meet Mr. Dovey of London, England, who is making a study of the interurban lines in this country. They will make a trip over the lines of the Traction company.

The City Council of Pana will next week pass the franchise of the Mattoon-Pana interurban line. This is the only town between the cities of Matton and Hillsboro that has not granted the line a franchise. It is said that the work of grading the line will be commenced at once.

The old suit of the Peoria Water Company against the Central Railway Company, based on alleged electrolysis of the pipes belonging to the former, was up again this week before Special Master Frank L. Ween in Chicago. A continuance was taken until April 28th. The master will report his findings to Judge Sanborn in the Federal court at Chicago. V. N.

Oklahoma.

Oklahoma City, April 11.—The Dunbar Electrical Supply Company of this city has been reorganized with the following-named officers: President, G. B. Stone; secretary and treasurer, S. E. Dunbar; sales manager, George L. Sayles.

The City Council of this city has passed an ordinance requiring inspection of all freight and passenger elevators in the city at least once in 90 days, and notice of the condition of the elevator posted in every car.

The Ten Thousand Club of Pauls Valley is considering a proposition of installing an electric-light plant.

The Oklahoma City-Shawnee Interurban Railway Company of Guthrie has been organized with a capital stock of $300,000.

The Sentinel (Okla.) Long-distance Rural Telephone Company has been incorporated for $10,000. The directors are J. M. Wright, F. Wingham of Sentinel, and W. H. Davis and C. C. Allen of Rocky, Oklahoma. K.

Northwestern States.

Minneapolis, April 11.—The City Council at Tower, Minn., has made a 10-cent advance on all residence lights for the summer. This municipal plant has not been making expenses.

The Village Board at Sheboygan Falls, Wis., has renewed the contract with the Falls Light and Power Company for lighting service for a term of five years.

Work will soon be resumed on the construction of the electric line between Brookings and Sioux Falls, S. D.

Roff & Kahner is the name of the new firm of electrical contractors at Beatrice, Neb.

The City Council at Minot, N. D., proposes an ordinance which provides for a city electrician who shall make a thorough investigation of all buildings, and report whether the wiring has been done in accordance with the rules of the fire underwriters.

The Columbus Electric Light and Water Company of Columbus, Mont., has been incorporated with a capital of $20,000. James Craig and others are interested.

The construction of an interurban line connecting Marquette, Mich., with Negaunee and Ishpeming is proposed by the interests controlling the Marquette County Gas and Electric Company. R.

Western Canada.

Winnipeg, April 10.—A case of much interest is now in progress before Mr. Justice Martin at Vancouver, British Columbia. It is an action brought against the Burrard Power Company by the attorney-general of Canada to set aside a grant of 25,000 inches of water from Lillooet Lake, granted by the water commissioner of New Westminster in 1897. The objection taken is that the lake is entirely within the government railway belt, and that water in that belt can only be granted by the Dominion government. The attorney-general of British Columbia has intervened, and the case is now a fight practically between the British Columbian and Dominion governments, with the power company an interested party. It is claimed, incidentally, that the depletion of Lillooet Lake will affect the spawning of salmon, and this adds more interest to the suit. It is stated that in any event the case will be appealed to higher courts.

H. B. Round of the firm of Carruthers & Round, Edmonton, Alb., is acting for an English syndicate said to be anxious to purchase the franchise for the street-railway system in Edmonton. Mr. Round says that the syndicate has $5,000,000 in sight, if such a sum is necessary.

At Edmonton, Alb., Griffen & Co. are building a seven-story packing plant, and in connection will have a fully equipped electric power plant.

The plant of the Winnipeg Electric Company at Lockport, Man., has been completed and is now having its trial run. This plant is situated near Selkirk, and, in addition to supplying light and power to that town, will generate power for the Winnipeg, Selkirk and Lake Winnipeg Electric Railroad, a subsidiary company of the Winnipeg Electric. Wilford Phillips, Winnipeg, Man., is general superintendent.

Cannel & Spencer, Edmonton, Alb., have received the contract for the power plant and building to be erected for the general hospital at that city. The contract price was $40,000.

At a meeting of the light and power committee of the City Council, Calgary, Alb., Chairman Graves stated that within two months he would be able to announce a further reduction in rates for domestic and manufacturing purposes. The committee also discussed the advisability of installing a 1,000-kilowatt unit, which would practically double the capacity of the plant.

At a meeting of the City Council of Lethbridge, Alb., it was decided to engage Cecil B. Smith, hydro-electric expert, Toronto, to report on the civic power proposition.

Hon. Adam Beck has introduced a bill into the Ontario Parliament providing for the development of power at Dog Lake, near Port Arthur. All the works are to be under the supervision of the Hydro-electric Commission. R.

Pacific Slope.

San Francisco, April 8.—The Great Western Power Company, which has a contract to supply the Cowell Cement Company with electric current to the amount of 6,750 horsepower, has effected an arrangement with the Pacific Gas and Electric Company to have the latter corporation furnish the current until the Great Western Power Company is able to carry out the agreement.

The Department of Electricity of San Francisco has presented to the Board of Supervisors of San Francisco its budget for the coming year. It calls for a total of $275,450.06, divided as follows: Salaries, $63,900; maintenance, $17,690; rehabilitation, $70,588.10; restoration of police signal system, $19,867.40; restoration of the overhead fire and police-alarm systems, $9,844.56; and underground system, $93,700.

The Allis-Chalmers Company has leased a location at the corner of Second and Mission streets in this city for its Pacific Coast headquarters, and will move its offices at once.

It is given out that work will be begun at once on the new hydro-electric plant of the Southern Pacific Railroad Company on the Klamath River, near Keno, in Southern Oregon. This plant will develop power for the operation of railroad trains over the mountains in Southern Oregon and Northern California.

The government's waterpower electric plant on the Klamath River, which will develop power for the irrigation pumping plants in the Klamath region, will not be pushed this year, as the pumping plants will not be completed and ready for operation for some time. [illegible] of 1,000 horsepower.

The Chehalis [illegible] Chehalis, Wash., [illegible]

The Town [illegible] election for May [illegible] issuing bonds to the amount of [illegible] water and sewer system.

The City Council of Union, Ore., has called an election for next June to vote on a proposition of issuing bonds to the amount of $55,000 for the purpose of putting in an electric-lighting system.

The City Council of Riverside, Cal., has granted an electric street-railway franchise in that city to the San Bernardino Interurban Railway Company.

The Westinghouse Electric and Manufacturing Company has closed a contract for a 750-kilowatt, three-phase Westinghouse-Parsons steam turbine for the Hawaiian Electric Company. This will be the first steam turbine installed by the latter company in its electric power station in Honolulu.

Bids are in for the electric wiring of the new Palace Hotel in San Francisco, but the management will take time to consider each proposal before awarding the contract, which will probably amount to about $50,000. Three 300-kilowatt Westinghouse direct-current engine-type generators are already on the ground, and it is expected that a fourth will be installed. The power plant will be located in the basement on the Market Street front. The steel frame of the nine-story structure, which covers a site of 344 by 275 feet, is almost completed. A.

PERSONAL.

Mr. P. M. Gelatt is the new manager of the La Crosse Gas and Electric Company of La Crosse, Wis.

Lord Rayleigh, the celebrated English physicist, has been elected chancellor of the University of Cambridge.

On April 10th the following-named associates of the American Institute of Electrical Engineers were transferred to full membership: Leander H. Conklin, Connellsville, Pa.; A. S. McAllister, New York city; Paul M. Downing, San Francisco, Cal.

Mr. Edward Schildhauer, formerly of Chicago, the electrical and mechanical engineer for the Department of Lock and Dam Construction for the Isthmian Canal Commission, is making his headquarters at Culebra, Canal Zone, Isthmus of Panama.

Mr. George F. Porter, sales manager of the Atlantic Insulated Wire and Cable Company of New York, was in Chicago last week. Mr. Porter, who is also master of transportation for the National Electric Light Association, is making an extended western trip.

Samuel B. Rawson of Elyria, Ohio, died of heart disease on April 9th. He was president of the Dean Electric Company and head of the Rawson syndicate of Independent telephone men which has financed telephone companies in several American cities. He leaves a wife and one daughter.

Mr. John F. Gilchrist, assistant to the president of the Commonwealth Edison Company, and Mr. E. J. Fowler, statistician of the same company, left Chicago on April 13th for an extended trip in Europe. They will be away about two months and will divide their time between business and pleasure.

The American Academy of Arts and Sciences has awarded its Rumford medal to Edward Goodrich Acheson of Niagara Falls, N. Y., for his discoveries in light and heat. The specific work Mr. Acheson has been engaged in was the production artificially of carborundum, graphite, silicon and siloxicon.

Mr. R. B. Brooks, who for 12 years has been connected with the operating department of the Huntington electric railways in Los Angeles, Cal., has resigned and will go to New York to take a position with the Pennsylvania Railroad, with which company he was connected before he went to California.

Mr. L. E. Colvin has been named as chief engineer of the Scranton Electric Company of Scranton, Pa., succeeding Mr. J. E. Parrish, who has resigned to engage in private business. Mr. Colvin had been chief engineer of the Lackawanna Light Company. Mr. H. C. Custard of Erie, Pa., assumes the duties of master mechanic of the Scranton company.

Mr. Hugh J. McGowan, president of the Indianapolis Traction and Terminal Company, and also at the head of the Indiana Traction syndicate, has been confined to his home for the last two weeks with a serious illness that has occasioned some alarm among his friends and business associates. It is said, however, that Mr. McGowan's condition during the last few days shows an improvement.

Mr. William J. Pringle, alderman from the Third Ward of Chicago, has been selected to head the important committee on gas, oil and electric light of the City Council. Mr. Pringle succeeds Mr. Linn H. Young, who withdrew from the committee after being its chairman for a number of years, [illegible]

Mr. [illegible] Welsh [illegible] the [illegible] & Co., bankers, of New York city, who control the [illegible] John [illegible] tendent of the Toledo Railways and Light Company. Mr. Welsh [illegible] Jackson, Mich., where he was manager of the gas company. [illegible]

Mr. E. E. Keller, for over 20 years connected with the Westinghouse interests and for [illegible] vice-president of the Westinghouse Machine Company, having completed his duties as receiver and general manager, severed his connection with the management of that company on April 1st. Mr. Keller will take a needed rest and will then devote most of his time to several personal interests. He was formerly an electrical engineer in Chicago, and he made a fine record while in charge of the construction and operation of the great Westinghouse service plant at the Chicago World's Fair of 1893. Mr. Keller has a multitude of electrical friends, who will extend their warmest wishes for his success in any undertaking to which he may turn his attention.

E. E. KELLER.

ELECTRIC LIGHTING.

Clark Pease has applied for an electric-light franchise in Corpus Christi, Tex.

The city of Wahoo, Neb., has voted bonds for the construction of an electric-light plant.

The Rathdrum (Idaho) Electric Company has been incorporated with a capital stock of $10,000.

The city of Ruston, La., has voted $50,000 in bonds to improve its electric-light and waterworks plant.

The Texarkana (Ark.) Gas and Electric Company has increased its capital stock from $100,000 to $200,000.

The Grand River Light and Power Company of Fort Gibson, Okla., has been incorporated with a capital stock of $15,000.

Fire broke out in the power house of the Grafton (N. D.) electric-light plant and before it was under control damaged the machinery and supplies to the extent of $5,000.

The Glose Heat and Power Company of Guthrie, Okla., has been incorporated with a capital of $10,000. J. J. Butler of Chicago and G. V. Pattison of Guthrie are among the incorporators.

A member of the Service Board of Columbus, Ohio, is quoted as saying that the city's finances are in such a strained condition that it cannot build a coal bin needed at the municipal lighting plant.

The Topeka (Kan.) Journal says: "If Topeka contracts with the Edison company to light the city, what will Topeka do with its old light plant which is worth at least $25,000? Throw it on the junk heap and save money by buying light, answers the Edison company."

The city of Galena, Ill., is to sell its municipal lighting plant. The Council is advertising for bids for the plant, and two lots on which it is located, pole lines, wires, lamps, fixtures and all appliances used in operating the system. Bids will be received until June 2d, and are to be filed with John J. Thode, city clerk.

The City Council of Ligonier, Ind., has accepted plans and specifications of the engineer and has advertised for bids for the construction and installation of a municipal lighting plant. The plant is to be a good one. The Council will have to provide the money to meet the expense, and long-time bonds will be issued.

The Lincoln Park Board of Chicago has decided to enter into a contract with the Sanitary District for current from the Lockport plant to light the park and North Side boulevards. Beginning about September 1st 600 horsepower will be used, to be increased later. Heretofore the park and boulevards have been lighted by gas and electricity, and it is estimated by the board that with the new arrangement several thousand dollars can be saved annually. The contract price, it is understood, will

be $2.20 a horsepower per month for continuous service and $1.25 a horsepower for 12 hours' use a day.

The receipts of the Lincoln (Neb.) Heat, Light and Power Company for heat furnished during the year ended March 1, 1908, amounted to $24,457.19.

Mr. Victor L. Scott of San Antonio, Tex., author of "Scott's Digest," who conducted a successful campaign in San Antonio, Tex., where he put the gasoline-lighting plants out of business, announces that he desires to make a traveling campaign against gasoline lighting for some large company interested in electric lighting.

The State Railroad Commission of Wisconsin has denied the city of Chilton authority to erect a municipal lighting plant to compete with the Wisconsin Electric Service Company of that city. The Common Council of Chilton and the local lighting company have not been in agreement for some time. The company has offered to sell its plant to the city for $20,000. The railroad commission advises the Council that if it wants to have the franchise of the company forfeited it should apply to the attorney-general, but it advises settlement outside the courts.

ELECTRIC RAILWAYS.

The St. Louis, Troy and Eastern Railroad, a steam road entering East St. Louis, Ill., from Madison County coal fields, may be equipped for electrical operation this summer.

Three important electric-railway extensions are planned for this summer in the vicinity of Salem, Ore., they being the line from Salem to Albany, the Welch line and the Salem-Stayton line.

A charter has been issued by the secretary of state to the Oklahoma City-Shawnee Interurban Company, with $300,000 capital and headquarters at Oklahoma City. The incorporators are H. M. Wyatt, A. M. Spencer, Stephen Brown, Joseph Brown and J. A. Stevenson, all of Oklahoma City.

The Cleveland Electric Railway Company has placed in service a postal car, which is said to be one of the most complete in existence. It will be used in collecting and distributing mail between the various postal sub-stations in Cleveland and suburbs. It is equipped with canceling machines both for first-class and second-class matter.

Earnings of the Kansas City Railway and Light Company for February show an increase of $40,609 in gross, and, after deducting operating expenses, taxes and bond interest, surplus for the month increased $15,359, compared with the corresponding period of the previous year. Gross earnings for nine months ended February 29th show an increase of $364,026, and surplus earnings for the same period gained $32,385.

The Chicago and Oak Park Elevated Railway has practically completed plans for extending its surface line from Wisconsin Avenue in Oak Park, which is now the terminus of the railroad, to Elmhurst, five miles west of that point. The arrangement involves the formation of a new company to be incorporated and financed as a separate organization, but it will be owned by the same interests which now control the Chicago and Oak Park line. It is said that practically all of the right-of-way has been acquired for the new line, and franchises have been obtained from all villages through which the road will pass, excepting those of Harlem and River Forest. The new company will charge a 10-cent fare west of the Desplaines River, and will divide its revenue with the Chicago and Oak Park company.

The sale of $1,000,000 worth of receivers' certificates of the Chicago and Milwaukee Electric Railroad Company has been authorized by Judge Grosscup. It is reported that Canadian bondholders may take the larger share of the issue. Out of the total proceeds $122,000 is to be reserved to pay for a portion of the construction material belonging to the Chicago and Milwaukee Railroad Company of Illinois, which is to be used for completing the Wisconsin company's line into Milwaukee. In addition to this, $10,500 is to be spent for taxes and $27,000 goes to the city of Milwaukee for part payment for its Sixth Street viaduct. Judge Grosscup also authorized a meeting of the directors of the [illegible] to vote $30,000 for the payment [illegible] of the Wisconsin company, [illegible] the Illinois concern. This is to keep [illegible] market.

POWER TRANSMISSION.

[illegible] president of the Central [illegible] eral Georgia rivers, says that the company is pre- [illegible]

terurban trolley company that will build the road from Albany to Atlanta, through Macon and Griffin, and it is believed the power derived from the Ocmulgee, Oconee and Flint rivers will be used to run a network of trolley lines over South Georgia.

The last of the big water pipe for the new power plant of the California Gas and Electric Corporation on Deer Creek has been hauled from Nevada City. For several weeks past from 7 to 12 teams have been engaged in hauling pipe to the plant, and in the main the road was entirely rebuilt to enable heavy teaming to proceed. Early in April, it is stated by Superintendent Wilcox, the plant will be in operation and generating 8,000 horsepower.

The Nevada-California Power Company, formerly the Nevada Power, Mining and Milling Company, Goldfield, Nev., is preparing to install a fourth Allis-Chalmers alternating-current generator, of the waterwheel type, having 1,500 kilowatts rated capacity, to augment the enlarged power service, now contracted for in the vicinity, pending the completion of its new hydro-electric stations on Bishop Creek, Inyo County, Cal. Current from these generators is transmitted 113 miles at 60,000 volts to Tonopah and Goldfield, Nev.

The Menominee (Mich.) Light and Traction Company has purchased the rights of former Mayor William Holmes, and, it is said, will commence to develop the waterpower of the Menominee River by building a $400,000 electric power plant at Chappee Rapids, four miles from Menominee, and transmit the power to Menominee and Marinette, Wis., for light and power purposes. The interurban electric railway between Menominee and Escanaba, which was surveyed several years ago, will be built as soon as the right-of-way can be secured, it is said.

Electric current from the Snow Mountain Water and Power Company's plant on Eel River has been turned on, and Ukiah, Cal., is now lighted with electricity from this point. The power line will be extended to Santa Rosa in a few months and contracts for the work are already being let. The Snow Mountain is said to be the only company in California which does not use flumes or ditches to transmit the water to its power house, a tunnel being the only connection, and for this reason it is claimed that there is very little probability of current ever being interrupted.

PUBLICATIONS.

The New York Insulated Wire Company is issuing an interesting series of blotters illustrating and describing the production of rubber.

Attractive souvenir postcards are being sent out by the National Electric Light Association, showing the Auditorium Hotel, where the Chicago convention will be held, May 19th to 22d.

The United States Geological Survey has issued Bulletin No. 336, which is the report of the washing and coking tests of coal and cupola tests of coke conducted by the United States fuel-testing plant at St. Louis, from January 1, 1905, to June 30, 1907. The tests show clearly the advantages of washing coal used for coking purposes.

"'Permanized' Negative Plates" is the title of an interesting circular just issued by the General Storage Battery Company of Boonton, N. J. Mr. Joseph Bijur, the president of this company, is widely known for his useful storage-battery inventions, and the present circular describes the Bijur method of making negative plates, which has attracted much attention. Exceptional long-life capacity is claimed for these plates.

SOCIETIES AND SCHOOLS.

At last week's meeting of the board of directors of the American Institute of Electrical Engineers in New York 168 associates were elected to membership.

The Oklahoma Electric Light, Railway and Gas Association will hold its second annual convention at Guthrie, Okla., on May 25th, 26th and 27th. F. H. Tidnam of Oklahoma City is president and Galen Crow of Guthrie, secretary.

On April 10th the Electrical Section of the Western Society of Engineers held a meeting at which Mr. J. C. Kelsey read a paper on "The Relation Between Banker and Engineer." The subject was then discussed by Chairman Roper and Messrs. W. P. Jackson, E. N. Lake and J. R. Cravath.

The students' branch of the American Institute of Electrical Engineers at Armour Institute held a largely attended meeting on April 3d, which was addressed by Mr. C. A. Howe, western manager of the Holophane Company, on the subject "Globes and Reflectors in the Distribution of Light." At a special meeting held on April 9th, Mr. E. W. Adams, '08, read an interesting paper on "An Electrically Controlled Interlocking System." Another special meeting has been arranged for April 30th, when Prof. E. H. Freeman will give an exhaustive discussion on the "Study of Alternating Currents with the Oscillograph."

A New York meeting of the American Institute of Electrical Engineers was held on April 10th. Vice-president A. H. Armstrong presided, in the absence of President Stott. Henry Floy of New York presented a paper on "The Engineer's Activity in Public Affairs—Public Utility Commissions and Franchise Valuations." There was an interesting discussion, points from which are presented elsewhere in this issue.

The fourth annual inspection trip of the senior and junior engineering students of the University of Colorado was made during the week beginning March 23d. Four days were spent in examining engineering works in and near Denver, one day at Georgetown and one day at Idaho Springs. The party was composed of 63 students and was under the direction of Professors Ketchum, Evans and Hunter and Messrs. Williams and Jenkins of the engineering faculty.

MISCELLANEOUS.

Paul McGregor, representing eastern capitalists, is said to have secured an option on 42 acres near Newcastle, Ohio, and in case present plans mature a large works for the manufacture of electric locomotives, electric dray wagons, automobiles, etc., will be built.

Mrs. F. Violet Sanborn of St. Louis has been conducting a series of lectures on domestic science at a large department store in Milwaukee. A model electric kitchen is used to demonstrate. Mrs. Sanborn's lectures contain many valuable suggestions regarding cooking. Special attention is given to the art of cooking by electricity.

Commenting on his recent visit to the works of two of the leading electrical manufacturers in the German Empire, Mr. G. L. Carden, special United States agent, says that the business is very good, with work in sight for one year's operation. The standard of work turned out is very high, and calls not only for expert workmen, but, where machine tools are used, the tools must be of the very best. In the machine-tool branch of the works only American and German tools are observed.

The Niagara Falls Hydraulic Power and Manufacturing Company and the Oneida Community have set a large number of men at work on the debris slope of the bank of the Gorge, turning over the earth there in order that trees and shrubs may be set out to beautify the locality under the direction of the Taft scenic commission. This section to be improved is immediately below the upper steel arch bridge, and the bank to a point below the power houses is to be "transformed."

The United States Civil Service Commission, Washington, D. C., announces an examination on May 6, 1908, at the larger cities in all the states to secure eligibles from which to make certification to fill a vacancy in the position of switchboard attendant, $900 per annum, United States Military Academy, West Point, N. Y., and vacancies requiring similar qualifications as they may occur in any branch of the service. The examination will consist of letter writing, practical questions, experience Applicants should be practical electricians.

The Civil Service Commission announces an examination on May 13, 1908, at the larger cities in all the states to secure eligibles from which to make certification to fill a vacancy in the position of electrician, $1,000 per annum, Quartermaster's Department at Large, Columbus Barracks, Ohio, and vacancies requiring similar qualifications as they may occur in any branch of the service. The duties of the specific position to be filled require thorough knowledge of and experience in house wiring, installation of electric-lighting fixtures, and construction of pole lines; ability to read and test wattmeters and to care for and make slight repairs to transformers and arc lamps. Applications should be made to the United States Civil Service Commission, Washington, D. C.

TRADE NEWS.

Holders of the Automatic Electric 20-year six per cent. first-mortgage bonds, who were recently given these securities in exchange for stock in the new consolidated Automatic Electric Company, which had been previously exchanged for shares of the Strowger Automatic Telephone Company, have received a proposition from a syndicate which offers to buy the bonds on a basis of 85 and interest at the end of four months. Deposit of the bonds for that period is asked.

The net profits of the Canadian Westinghouse Company for the fiscal year ended December 31, 1907, were $427,053, an increase of 23 per cent over the preceding year, according to reports read at the annual meeting of the stockholders a few days ago. Dividends paid during the year amounted to $215,221; $200,000 was set aside as reserve for depreciation, and $20,000 as reserve for inventory. The deficiency of $8,168 was deducted from previ-

ous surplus, and a balance of $391,284 was carried forward to profit as of January 1, 1908. Unfilled orders on hand on December 31, the report showed, amounted to $1,130,000. All the directors were re-elected, and the board subsequently organized by re-electing the officers.

A. P. Munning, general sales manager of the Cutler-Hammer Manufacturing Company, maker of controlling devices, was in Chicago last week. Mr. Munning has just completed an extensive tour of the South and also spent a week at the home office of his company in Milwaukee. Mr. Munning reports business conditions greatly improved over what they were several months ago, and says that the outlook is encouraging. It might be added that Mr. Munning secured several large contracts for Cutler-Hammer apparatus on his present trip.

DATES AHEAD.

[illegible]

Iowa [illegible] Des Moines [illegible] and 9th.

Missouri Electric Light [illegible] Marquette Hotel [illegible]

Omaha Electrical [illegible] 4th to 9th.

Nebraska Electrical Association [illegible] Neb., May 6th and 7th.

Missouri Independent Telephone Association [illegible] May 6th and 7th.

Southwestern Electrical and Gas Association [illegible] El Paso, Tex., May 7th, 8th and 9th.

Grand Rapids Electrical [illegible] to 16th.

Indiana Independent Telephone Association [illegible] Indianapolis, May 13th and 14th.

[illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 7, 1908.

883,701. Switching Device. James A. Duffy and Oscar Irwin, Pittsburg, Pa., assignors of six-tenths to Charles D. Armstrong, Pittsburg, Pa. Application filed January 19, 1904.

An electric switching mechanism on a car has two electromagnets arranged to throw a track switch, signals for indicating the position of the switch, an insulated section for the traveling contact and a current-changing device connected with the electric switch for the two magnets and arranged to change the current thereto when the changing device is actuated.

883,723. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed July 12, 1907.

In combination with one or more lines of transmission positioned in the inducing region of a power wire are means to neutralize the inducing effect of the power wire, which means comprise a shunt for part of the lines of transmission, the shunt wire being in the inducing region of the return for the power wire.

883,724. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed July 18, 1907.

A telephone or telegraph line adjacent a single-phase railway with rail return has part of its line in the inducing region of the trolley wire and part in the inducing region of the rails.

883,725. Working of Electric Vapor Lamps. Richard Küch, Hanau, Germany, assignor to the firm of W. C. Heraeus, Hanau, Germany. Application filed December 7, 1905.

The method of working mercury-vapor electric lamps consists in applying to the electrodes an electric potential of not less than 25 volts per centimeter of the length of column of light.

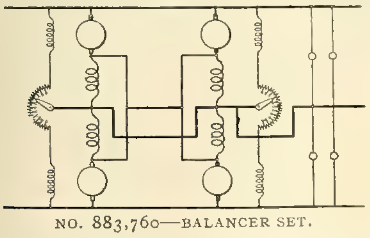
883,737. Talking Sign. Lucius R. Paige, Worcester, Mass. Application filed February 21, 1907.

In this sign there is an electric lamp, a switch for the circuit thereof having means for holding it open, transparencies, and a movable member adapted to move upwardly to display a transparency, and to engage the switch directly when in its upward position so as to move the switch to close the circuit of the lamp.

883,756. Heat Radiator for Hydrocarbon and Other Heat Motors. Klaus J. Steiner, Pittsburg, Pa. Application filed December 28, 1906.

The method of electroplating these and similar multitubular articles consists in connecting the article to form a part of an electrolyte-containing and circulating system, the article forming the cathode therein and being placed exteriorly of the vessel containing the electrolyte, and circulating the electrolyte through the article.

883,760. System of Distribution. Lewis L. Tatum, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed February 19, 1906.



NO. 883,760—BALANCER SET.

A balancer for a multiple-voltage system of distribution comprises two compound-wound machines, the armature and series field windings being connected in series across the main conductors and to a neutral conductor, the shunt field windings being also connected in series across the main conductors, and a rheostat in the shunt circuit between two shunt windings, the arm of the rheostat being also connected to the neutral conductor. (See cut.)

883,777. Cluster Lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed April 14, 1904.

A plural lamp socket has a hemispherical casing with a central opening and a circularly arranged series of openings, a number of lamp-receiving sockets registering with the openings and means for sustaining these sockets in inclined position relatively to the axis of the casing.

883,811. Telephone Support. Otto Kraus, New York, N. Y. Application filed September 1, 1906.

The instrument supporting part ends in a ball that fits into a spherical socket provided with a leaf spring to frictionally hold the ball in any adjusted position.

883,822. Dynamo-electric Machinery. Charles A. Parsons, Newcastle-upon-Tyne, England. Application filed April 23, 1906.

Metal strips of small section relatively to that of the conductors are lapped round the latter and [illegible] as to form a heat-conducting path [illegible] the interior of the body of conductors.

883,823. Insulator Support. Charles L. Peirce, Jr., Elkhart, Ind., assignor to the Peirce Specialty Company, Chicago, Ill. Application filed August 10, 1907.

A narrow loop member is secured to a bracket so its closed end projects above the latter. A coil spring surrounds the loop member and has an end portion thereof bent transversely and inserted between the sides of the loop member.

883,829. Automatic Signaling Mechanism. Josef Reuter, Rochester, N. Y. Application filed April 15, 1907.

There are in combination a number of relatively adjustable pivoted members, each provided with a number of notches adapted to actuate the same contact member, a motor adapted to create relative movement of the adjustable members and the contact member, and circuit terminals arranged to coact with the contact member.

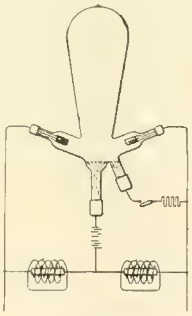
883,846. Electrical Multiple Influence or Condenser Machine. Heinrich Wommelsdorf, Charlottenburg, Germany. Application filed February 28, 1905.

A revolving-plate form of static machine is described.

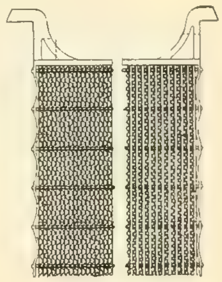
883,865. Advertising Apparatus. Henry Dahn, Edgewater, N. J., and Frederick Becker, New York, N. Y. Application filed June 6, 1907.

A hollow cigar-smoking image is provided with electric lights automatically controlled from a switchboard and an electric motor simultaneously operated with the lights and driving an air pump which blows a puff of smoke from the cigar.

883,919. Reactive Coil. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company. Application filed May 19, 1906.



NO. 883,919.—REACTIVE COIL.



NO. 884,028.—ACCUMULATOR PLATE.

A mercury arc rectifier has a reactive coil for maintaining the device active and a secondary coil in inductive relation to the reactive coil and used for equalizing the discharge of the latter. (See cut.)

883,924. Arc Lamp Electrode. William S. Weedon, Schenectady, N. Y., assignor to the General Electric Company. Application filed April 21, 1903.

This electrode consists of a core or pencil containing titanium carbide and a casing therefor formed of some material which will prevent injurious oxidation of the titanium carbide when heated.

883,943. Reverse-current Circuit-breaker. Charles E. Eveleth, Schenectady, N. Y., assignor to the General Electric Company. Application filed May 25, 1904.

Means located in the magnetic field adjacent to the breaker contacts comprise a polarized magnet for causing the circuit to open when the current in the dynamo-electric machine reverses. There are also means for giving an initial magnetomotive force to the magnet while the circuit-breaker is being reset.

883,944. Electric Lighting. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company. Application filed December 8, 1904.

In combination with a vapor electric lamp is a light-transmitting reflector located in proximity thereto and [illegible]

883,956. Motor Starter. Albert J. Horton, White Plains, N. Y., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed June 13, 1906.

The starting [illegible] ances, a separate contact arm engaging each. There is a no-voltage and an overload release [illegible] ing to return the starting arm to initial position when an overload occurs or when this arm is moved too rapidly in starting.

883,961. Electrometallurgical Process for Extracting Copper from Its Ores. Lucien Jumau, Paris, France. Application filed January 19, 1907.

The process consists in lixiviating the ores with an ammoniacal solution, precipitating the copper from this in the form of a precipitate containing cuprous sulphite, dissolving the sulphite in an ammoniacal solution, subjecting the solution to electrolytic action, and simultaneously passing a current of carbonic acid gas through the solution.

883,964. Signaling System for Electric Railways. Harry N. Latey, New York, N. Y. Application filed January 19, 1904.

A relay between conductor sections is dependent for operation upon a predetermined difference of potential between the sections. A circuit is controlled by the relay and contains the signaling devices.

883,992. Electric Time-indicating Device. William F. Wentz, New York, N. Y. Application filed December 22, 1904.

A pair of drums with pins on their peripheries revolves just below a plate carrying contact springs that engage the pins.

884,002. Controller for Electric Motors. Thomas E. Barnum and Henry H. Cutler, Milwaukee, Wis., assignors to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed June 18, 1902.

A device for automatically removing the resistance from the motor circuit has a handle for operating the device to insert resistance and electrically controlled means to prevent the operation of the removing device until the handle has been operated sufficiently to permit all of the resistance to be removed from the circuit. The motor is prevented from starting except when all of the resistance is in circuit therewith.

884,007. Train Control for Electric Accumulator Locomotives. Otto Böhm, Berlin, Germany. Application filed August 6, 1907.

Electric couplings between a number of locomotives connect all the controllers, motors and batteries in series, the arrangement being such that the motors are controlled by only one controller, while all other controllers are permanently fixed to full speed.

884,015. Electrolytic Cell. Albert S. Gray, Chicago, Ill., assignor to Ross J. Beatty, trustee, Chicago, Ill. Application filed March 15, 1906.

The cell is provided with upper cathode and lower anode elements, a diaphragm separating the same and inlet and outlet openings for the circulation of the charge under treatment through the cell between the anode and cathode, the cell having multiple vents for the escape of evolved gases leading from the under surface of the cathode element.

884,018. Incubator Alarm. Fremont R. Harris, Kenmare, N. D. Application filed May 22, 1907.

Contact wires are carried by blocks and located in position for engagement by a movable damper arm. A battery and bell are in circuit with the wires.

884,021. Apparatus for Making Copper. Marcel A. Jullien and Emile L. Dessolle, Levallois-Perret, France. Application filed April 4, 1907.

An apparatus for polishing electrolytic copper comprises a vat provided with a spindle carrying the cylinder on which the metal is deposited, an outside shaft drying the spindle by means of a wooden tappet, a carriage arranged above the vat and moving longitudinally thereon and carrying a motor operating, by means of a connecting rod and crank, an oscillating lever provided at its end with the polishing tool.

884,028. Accumulator Plate. Michail Margulis, Odessa, Russia. Application filed June 7, 1907.

The accumulator plate consists of a head-piece, a number of alternately straight and wavy lead strips suspended from the head-piece and provided with holes, a number of pressure strips suspended from the head-

piece and adapted to yieldingly compress the straight and wavy strips in the horizontal direction, and a number of horizontal cross rods passing through the holes of the straight and wavy strips and adapted to connect together the pressure strips. (See cut on preceding page.)

884,047. Automatic Alarm System. John E. Shepherd, Chicago, Ill. Application filed January 13, 1908.

A signal is electrically controlled by a pressure responsive means.

884,049. Pneumatic Holder for Commutator Brushes. Charles W. Speirs, Battersea, London, England, assignor to the Morgan Crucible Company, Ltd., London, England. Application filed February 23, 1907.

There is provided a pair of tubes, one sliding within the other and one being stationary, the sliding tube having a part engaging the brush, a flexible and extensible chamber within the tubes, and means for continuously supplying air under pressure to the chamber, whereby the chamber will compensate for the wear of the brush and maintain it in contact with the commutator.

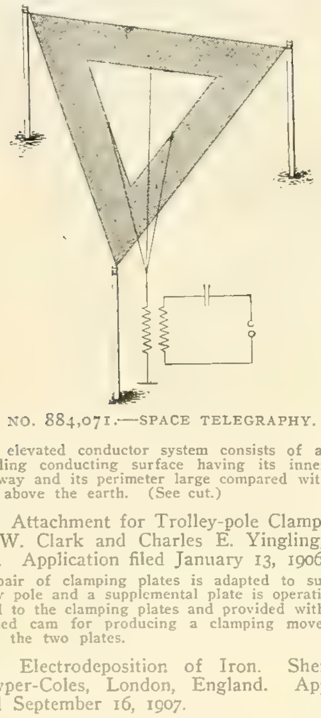
884,066. Automatic Alternating-current Contact Apparatus. Charles E. L. Brown, Baden, Switzerland, assignor to Actiengesellschaft Brown, Boveri & Co., Baden, Switzerland. Application filed November 7, 1903.

In this circuit closer there are means to produce an alternating-current field, a disk rotatable in the field, an adjustable weight, a suspension therefor connected to the device and circuit-closing terminals closed by the weight when lifted, the time of closure being controlled by the length of the suspension.

884,070. Space Telegraphy. Sewall Cabot, Brookline, Mass., assignor to the Stone Telegraph and Telephone Company, Boston, Mass. Application filed November 13, 1906.

In a space-telegraph system, a normally closed power circuit includes the primary winding of a transformer, a sonorous circuit, a normally open intermediate circuit connecting the sonorous circuit to the secondary of the transformer and means operated by a sending key for controlling the current flow in the intermediate circuit.

884,071. Space Telegraphy. Sewall Cabot, Brookline, Mass., assignor to the Stone Telegraph and Telephone Company, Boston, Mass. Application filed December 31, 1906.



NO. 884,071.—SPACE TELEGRAPHY.

An elevated conductor system consists of a laterally extending conducting surface having its inner portion cut away and its perimeter large compared with its distance above the earth. (See cut.)

884,074. Attachment for Trolley-pole Clamps. Curtis W. Clark and Charles E. Yingling, Eaton, Ind. Application filed January 13, 1906.

A pair of clamping plates is adapted to surround a trolley pole and a supplemental plate is operatively connected to the clamping plates and provided with a lever-operated cam for producing a clamping movement between the two plates.

884,075. Electrodeposition of Iron. Sherard O. Cowper-Coles, London, England. Application filed September 16, 1907.

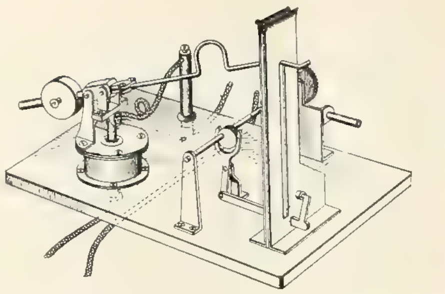
The process consists in forming an electrolyte from sulpho-cresylic acid and substances containing iron and depositing the iron upon a cathode in the usual manner.

884,076. Space Telegraphy. Ernest R. Cram, Cambridge, Mass., assignor to the Stone Telegraph and Telephone Company, Boston, Mass. Application filed May 7, 1906.

In this receiving system there is provided an elevated receiving conductor system, a resonant receiving circuit [illegible] the energy of [illegible] circuit tightly coupled [illegible] interposed between [illegible] a pronounced natural rate of vibration different from that of [illegible]

[illegible] Mortimer Norden, New York, N. Y., assignor to Joseph Norden, New York, N. Y. Application filed March 4, [illegible]

[illegible]



NO. 884,247.—PREPAYMENT DEVICE FOR METERS.

pacity connected with the elevated conductor of a "wireless" telegraph system.

884,110. Space Telegraphy. John S. Stone, Boston, and Sewall Cabot, Brookline, Mass., assignors to William W. Swan, trustee, Brookline, Mass. Application filed January 4, 1907.

The receiving system has in combination a vessel, a heated member and an electrode included therein, a local circuit connecting these, a conducting member also in the vessel, connections from the heated and conducting members to a closed oscillation circuit, and a battery included in these connections and having its positive terminal connected to the conducting member.

884,116. Electrical Ignition Spark-coil for Gas or Vapor Engines. Edward Q. Williams, Syracuse, N. Y., assignor to the Connecticut Telephone and Electric Company, Meriden, Conn. Application filed December 28, 1904.

In a multiple coil for gas engines, a case contains separate elements, each interchangeably removable and connected with the primary and secondary circuits by binding posts extending longitudinally through the case and connected with the general return as ground circuit by means of a spring and bus-bar and switch.

884,121. Automatic Electric Alarm for Beds to Be Occupied by Patients, Such as Hospital Beds. Frank Apold, Philadelphia, Pa. Application filed August 4, 1906.

A vibrator consists of a casing with cover and containing coiled terminals for a circuit including an alarm.

884,124. Process for the Electrolysis of Fluid Salts or Compounds. Henry S. Blackmore, Mount Vernon, N. Y. Application filed January 2, 1907.

This process makes use of a number of liquids separated by a layer of liquid of intermediate density and by a septum to prevent diffusion of the liquids.

884,129. Electric Signal. Arthur J. Cleveland and Frank S. Brown, Minneapolis, Kan. Application filed March 18, 1907.

Below the locomotive is suspended a circuit-closing mechanism consisting of a frame carrying trolleys that engage the rail conductors.

884,130. Electric Time Switch. James J. Coachman, London, England. Application filed July 18, 1905.

A device for controlling an electric circuit comprises a circuit, a cylinder mounted to revolve with its axis in a plane perpendicular to the axis of rotation, a fluid therein, a detached body adapted to descend by its own weight in the cylinder and means whereby at the end of its descent the body controls the circuit.

884,142. Insulator. Ernest J. Foreman, Trinidad, Colo. Application filed November 2, 1906.

The insulator is provided with a longitudinal wire-receiving slot, hoods extending laterally from the opposite ends of the insulator and having their free ends separated, there being transverse grooves formed in the bottom of the insulator and intersecting the wire-receiving slot.

884,158. System of Automatic Block-signaling for Electric Railways. Winthrop K. Howe, Buffalo, N. Y., assignor to the General Railway Signal Company. Application filed September 28, 1906.

This system, comprising an alternating generator, has separate means connected therewith and arranged to produce respectively a difference of potential across the rails and a continuity current along the rails of a block section.

884,170. Third-rail Electric-railway System. Charles Kozesnik, New York, N. Y. Application filed December 17, 1907.

A sectional third rail is composed of top and bottom portions insulated from each other and electrically connected only by occasional contact devices with vertically moving armatures.

884,224. Railway Signal. John S. Sims, Longbeach, Cal., assignor of one-half to Edward Richard Millar, Longbeach, Cal. Application filed May 22, 1907.

This signal comprises an electromagnet, a member movable against the action of gravity by the magnet when energized and consisting of a wheel with an eccentric rim, an arm actuated by the wheel, a pendent semaphore or target carried by the arm and a receptacle for the magnet, gravity member and target, in which receptacle the target is normally held by the action of the electromagnet when energized.

884,235. Receiver for Telephones. Louis Steinberger, New York, N. Y. Application filed February 18, 1907.

[illegible] instrument is provided with a thread [illegible] core [illegible] with a second [illegible] different from the [illegible] provided with [illegible] threads of the cap.

884,2[illegible]. Combined Graphophone and Picture Exhibitor. Charles W. Taylor, Detroit, Mich., assignor to Eugene F. Glock, Detroit, Mich. Application filed January 25, 1904. Renewed December 21, 1905.

The motor of the graphophone, a lamp and a circuit closer are in a normally open circuit, which also contains a locking means for a movable picture carrier.

884,247. Coin-controlled Apparatus. David Wedgewood, Peterboro, Ontario, Canada. Application filed May 29, 1906.

This prepayment apparatus for electric meters comprises means for closing the meter circuit by the deposit of a coin, and means independent of the coin to alternately and automatically release succeeding coins into closing position and locking the circuit-closing means in coin-operated position. (See cut.)

884,264. Storage Battery. Georgie A. Carpenter, New York, N. Y., administratrix of Hiram Henry Carpenter, deceased, assignor to the American Battery Company, Cedarhurst, N. Y. Application filed February 1, 1906. Renewed April 4, 1907.

The negative plates are arranged in pairs, edge to edge, the plates of each pair being insulated from each other. The positive plates are arranged to have the same aggregate area as that of the negatives.

884,271. Electric-light Socket. Franz Frankofski, North Braddock, Pa. Application filed September 12, 1907.

The cap is permanently secured to the bulb and provided with diametrically opposite shoulders and oppositely projecting lugs. A socket has means for preventing the turning of the cap within it, means within the cap for engaging said shoulders and means carried by the cap for disengaging the engaging means.

884,288. Cooking Apparatus. William Nash, Denver, Colo. Application filed October 23, 1906.

In combination with an oven is an electric heater, an air pump, a pipe system connecting the heater with the pump, the latter with the oven and the oven with the heater, a thermostat connected with the oven and having its movable element located in the circuit of the heater whereby the temperature of the oven may be controlled, and a check valve located in the air pipe between the oven and the heater for regulating the pressure within the oven.

884,296. Electric Curling Iron. Clara A. Rickards, Portland, Ore. Application filed October 15, 1907.

The handle of this iron has a circuit-closing key.

884,304. Fire Alarm. Albert S. Trask, Concord, N. H. Application filed May 14, 1907.

A thermostatic circuit closer has a spring contact finger and a stationary contact member. A detent for the spring finger is composed of members joined by fusible solder.

883,312. Electrical Connector. James L. Carnall, New York, N. Y. Application filed December 14, 1907.

In a tapping-in device there is in combination a supporting plate adapted for connection with a binding post, an insulating block mounted thereon, a binding post and a pair of spring-pressed clips mounted on the block, one clip being electrically connected with the supporting plate and the other with the binding post carried by the block.

884,343. Electric Water Heater. Herbert N. Roche, San Francisco, Cal., assignor of one-half to Thomas B. Gray, San Francisco, Cal. Application filed March 28, 1907.

An electric heating coil in the water conduit has means for connecting it with a circuit, comprising a stationary contact, a slidable rod contacting with a second contact and adapted to be moved to the first contact and to be pressed thereon to provide a frictional resistance against the removal of the slidable rod from the contact, a stem for so moving the slidable rod and a resilient connection between the stem and rod.

884,345. Controller. Emmett W. Stull, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Original application filed March 31, 1906. Divided and this application filed October 26, 1907.

The controller drum has a shaft of magnetic material and a number of blow-out magnets, the like poles of which form journals for the shaft.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 14, 1908:

450,172 and 450,173. Electric Switch for Electric Railways. F. Mansfield, New York, N. Y.
450,189. Electric-motor Car. F. A. Pocock, Scranton, Pa.
450,219. Dynamo-electric Machine. W. F. Collins, New York, N. Y.
450,221. Instrument for Measuring Electric Currents. H. H. Cunynghame, F. L. Lawson and O. E. Woodhouse, London, England.
450,228. Printing Telegraph. P. H. Fisk, New Richland, Minn.
450,245. Fire-alarm and Telephone System. S. W. Ludlow, Madisonville, Ohio.
450,272. Telegraph Relay. R. O. Wickes, Troy, N. Y.
450,307. Insulation of Armatures for Dynamo-electric Machines. R. Eickemeyer, Yonkers, N. Y.
450,390. Electric Time Call. R. Varley, Jr., Englewood, N. J.
450,426. Electrical Apparatus for Reproducing Sounds. J. E. Roulez, Paris, France.
450,441. Automatic Switch for Electric Motors. F. E. Whipple, Philadelphia, Pa.
450,458. Electric Signal. R. H. Gruschow, Chicago, Ill.
450,466. Fire-alarm and Telephone System. S. W. Ludlow, Madisonville, Ohio.
450,541. System of Electrical Distribution. C. J. Van Depoele, Lynn, Mass.
[illegible] Reciprocating Electric-railway-motor System. C. J. Van Depoele, Lynn, Mass.
[illegible] Electromagnetic Reciprocating Engine. C. J. Van Depoele, Lynn, Mass.
450,544. Pulsating-current Electric Motor. C. J. Van Depoele, Lynn, Mass.
[illegible] Electric Switch. F. Adam and J. Knapik, St. Louis, Mo.
450,586. Electric Railway. R. M. Hunter, Philadelphia, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Electric Steel.

By Frank C. Perkins

During the last decade there has been great activity and wonderful development in the use of electric furnaces for the production of high-grade steel, iron alloys and for other metallurgical work. It may be of interest to consider the construction of the Heroult electric furnace and its use in this country for the production of steel of the best quality.

That electric furnaces will be employed for the complete reduction of iron from the ore and converting the same into steel is hardly to be expected under the present conditions.

The recent demand for steel rails of high quality with less phosphorus and other impurities of a detrimental nature will undoubtedly spur engineers to consider the use of some electric steel process in the refining of the Bessemer and open-hearth product, but undoubtedly radical changes will be necessary from existing electric furnaces in order to turn out the necessary quantity of material at low cost. That electric steel of high quality can be produced by utilizing electric-furnace refining processes as auxiliary to the Bessemer converter and the open-hearth furnace on a scale of the proper magnitude is believed to be possible.

Of the accompanying illustrations, Fig. 1 shows the electric furnace utilized in this country in connection with the Heroult electric steel process. An open-hearth furnace of the Wellman design is used for making the steel, while the Heroult electric steel furnace is utilized for refining the steel, with a daily output of about 60 tons. The electric furnace has only the small capacity of four tons, while the capacity of the open-hearth furnace is over six times this amount, and works continuously. The open-hearth furnace is charged with about four tons of scrap as often as the four tons of molten metal are supplied to the electric furnace from the open-hearth, the electric treatment requiring about 90 minutes.

For treating a charge of about 10,000 pounds it is stated that 200 kilowatt-hours only are necessary if the over-oxidized metal is taken in a molten condition directly from the open-hearth furnace. Cheap current may be obtained from dynamos driven by gas engines operated from waste, blast-furnace gases and coke-oven gases or from water-power.

Of course, three or four times this amount of electric energy, or about 800 kilowatt-hours, is necessary in case the electric furnace receives its charge in a cold condition, but this is unnecessary except under special conditions, as the metal can be supplied directly to the electric furnace from the open-hearth furnace with very little loss of heat.

Fig. 1 shows the Heroult electric furnace in a plant where the open-hearth furnace is located by the side of the electric furnace, special apparatus being provided for lifting and lowering the electrodes, while the side door is used for charging purposes. An electric motor is used for tilting the electric furnace through special gearing, as shown in Fig. 2.

There is an automatic regulator provided for adjusting the position of the electrodes, with the necessary measuring instruments and controlling apparatus, rheostat switches and devices for electrode raising and lowering. The regulating apparatus is shown in Fig. 3.

Current passes from one electrode into the slag on the top of the metal in this electric furnace, then passes through the slag and out of it into the second electrode, and it is very important that the arcs are properly adjusted between the slag and each electrode, so that the automatic regulator provided is of more than passing interest.

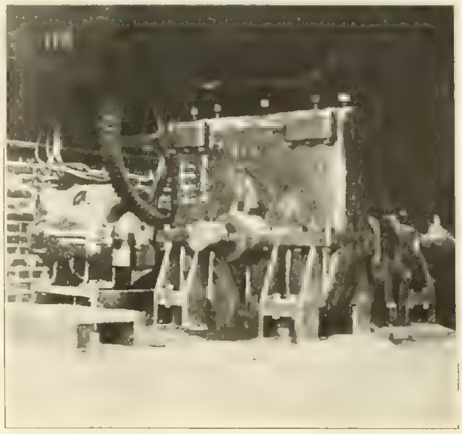


Fig. 2. Electric Motor and Gearing for Tilting Electric Furnace.

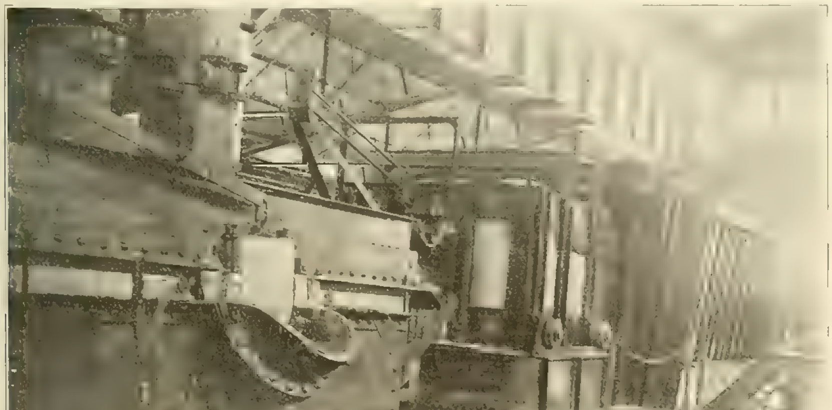


Fig. 1. Electric Furnace at the Left. Open-hearth Furnace at the Right.

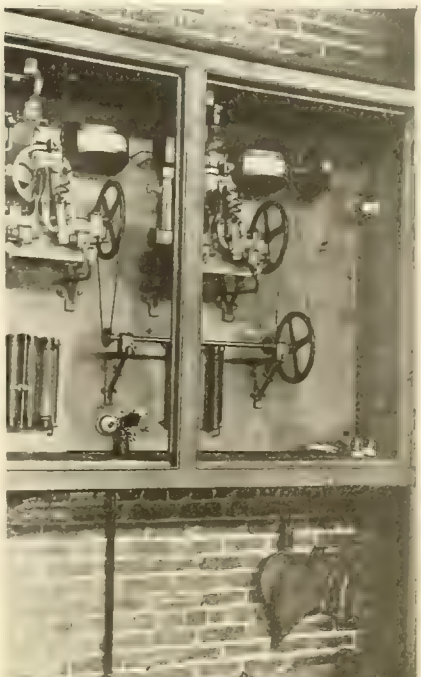


Fig. 3. Automatic Regulators for Electrodes.

THE MAKING OF ELECTRIC STEEL.

If a rod of steel is provided in the bottom of the furnace in contact with the molten mass, and this is connected to the two outside circuits, either of which contains a voltmeter and leads to one electrode, it will be seen that each voltmeter is in parallel with its electrode, the fused metal and the arc, and this instrument will indicate whether there is a proper voltage between the metal and the electrode.

For the automatic regulation of the position of the electrodes the reading of the voltmeter may be applied by means of electromagnetic apparatus. An automatic regulator has been in use at La Praz of the same type as in the Heroult furnace working in that European plant.

There is every reason to believe that the electric process of refining steel can be applied to the product from the Bessemer converter as well as from the open-hearth furnace, resulting in great economy and the production of a high-grade steel; but the handling of a large quantity of metal in a short space of time and other problems will have to be solved.

Electric steel is now obtained by two stages, the [illegible] hearth furnace is utilized for the reduction of [illegible] It is held that this is desirable for treatment in the electric furnace, but this product obtained from the open-hearth furnace is very undesirable in ordinary practice.

The electric furnace receives the highly oxidized molten metal from the open-hearth furnace with very low carbon and phosphorus, and the electric steel process consists of eliminating the sulphur, deoxidizing the metal and accomplishing its recarburization.

It is said that the Heroult electric steel process successfully attains this desired end, yielding a product with less than 0.01 phosphorus and sulphur and free from slag and oxide, while containing the desired percentage of carbon.

Professor Eichhoff points out that there are chemical reactions taking place in this electric furnace of great interest. It is stated that on account of the possibility of selecting slags which would not be sufficiently fluid at lower temperatures but which can be employed to advantage with the high temperature of the electric furnace, the removal of sulphur is possible to a degree not within the reach of the ordinary furnace.

It is also asserted that even at this very high temperature there is no danger of spoiling the charge, as it is kept continually circulating rapidly, and all parts of the molten metal are brought into contact with the slag, where the highest temperature is concentrated.

With the electric steel process more time and more electric power are of course required when the phosphorus has not been reduced to such a low percentage, and any ordinary steel may be treated electrically, whether made in the open-hearth furnace or converter.

An oxidizing slag is first placed on the molten

metal after being run into the electric furnace until it has performed its work, it being then replaced by a carbon and neutral slag for the final refining treatment.

For the production of the finest grade of tool steel, where it is necessary to eliminate the phosphorus and sulphur, the refining process must necessarily be carried out to the very highest point at considerably more expense than where the finished steel is utilized for purposes not requiring the elimination of phosphorus and sulphur. In the latter case it is held that the cost of the electric steel process is little greater than that where ordinary basic open-hearth steel is produced.

Selection of Motors for Hoisting Work.[1]

By R. M. Gaston.

Many motors are selected by comparisons and guesses, but for the majority of practical purposes it is necessary to select motors by methods which compare favorably with other engineering work in accuracy. The selection of the correct motor is important, when there is danger of causing delays, either in payment for equipments worth many times the motor cost, or where a large machine would be classed as a failure on account of a motor failure. It is also very important to select a proper motor which is to be sent a long distance, where unsatisfactory operation would be the cause of expensive delays. By using proper methods and care motors can be selected and gearing arranged with a high degree of accuracy.

In selecting motors for any purpose, there are certain necessary requirements to be met. For instance, it is well to allow plenty of reserve power with which to pull out of any reasonable difficulty, such as temporary overloads from bad track, snow, hot bearings, or the various other troubles which

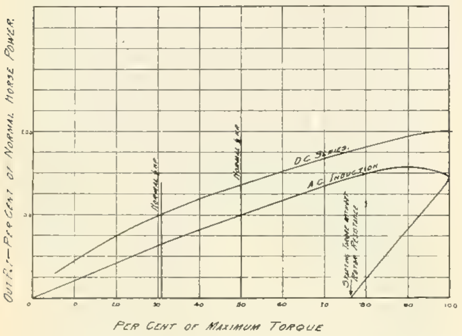


FIG. 1. COMPARISON OF HOISTING MOTORS.

may be met by any piece of machinery. It is usually necessary to meet speed specifications of some kind, which sometimes are rigid and sometimes are left to the discretion of the engineer. It is always necessary to be able to handle the probable loads without dangerous heating. Efficiency is a secondary consideration at the present stage of the art, and is overshadowed by the more important requirement of reliability.

The accompanying curves illustrate the difference between a 15-horsepower, direct-current series and a 15-horsepower slip-ring induction motor, such as are usually used for hoisting work. It is not the intention here to cover details of design, but to confine these remarks to inherent differences of the two types of motors.

A good method to follow in selecting a motor which will give ample emergency reserve is to

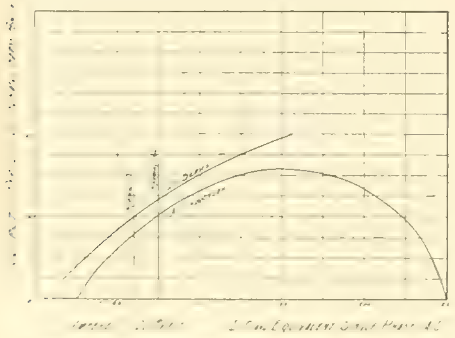


FIG. 2. COMPARISON OF HOISTING MOTORS.

[illegible] machinery friction, as [illegible] allow a maximum [illegible] or seven times the [illegible] usually allow[illegible] [illegible] rating for [illegible]

[illegible] Motors to Hoisting [illegible]

both the direct-current and alternating-current motors are shown in relation to the maximum torque as guaranteed by the manufacturers. From these curves can be found the horsepower output when operating at any per cent. of maximum torque; i. e., if experience tells us that for the conditions at hand it is good policy to reserve a torque allowance of five times normal, it is possible to use only 20 per cent. of the maximum torque for obtaining the normal motor capacity in this case. This would rate the series motor at 75 per cent. of the manufacturer's rating, or 11¼ horsepower, and, similarly, it would rate the induction motor at 40 per cent. of the manufacturer's rating, or six horsepower. This is true, although the manufacturers are selling both motors for 15-horsepower motors, and they would be 15-horsepower motors if they were to be used under the exact conditions assumed by the manufacturers. From this example one can at once see the importance of rerating motors for each particular problem.

If it is necessary to meet certain speed requirements after acceleration, one must estimate by comparison with former work or otherwise, the

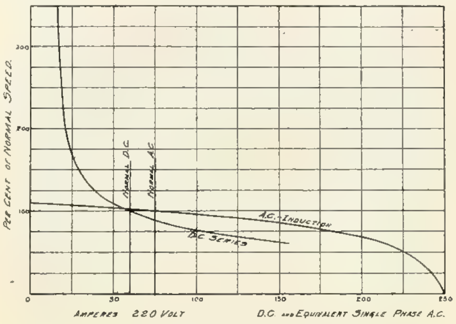


FIG. 3. COMPARISON OF HOISTING MOTORS.

horsepower required after acceleration, and read the speed of the motor from the speed curve at that load. Performance curves are usually plotted on an ampere base, and after finding the amperes for the necessary load from Fig. 2, the speed can be read from Fig. 3.

The main difference in the operation of the two motors is shown by the different shaped speed curves; i. e., the curve for the series motor is convex downward, while the curve for the induction motor is convex upward. The ultimate speed of a machine operated by a series motor cannot be estimated very accurately when the motor is operated at a steep point on the curve, while the ultimate speed of a machine operated by an induction motor can be estimated very closely, because the speed curve has a flat top. It is usually dangerous to allow series motors to operate at full voltage with light loads, on account of the ex-

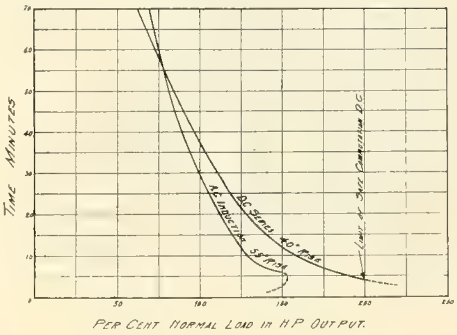


FIG. 4. COMPARISON OF HOISTING MOTORS.

cessive speeds they may attain, while an induction motor may run without load indefinitely with no danger.

Fig. 4 shows that an induction motor may be operated with 150 per cent. normal load for about five minutes without injury, while a series motor may be operated at 200 per cent. normal load for about four minutes without injury. If a motor has been selected by the method outlined, there is usually very little danger of overheating in the class of service under discussion.

If a series motor is running and it receives a very excessive load, it will slow down, but continue to move until it burns out or its fuse is melted; but an induction motor will come to a stop under an excessive load without short-circuiting the system.

Fig. 5 shows the torques of the two types of motors plotted on an ampere base. We often read in text-books and engineering articles that the torque of a series motor is proportional to the square of the current, but I have never seen a series-motor torque curve show much tendency to follow such a curve. From this curve, which is a fair representation of motors of this type, it can be seen that the torque is proportional to the current minus a constant. Similarly, we may read that the torque of an induction motor is proportional to the current, but this is approximately correct for a limited range only, and must be used with care.

Fig. 6 shows the efficiency for the two motors. The main difference is the sudden drop at the pull-out point, due to excessive slip. This drooping characteristic is continually appearing in performance curves of all induction motors.

Fuses and circuit-breakers offer but little protection to the motor for this class of service, but are necessary to protect the remainder of the system. Fuses have the advantage of being able to carry

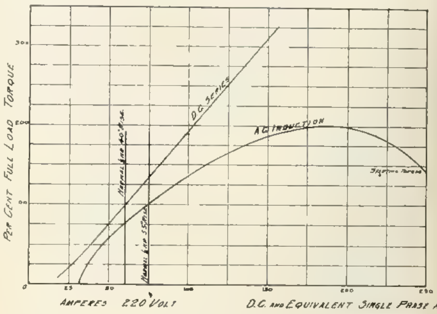


FIG. 5. COMPARISON OF HOISTING MOTORS.

moderate overloads momentarily, which is a valuable feature for this class of work. If an excessive overload occurs, the operator is not tempted to hold a fuse to prevent its opening the circuit, as is frequently done with a circuit-breaker.

Wires are frequently fused to points higher than recommended by the underwriters' code, but I think it is good engineering to depart from constant-load practice in this class of work.

In practice, there is a difference between the two types of motors which is not shown by the curves, which, however, should not be overlooked. If a series motor is in fair condition, it will probably develop more than the overload torque given by the manufacturers, and do it even if there is considerable voltage drop in the line; but an induction

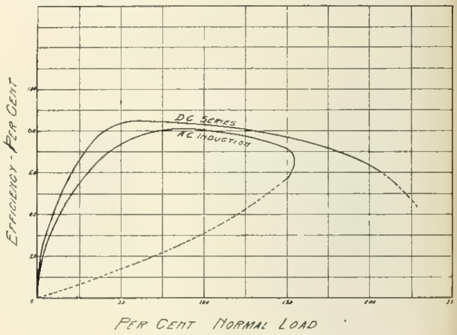


FIG. 6. COMPARISON OF HOISTING MOTORS.

motor can seldom be expected to develop the starting torque in practice that it will on the test floor, on account of the voltage drop in the line, transformers, and even the generating system.

After careful consideration of the points named it may be found advisable to use a 50-horsepower induction motor to do the same work that a 25-horsepower series motor will do.

The manufacturers have reduced the price and weight of induction motors until they are about equal for the two types per horsepower at one-half hour rating; but this does not mean that they will do the same work per horsepower of rating under all conditions.

Tungsten Lamps More Economical Than Gas.

A case where actual comparison between gas lighting and tungsten-lamp electric lighting was available is reported by Mr. H. A. Fee, manager of the Citizens' Light and Power Company of Adrian, Mich. A drug store in Adrian was lighted by three three-burner gas "arcs." These lamps took gas at the rate of 44.063 cubic feet per hour, which, at $1.40 per thousand, would make the cost of gas per thousand hours $61.69. Adding to this $6 for maintenance (25 cents per month per lamp), the total for 1,000 hours was $67.69.

The gas lamps were replaced by 12 40-watt tungstens in ceiling receptacles. The electric lamps take 437 watts actual, and will average considerably over 32 candlepower each. They give more light than the gas, with a better distribution, and are not provided with proper glassware at that. The central-station company's rate on this business (to 9 p. m.) is eight cents a kilowatt-hour, making a current cost for 1,000 hours of $34.96. Adding cost of lamps, $18, makes the total cost $52.96.

Mr. Fee reports that the customer is greatly pleased with the change and allows the company to advertise the facts in the store and also in the

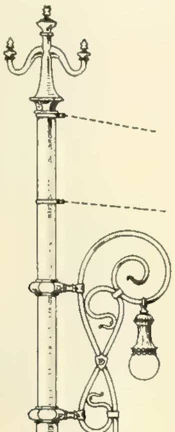
papers. Tests covering 570 hours burning under voltage five per cent above normal during two-thirds of the time show that the tungsten lamp will stand such variations and maintain its initial candlepower, so that the company has every reason to believe that these lamps will remain in service to the exclusion of gas.

Preparations for the Arrival of the Fleet at San Francisco.

The San Francisco harbor commissioners have commenced the work of decorating and illuminating the Union Ferry Depot in San Francisco for the celebration in honor of the visit of the Atlantic battleship fleet. Men are wiring the lofty tower and installing electric lamps which will show the graceful outlines of the structure on all four sides from the roof of the main building to the pinnacle. On the Market Street front will be an electric American shield about 30 feet square containing about 1,500 incandescent lights, furnished by the citizens' reception committee. The harbor commission will furnish the electric current. Vari-colored incandescent lights will be installed in the grand nave. A lavish display of flags of all kinds will be made.

New Pole Design for Denver Lighting Scheme.

The accompanying drawing shows the proposed pole to be used in the special lighting of Fifteenth Street, Denver, Colo. It is a combination trolley pole and light standard and differs from those used



COMBINATION TROLLEY AND LIGHT STANDARD FOR DENVER.

in the Sixteenth Street lighting scheme in that it is of lighter construction. The design was submitted by H. Read, a member of the art commission. A feature is the small green light placed below the large lamp.

An Optician's Ruse.

Walter Claypoole of Thornton Heath, England, writes to the London Electrican to tell of one of the "tricks of the trade" in the treatment of eye troubles. He says:

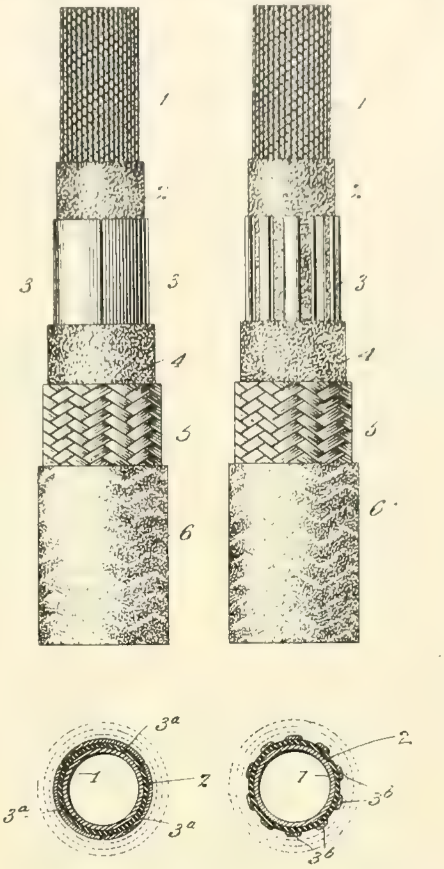
"Everyone admires the man of Napoleonic spirit who creates opportunities.

"An oculist [optician?] of Croydon, realizing that the public eyesight is not as bad as it might be, is laying ground bait in the shape of a row of Osram lamps across his window five feet above ground level. Between the center two appears the familiar invitation to step inside if you cannot read the smallest type on this card! Personally, I found it impossible to read the name of the establishment in 12-inch letters after being unwise enough to expose my retina to the glare inside.

"This man should be making money."

A New Non-metallic Flexible Conduit.

A highly desirable [illegible] in conduits for interior wiring is that they should be quite flexible to permit their being bent around corners wherever desired, but the flexibility should not be at the expense of strength. The conduit should retain its circular outline under all conditions and should be capable of withstanding considerable longitudinal strains which are applied in drawing or pulling the conduit into their position for use. In a



A NEW NON-METALLIC FLEXIBLE CONDUIT.

recently patented invention of William S. Brown of New York city, the inventor has aimed to secure all these requisites by a conduit of insulating material throughout and having in its composition no metal which might produce grounds and short-circuits and fires resulting therefrom.

The essential principle involved in this construction is based on the characteristic of independent longitudinal strips or ribs incorporated in a tubular body for imparting considerable strength to such body against longitudinal strains without substantially diminishing its quality of lateral flexibility. In Mr. Brown's invention this principle is utilized by incorporating longitudinal strips or ribs in the body or material of a flexible conduit, these strips being independent of one another so as to be capable of a slight relative longitudinal displacement where the conduit is bent or deflected at any point. This displacement is carried into the straight portions of the conduit adjacent to a sharp bend, and thus straining, buckling or distortion at the bend is avoided.

In the accompanying drawing are shown two slightly modified forms of this conduit. Below each of the longitudinal views is a partial cross-section of the respective conduit. The interior layer (1) is made of a suitable fabric woven, braided or knit into circular form. Over this is a plastic waterproof coating (2), preferably of an insulating character. The layer (3), which is the particular feature of this conduit, consists of longitudinal strips, ribs or members that form the backbone of the construction, and will be described in more detail below. Over this layer is placed another waterproof and insulating coating (4) somewhat similar to (2). Upon this is placed an outer protecting jacket (5), which is preferably coated on its surface with a waterproof composition (6).

The layer (3) may be made in different ways. As shown at the left, this layer comprises a number of entirely separate strips (3^a) of strong canvas or paper running lengthwise, or parallel with the elements of the conduit. In this way the strips together constitute a substantially complete [illegible] longitudinally, so that the required displacement [illegible] at either side of the point of flexure.

In the form shown at the right of the drawing [illegible] purpose. The rattan used may be of the sort ordinarily employed in chair seats, which is strong, smooth and flexible and at the same time insulating in character, and capable of being easily cut or sawed with ordinary tools. With this material a sharp bend may be made in the conduit at any point, such bend merely resulting in slight relative displacement of the separate strips (3^b), which is distributed to and taken up by the straight portions of the conduit adjacent to the bend.

In some cases where especial flexibility is required it is proposed to crimp or corrugate the longitudinal strips, which gives them a slight longitudinal elasticity. The essential characteristic of the material in the layer (3) is that it is fairly resilient to resist lateral flexure as distinguished from freely flexible materials such as fibrous cords or strands. The closely woven canvas (3^a), shown at the left, is so tight and stiff as to have this lateral resiliency, which is increased by the segmental form of the strips. Rattan, as shown at the right in the strips (3^b), is particularly advantageous, as it has lateral resiliency in a very high degree. It is evident that such resiliency is important at the bends of the conduit. The resilient strips, imbedded as they are between plastic layers (2) and (4), are capable of telescoping longitudinally on the inside of the bend, instead of being buckled. The result is to insure the distribution of the bend through a sufficient length of the conduit to prevent any local injury, whereas if freely flexible strips were used the conduit would be likely to bend or buckle sharply at local points and be contracted and injured.

Emergency Lights for Residences.

In the wiring up of residences it is desirable to install a number of emergency lights distributed around the house and controlled by a switch or switches in the bedrooms, so that general illumination throughout the entire house may be had at a

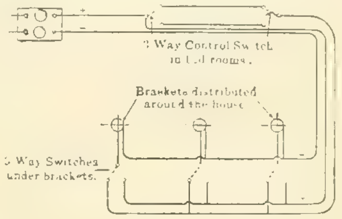


DIAGRAM FOR EMERGENCY LIGHTS FOR HOUSES.

moment's notice in case of emergency. Heretofore the chief objection to this plan was that these special lights were not available for any but emergency purposes. This is objectionable, as it looks bad to have certain lights in the room that cannot be lighted for general illumination purposes. This defect may be overcome by installing the wiring as shown on the accompanying diagram.

The idea is that emergency lights have three wires run to them. The first wire is a common negative; the second wire is positive and connected up to the emergency switch or switches in the bedroom, and the third wire also positive, but shunting around the emergency switches in the bedrooms. Each emergency light is provided with a three-way switch which acts as a throw-over switch, so that in order to use the emergency light for general illumination, current is supplied to it by means of the common neutral and the third positive wire, which is shunted around the emergency switch as described above. It is obvious that when an individual emergency light is turned off by means of the three-point switch directly under it, it is thrown on to the emergency circuit so that it can be controlled from the emergency switches in the bedrooms.—George H. Jones, in N. E. L. A. Bulletin.

The Chicago City Railway has just placed 40 new pay-enter cars on the State Street line, making a total of 265 of this type now in service on the South Side.

Metallic-filament Lamps Earnestly Discussed in Great Britain.

[From the London correspondent of the Western Electrician.]

London, April 10. Metallic-filament lamps have now been in use in Great Britain in sufficient quantities and for a long enough period for station engineers to begin to realize that their effect upon the revenue, up to the present, has been a detrimental one. Evidence of this is given in the yearly reports of quite a number of station engineers, who point to the use of these lamps as the cause of reduced revenues.

In the majority of cases these reports have been passed over in silence by the committees to which they have been presented, but striking action has been taken this week by the Beckenham Urban District Council, which has issued a notice to all wiring contractors in the district, informing them of the intention slightly to increase the price of electrical energy should the continued use of metallic-filament lamps render such a course necessary. Hence it was only in the fitness of things that the matter should become the subject of public discussion as to what effect the use of metallic-filament lamps would ultimately have upon the supply business.

Realizing the importance of the problem, the Institution of Electrical Engineers accepted a paper dealing with the point, and it was read and partly discussed at the last meeting. So many speakers wished to speak that the discussion will have to be spread over another evening, but as far as we have gone it is quite evident that the question of charging for electric supply is still a nightmare to the supply-station engineer and manager. The authors of the paper in question boldly stated that in their opinion it would be necessary, in order to maintain the present level of revenue, to increase prices for electric supply, a conclusion which at once startled a good many, especially those who are having a day-to-day tussle with vigilant gas companies.

The contention has been made, on the other hand, that whereas the advent of the incandescent gas mantle was the cause of the resuscitation of the gas industry at a time when the claims of the then new illuminant, electric light, were being forced upon the public, so will the arrival of commercial metallic-filament lamps revive the electrical industry. The authors of the paper differed from this view, for the reason that they held the advent of the gas mantle to be more or less coincident with the introduction of greatly improved and cheapened methods of gas cooking and heating and without a similar development from the electrical point of view, the effect of the new lamps upon the industry would not be the same as was the case with gas.

From this point of view the discussion immediately turned upon the question of tariffs, and the authors' suggestion was that in each case of a prospective consumer, his maximum demand should be ascertained, and this to be called the "contract demand," for which a fixed sum per kilowatt per annum should be paid, plus so much per kilowatt-hour consumed, say, two cents. This fixed sum could be varied according to the nature of the demand, and examples were given tending to show that by such an arrangement, while the general price to the consumer would not be increased, the present unprofitable consumer would have to pay more, while the profitable consumer might possibly have to pay less. An advantage, too, of this system would be that all the supply could be taken through one set of wires and one meter, whereas at present all power supply has to be through separate mains and separate meters.

As far as it has gone, the discussion upon this system has not called forth any very strong criticism, although there are signs that many people disagree with it. Mr. Arthur Wright, of maximum-demand-indicator fame, rather thought much mis- [illegible] advertising that a consumer, by using metallic-filament lamps, would get the same light for half the price. He wished to encourage users to go in for more light [illegible] for the same price. Lamp makers rather resent the view [illegible] to the industry, and more or less urge the supply- [illegible] ing in vogue throughout the country, but one of [illegible]

neer at Norwich grouped houses assessed at £20 per annum and upward to £50 per annum, and, dividing these by the number of kilowatt-hours consumed, found the average to be about seven units per one pound ($4.87) of assessment, and, curiously enough, this figure remained more or less constant no matter what the size of the house. Upon this basis he has worked out a system of charging which he says has been very satisfactory.

Judging from the list of speakers, there will be a warm discussion when it is continued after Easter.

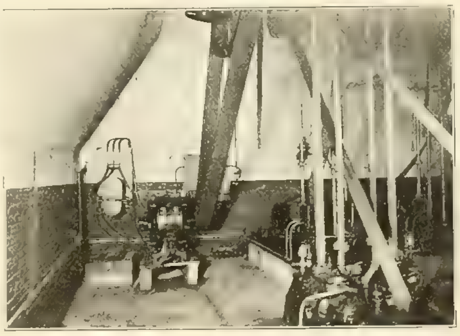
G.

How Electricity Contributes to Economy and Cleanliness in the Chicago Stockyards.

By C. A. Tupper.

Whatever may have been the conditions that inspired the writing of "The Jungle," with its plainly exaggerated account of the state of "Packingtown," there is nothing in or about the Chicago Stockyards of today and their manifold industrial plants, teeming with operatives, even faintly to suggest the repulsive scenes which the author's lively fancy pictured. On the contrary, all indoors is the product of an order, good system and cleanliness almost beyond belief, and one of the most potent factors in bringing this about has been the introduction of electric drive, with its consequent clear headroom, freer floor space, better light, ventilation and operating conditions than could ever have been possible under the old system of shafting, belting, pulleys and gears innumerable which formerly stretched in a network across each room, "cluttered up" the place and gathered dirt and waste on every exposed surface.

The extent to which motors are now utilized and their widely diversified application were shown in a recent visit of the writer to the various Chicago plants of Swift & Co. and Libby, McNeill & Libby, where machines to the capacity of about 9,000



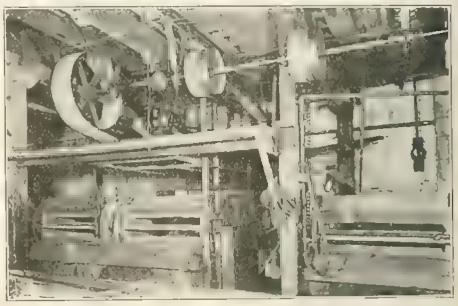
40-HORSEPOWER INDUCTION MOTOR DRIVING SIX VACUUM PUMPS IN A PLANT AT THE STOCKYARDS.

horsepower, in sizes from one horsepower up, are in daily operation.

Strange and queerly named apparatus, which the average man never heard of and probably would not understand, such as rockers, plotters, candlers, crimpers, crutches, neutralizers, etc., are driven by motors on the same current as that supplied to others turning, shaking or agitating the mixtures in machines of homely but perfectly intelligible names, as brainers, splitters, cleavers, skinners, strippers, carcass-conveyors, meat-hoists, metal sharpeners, rip-saws, horn saws, throw outs, etc., in the butcher shop; rippers, cleaners, stuffers, roller-benches, washers, salters, brine-cooler pumps, fan blowers, spice mills and mixers, sewing machines, etc., in the sausage plant; oil pumps, mixers, renovators, box churns, suet choppers, salt mills, butter-workers, etc., in the butterine factory; kettle stirrers, cutters, hashers, presses, mills, oil circulators, molding machines, box nailers, etc., in the soap factory; bone saws, pulverizers, blood presses, dryers, washers, compressors, guano crushers, screens, etc., in the fertilizer works; dryers, grinders, reels, etc., in the glue establishment; barrel-headers, hoopers, borers, washers, scourers, etc., in the cooperage plant; paddles, stirrers, etc., in the skin-curing house; cutters, shears, crimpers, etc., in the tin shop; suet choppers, fat cutters and wringers, stearine presses, lard cylinders, screws, agitators, ice crushers, etc., in the lard and stearine factory; wool breakers, dryers, dusters, combers, etc., in the wool rooms; pickers, seed grinders, oil presses, tank agitators, oil pumps, etc., in the cotton-seed-oil department; and feather fans, hair dryers, etc., in the plants where these products are prepared for market.

In addition, hydraulic presses, small pumps of every conceivable description, fans, blowers, elevators, conveyors, separators, hoists and machinery of general utility are electrically operated in all departments and throughout the yards. Then there are the numerous motor-driven tools in the boiler shops, where tanks are made for plants and cars, the woodworking and carpentry shops, machine and general repair shops, and apparatus installed in the coal sheds, power houses, refrigerating plants, ice houses, warehouses, office buildings, laundries, restaurants, and elsewhere, all run by electric power.

Illustrations of some of this apparatus, showing



15-HORSEPOWER INDUCTION MOTOR DRIVING SHAFT IN SHEEPSKIN-CURING HOUSE IN STOCKYARDS.

the induction motors supplied by Allis-Chalmers Company of Milwaukee, for operating them, are given herewith.

Of all the numerous establishments which have transformed Packingtown from a collection of slaughter-houses into one of the most varied and extensive industrial communities to be met with anywhere in the world, none is more typical of the best modern practice, both mechanically and from a sanitary standpoint, than that of the nine-story "kitchen" of Libby, McNeill & Libby, where canned corn beef, potted tongue, boneless chicken and other delicacies are prepared for shipment to all quarters of the globe.

Meat from the adjoining slaughter-house, after being cut into suitable lengths and thoroughly cleansed, is brought to this building by an elevator (or, if corned beef, lifted from the pickle-curing cellar) and transferred in buckets on trolleys, to the cooking room, which occupies the ninth floor, equal in area to a thousand household kitchens. Here may be seen at a glance the feature which is characteristic of this plant, viz., absolute cleanliness. The walls are faced with pure white enameled brick, the ceilings and floors are of concrete, the window sashes shine with polished metal, and there is not a piece of wood either in this or the other rooms to be seen.

From the cooking room, meat is sent on enameled conveyors to large white tables in the trimming room on the eighth floor, where it is put in shape for the tins. Meat representing over two hundred and fifty cattle can be trimmed here in an hour, with the aid of five meat choppers, each direct-connected to a two-horsepower motor.

The seventh floor is known as the square-canning room, where corned beef is put up. Four stuffing machines, each driven by a five-horsepower motor, and three capping benches, each taking its power from a two-horsepower motor, constitute the principal apparatus used.

On the sixth floor is the round-canning room, filled with stuffing machines and capping benches,

20-HORSEPOWER INDUCTION MOTOR BELTED TO SUET-HASHER IN BUTTERINE FACTORY AT STOCKYARDS.

driven in the same manner as those above described.

Both are supplied with vacuum pans, enabling the cans to be sealed in vacuum, and the six American air-compressor pumps installed for this

service in an adjoining room are all driven by belting from one 40-horsepower motor.

The various conveyors used in these rooms have each one one-half-horsepower motor, direct connected.

All of the motors operate on alternating current and are of the so-called "squirrel-cage" induction type. They offer especial advantages for the service, being very simple in construction and easy to keep clean. The arrangement of each with respect to the machines is plainly shown by the pictures.

The fourth and fifth floors are devoted to storage rooms, in which may be found the thousands of cans, bottles, jars, glasses, etc., in which the products of the plant are packed.

From the third floor the shipping is done. On the first and second floors are the offices, electric generating plant and refrigerating machines. Here the walls and ceilings, covered with white enamel, throw into sharp contrast the glistening black paint and highly polished steel of the machinery.

All of the stories have numerous windows, and, with the absence of overhead gear of any kind, good light and ventilation are secured, making the entire plant, with apparatus such as that above described, a veritable triumph of sanitation. What part the use of motors plays in this the reader will readily understand. All tables, trucks, instruments, etc., are in keeping with the rest of the establishment, there being nothing that will absorb moisture, and every fixed piece stands on legs high above the floor, enabling the latter to be thoroughly flushed at the close of each day.

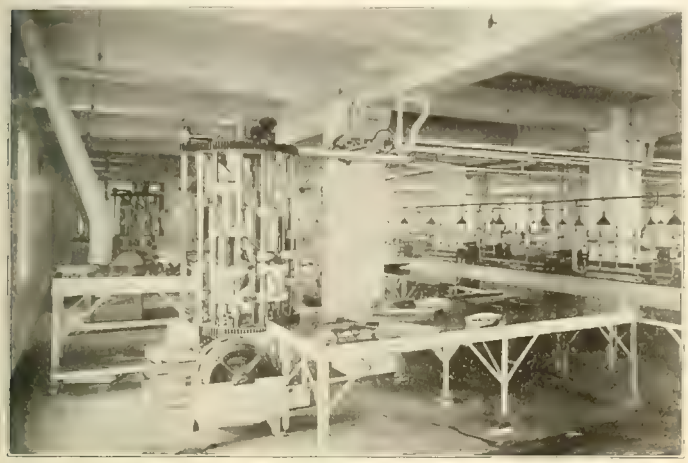
A total reaching many hundreds of millions of dollars is realized each year from the sale of packing-house products, including fresh beef, mutton, pork and veal, corned beef, tongues, ox-tails, hams, bacon, lard, poultry, eggs, butter, butterine, soaps, tallow, glues, oils, bones, fertilizers, pelts, hides, casings, wool, hair, feathers and various other by-products derived from cattle, sheep, hogs and poultry.

The industry is operated on a very narrow margin, and, as there are no secret or complicated processes not open to all, packers such as Swift & Co., Armour & Co. and Morris & Co. must depend for their very existence, as large corporate concerns, upon such advantages as location at the [illegible] manufacturing in large quantities, at the minimum of expense [illegible] highly efficient business management, including the use of the best mechanical methods and appliances. It is here that motor drive has been taking up with such notable results, particularly in the conversion of "waste" into dollars; for, were it not for the so-called "by-products," there would be, under present conditions of trade, not only no profit but an actual loss in the handling of meats from live animals.

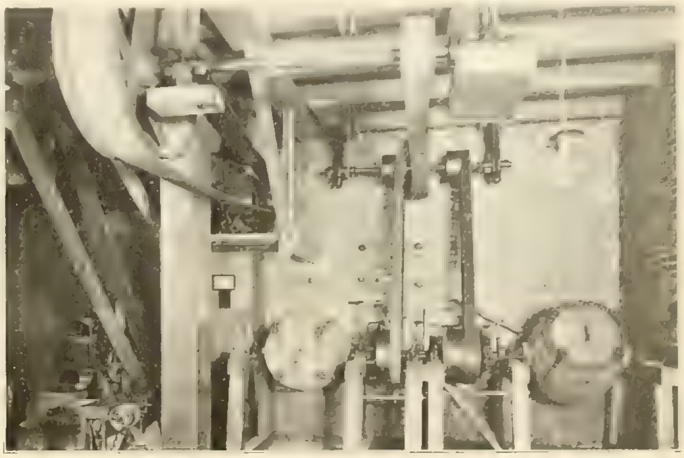
Some years ago the only materials [illegible] to which the packer gave any thought were hides and tallow. Other manufacturers in the vicinity, such as glue makers, bought certain parts of the waste; but no really effective utilization of it was made until the meat-men themselves had their attention aroused to the possibilities of this branch of the business.

First they undertook the manufacture of soap, then glue, then fertilizers. Hair, which was formerly thrown away, except for small quantities used by plasterers, is now dried and sold for many purposes. Horns and hoofs form valuable articles of commerce, being used for combs, handles, buttons and ornaments by the score, including excellent imitations of costly materials. Dried blood, ground bone, waste tissues and fibers, when made up into fertilizer mixtures, retail at many dollars the ton. Cartilage and related substances reappear as glue. The choicest of the fats, once indiscriminately classed as tallow, or at best used for lard, form the chief element in making butterine or oleomargarine, and the residue from this fat is refined into stearine, an element of chewing-gum. Other by-products are so familiar that they will readily occur to all.

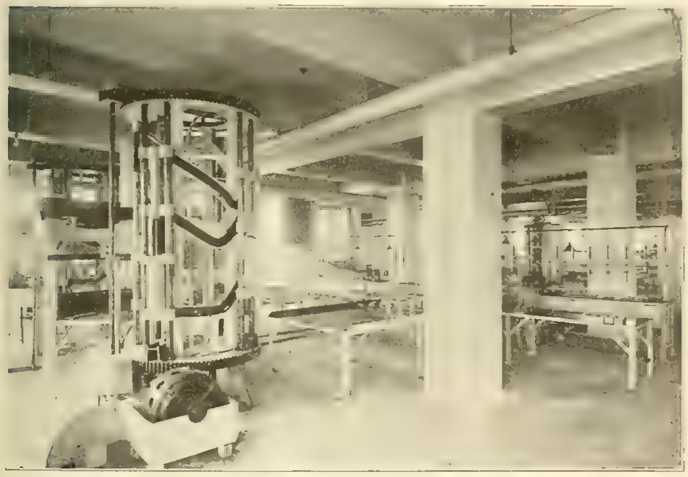
In each process through which any part of the animal passes, until its last vestige has disappeared in the fertilizer house or glue factory, a great deal of machinery is used, and most of this is capable of being electrically operated. A mere perusal of the long list of motor-driven machines mentioned in the first part of this article will show even a casual reader what the change from mechanical power transmission to motor drive means. So far as economy is concerned, there can be no question [illegible]



Stuffing Machine Direct-driven by Motor



15-horsepower Motor Operating Spice Mill and Churn Mixer in S[illegible] Factory



Another View of Electrically Driven Stuffing Machine.

Two-horsepower Motor Coupled to Meat Choppers.

INDUCTION MOTORS IN USE IN VARIOUS PLANTS IN THE UNION STOCKYARDS, CHICAGO.

Electric Railroading in Illinois.

[illegible] each morning and continue until 8 in the evening. [illegible] sleeper that leaves before midnight. On May 3d a new limited service will be installed between Peoria and Springfield, limited cars leaving Springfield and Peoria at 6 o'clock in the morning and running at four-hour intervals during the day till 6 in the evening. The time will be three hours between the cities. This service will connect at Mackinaw with the electric limited on the Peoria-Bloomington line, making through connection for Bloomington.

The New York Central lines which run into Peoria have announced a reduction in fare between Peoria and Bloomington to compete with the Illinois Traction System. A rate of $1.25 for the round trip will be made and these tickets will be honored for one person in both directions or two persons in the one direction.

Largest Steam Turbine Built in Europe.

The firm of Franco Tosi, Legnano, Italy, is reported as having just completed a 12,000-horsepower turbine, supposed to be the largest hitherto built in Europe. The turbine is of the Parsons type, and designed to run at 750 revolutions per minute. It will be direct coupled to a Brown & Boveri alternator, generating three-phase current at 25 cycles, 12,000 volts. It forms the first of an order of three units, each of 12,000 horsepower, passed by the Deutsche Ueberseeische Elektricitäts-Gesellschaft of Berlin. The remaining two groups will be delivered during the present year. The three units are destined for a generating station which the above-named company is putting down at Buenos Ayres, in addition to its other electric plants there and at Santiago, which already comprise a Tosi reciprocating engine of 20,000 horsepower and three Tosi turbines aggregating 18,000 horsepower.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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demonstrations. Exhibitions of this character have been held in large stores in Chicago, St. Louis, Milwaukee and other cities, and no doubt they do a great deal of good by bringing the electric household utensils directly to the attention of housewives who would not be so apt to see them at the more pretentious electrical shows.

APROPOS of the movement in Massachusetts to raise the price of street-railway transportation where the long-existent five-cent rate has not proved remunerative, a recent decision of a quasi-judicial body in that state is interesting and important. The six-cent fare issue raised by remonstrants against the increase put into effect a short time ago on the Blue Hill street railway near Boston has been determined in favor of the company, and the new rate will stand. The Railroad Commission of the state decides that there is nothing inherently sacred in a five-cent fare, but that a road which is not on a paying basis with such a fare may legitimately raise its schedule.

VOTES FOR WOMEN!" is the rallying cry of the ladies militant in England who are struggling toward the goal of suffrage. Patterned after it, why not raise another note intended to call attention to the need of lifting the burden on the physical strength of women? This cry may well be "Motors for women!"—motors to run the sewing machines, the carpet sweepers, the laundry apparatus of the home; motors to operate the dishwashing, scrubbing and window-cleaning machines of the brighter future, when household drudgery shall be a thing of the past, and motors to drive all the machinery in every factory where women are employed.

"Motors for women!" The slogan has an inspiring sound. Let the electrical manufacturers, the new-business champions, enlist the women of America under their banner. The phrase is not copyrighted. We offer it freely. May the welkin ring with it!

INSPECTIONS of electrical construction work by engineers employed by the National Board of Fire Underwriters often result in reports which are instructive to the electrical fraternity. Such an inspection was made last July in St. Paul, Minn., and 37 new and 40 old installations, said to be representative, were examined to ascertain the quality of the supervision maintained and the general condition of old wiring. In the new work inspected a total of 87 defects was noted, an average of about three per equipment, due to the misuse of approved materials or poor workmanship. Among the more common defects were: Connections from underground service improperly arranged; unapproved work at meter; ordinary flexible cord, used for extensions, too long and not knotted in sockets. In the old work inspected 320 defects were noted, an average of eight per equipment, showing the need for systematic reinspection. In addition to the defects noted under new work, the following were frequently found: Fuses too large for circuit; cut-out cabinets not standard; joints not properly soldered and taped; wires not properly bushed through walls, floors, etc.; wires not properly supported in open work; wires not protected from mechanical injury and not properly installed in elevator shaft; rheostats not properly mounted or not automatic; unapproved rosettes and sockets. Other defects were noted, but each one only a small number of times. The defects noted were due partly to the use of material not now approved and partly to poor workmanship and natural deterioration of electrical work.

It is reported that the municipal inspection department is well organized and is in charge of a capable man. Authority over outside work is divided. The laws are based on the National Electrical Code, and very good results are obtained on new work. The old work inspected was found defective and showed the need for thorough reinspection. Outside work is not inspected systematically. However, in the business district, outside wires are mainly underground. While trouble has resulted from electrolysis in the past, the situation is well known, and steps are being taken to improve conditions. It is recommended that the municipal inspection force be increased and be held solely responsible for the supervision of outside as well as inside work; that a complete reinspection of old wiring be made and defects corrected; that all wiring be subsequently reinspected at suitable intervals, and that systematic tests be made for electrolysis, and dangerous conditions eliminated.

St. Paul is perhaps a fairly typical American city of its size, so far as the electrical survey is considered; and it is of some importance to see its electrical points of excellence and shortcomings as they appear to the underwriters' inspectors' eyes. In general, the fire-insurance engineers are reasonable in apportioning praise and blame, and their admonitions should be given attention, not only in St. Paul but elsewhere.

THE METALLIC-FILAMENT lamp has come to stay; there seems to be no reasonable doubt of that fact. That being the case, the question arises, What should be the attitude of the central station toward it? In this country, we believe, the general attitude is one of friendly but perhaps watchful interest. We print in this issue a brief account of a specific instance of the replacing of gas "arcs" (to employ the misnomer of the gas trade, which is an admission of the brilliancy of the real arc) by tungsten lamps in a drug store in Adrian, Mich., with a resulting saving in the cost of lighting the store by a better and more attractive illuminant.

But in England the central-station managers appear to look upon the new lamps with anxiety and doubt. They seem to think that their bills for current will be very materially reduced, owing to the fact that the new lamps give perhaps twice as much light for a given current consumption. Apparently they overlook the fact that electric light will be used plentifully where before it was used niggardly; that it will be introduced in many places where it was never used before, and that it may be expected to supersede gas lighting to a greater extent than ever before. They are of little faith; they talk of raising rates, whereas the American seller of electricity seeks to turn this new development to his advantage by "hustling" out after new business which he had only remote hope of securing before. Then, too, if electric light is more popular in the home, the shop and the factory, a greater use of current for motors, heating devices and many industrial and household purposes will surely follow.

Perhaps the temperamental attitude of the two peoples has something to do with the manner in which this emergency is approached. The Englishman is more attached to old customs; he is a sturdy, positive, tenacious personage, slow to adopt innovations, good or bad, but not slow to speak out his mind about them while he is deliberately examining the change from all points of view; he is something of a grumbler and a "kicker," and he takes a good deal of pride in the fact—as well he may, in some points of view, for thunder-storms keep the air sweet. On the other hand, the American, with possibly more alert although scarcely more profound intelligence, takes up new things readily if they commend themselves to his judgment. He has a practical mind and can decide quickly if need be. He does not cling to the past with vain regrets; he is very self-confident and quickly drops an old method or an old tool when he finds another better adapted to his purpose. This trait stands him in good stead when an important change is rather unexpectedly forced upon him, as is the case, perhaps, with the metallic-filament incandescent lamp.

But whatever the cause of the difference in attitude between English and American electrical men toward the new lamps, it seems to exist. We may think, perhaps, that they seem to give up the battle in advance; that they do not get out and "hustle" to meet the new conditions. They may be of opinion that we are superficial; that we have not studied the question thoroughly and that our experience is limited; that, paraphrasing an old adage, Americans rush in where Englishmen fear to tread. At any rate, their views and experience are valuable to us, whether ours are to them or not; and as that is the fact, we are sure that the brief article by the London correspondent of the Western Electrician, published elsewhere in this issue under the heading "Metallic-filament Lamps Earnestly Discussed in Great Britain," will be read with attention.

Lighting a Shoe Store A Practical Illumination Problem.

At the meeting of the New England Section of the Illuminating Engineering Society, held on April 14th in the Edison Building in Boston, there was an interesting presentation of papers on the practical subject of lighting a shoe store of given dimensions, as delineated in the accompanying plan. About 30 members were present, and Chairman L. S. Codman presided.

The first paper was by A. L. Holbrook, who is connected with the Nernst Lamp Company. The essential points were as follows:

The lighting of a shoe store is a science of itself. The goods shown must receive their best illumination on the feet of the customer in the trying-on stage, on the floor or on the foot-rest raised about one foot from the floor.

For this purpose an installation of six two-glower Nernst lamps hung from the ceiling is suggested. The glowers are thus brought 12 inches from the ceiling and 10 feet from the floor. The cashier's space and bootblack stand should be specially lighted by two drop lights, and the window specially lighted by three 110-watt lamps.

Figuring illumination, we take the angles from the point where light from the glowers meets a 10-inch perpendicular line reaching from the floor toward the ceiling. The spacing is six feet from wall to lamp and 12 feet from lamp to lamp across the width of the room, and seven feet from front wall to lamp and 14 feet from lamp to lamp down the length of the room, making two rows of three lamps each.

Mirror-lined reflectors at the front of the window enclosure project the light from the front into the window and against the display goods, thereby eliminating shadows between the goods and the observer. The windows will thus have a light intensity of 10 watts per square foot of floor space and a value of 9.2 candle-feet at all points.

The store proper will be very evenly lighted. A cross-section across the width would show 2.5 candle-feet directly underneath the lamps, 1.89 between the two lamps, 1.12 at the corners, 1.09 three feet from the floor, 0.876 at a point six feet from the floor and 0.78 nine feet from the floor.

H. M. Daggett, Jr., with the Welsbach company, presented the second paper, outlining a modern gas-lighting installation. In brief he said:

The problem divides itself into two parts—outdoor and indoor lighting. Sidewalk lighting is not a good plan for window illumination. It takes more light than would otherwise be necessary. The greater the contrast between the interior of the window and the sidewalk the better lighted will the window appear.

I would recommend a sealed window space with a false ceiling. Directly over the glass in each window place seven reflex inverted lights. The mean spherical candlepower of each unit is taken as 54. Allowing 3 per cent. for the absorption of the ground glass leaves an average of about 12 net spherical candlepower per square foot of floor space. Double-pipe the window so all or part of the lights can be used.

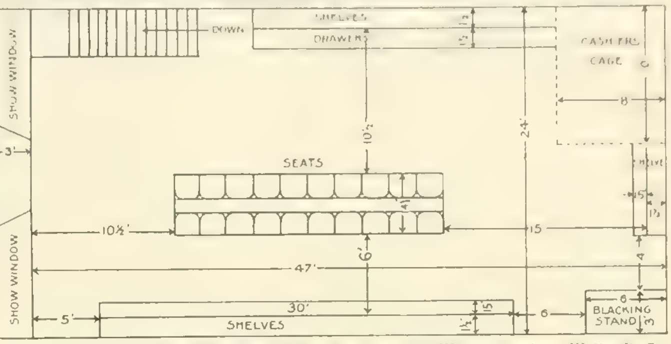
The candlepower curve of the reflex light with No. 6333 Holophane reflector has a maximum candlepower in the vertical direction of 314, and 307 at 10 degrees from vertical, 250 at 20 degrees and 116 at 30 degrees. Covering an angle of 40 degrees directly under the lamp there are concentrated more than 250 candlepower.

The store proper may be divided into general and special lighting. I would suggest general lighting, the store being all open and free from need of special lights, except for the bootblack stand and the cashier's desk and the stairway to the basement. Use a two-light chandelier for the cashier's space. For the store three-light chandeliers are recommended. The fixtures should be 24 inches over all, placing the lights nine feet from the floor or eight feet above the shoe-fitting stool. The amount of light is computed on this plane one foot from the floor. Light clusters approximately 12 feet apart give a fair illumination in eight rectangles, 10½ feet wide, one-half the distance between shelves on either side and 11½ feet long, one-fourth the length of the room [illegible]

[illegible]

foot-candles of well-diffused light for general illumination [illegible]

The third paper was submitted by Harry V. Allen, with the General Electric Company, and considered the lighting of the store with the tungsten lighting system as follows:



Height of Ceiling, 11 Feet. Height of Ceiling from Floor of Window 9 feet. Walls, Buff Color; Woodwork, Natural Finish.

PRACTICAL PROBLEM IN SHOE-STORE LIGHTING.

General Illumination.—Four tungsten "Economy diffusing clusters," each equipped with three 60-watt and three 100-watt clear bulb tungsten lamps hung 10 feet from the floor, outlets to be arranged in middle line of store, equally spaced 12 feet 9 inches apart.

Cashier's Desk.—One 60-watt tip-frosted tungsten lamp with Holophane bowl reflector frosted on the inside.

Windows.—Two 100-watt lamps tip-frosted, with reflector same as above, front of glass opaqued from the top far enough down to prevent lamps coming in direct line of sight.

Purpose.—Give appearance of height by having lamps near ceiling; smallest number of light units consistent with uniform illumination; not fatiguing to the eye; circuits so arranged that three steps of illumination can be obtained without sacrifice of uniformity; temperature kept within safe limits.

Remarks.—The intermediate point, using 300 watts per fixture, or 1.06 watts per square foot, recommended for working conditions; the 180-watt auxiliary to supplement daylight; the 480-watt to be used on special occasions when high intensity is desired.

The discussion which followed, about a dozen participating, raised the question on the number of units as to whether best results would not be obtained by the distribution of small lighting units about the room. It appeared to be the general opinion that several comparatively small units would serve the purpose better than a few large units.

Central-station Statistics for New York.

In a recent London lecture on "America Revisited, 1907," Sir W. H. Preece presented the following table to show the extent and character of the business of the New York Edison Company. The figures are as of April, 1907:

	Customers.	Meters.	Glow Lamps.	Arc Lamps.	Heating Appliances.	Storage Batteries.	H. P. Motors.	16 C. P. Equivalents.
					kw.	kw.		
*Manhattan	54,185	68,035	2,535,268	33,602	739	4,296	144,750	4,931,529
*Bronx	2,352	3,254	121,195	1,898	51	15	2,452	168,549
Yonkers	1,311	1,461	35,786	456	5	1	550	50,072
*Brush	88	....	2,242	314	....	....	10	5,091
Totals	57,936	72,750	2,694,491	36,270	795	4,312	147,762	5,155,241

* City of New York.

In this table Brooklyn, with its separate company, is not included. Sir William gives these figures for London: Plant installed 195,252 kilowatts; maximum load, 123,249 kilowatts; eight-candlepower lamps connected, 8,282,235; units sold, 178,243,282.

The New York Edison Company, says the lecturer, distributes energy on the three-wire, continuous-current system at 240 and 120 volts. It has four generating stations—Duane Street, East Twelfth Street, West Twenty-sixth Street, One-hundred-and-fortieth Street, Bronx, supplying direct to their immediate neighborhoods, and one great modern Waterside station generating high-pressure three-phase alternating current at 6,600 volts transformed down to 240-120-volt continuous [illegible]

[illegible] turbo-generators, the present favorite unit."

Health Commissioner Demands Railroad Terminal Electrification.

The electrification of all railroad terminals in the city limits of Chicago as next in importance to the Drainage Canal in solving the health problem of Chicago was urged by Health Commissioner W. A. Evans in an address before the Traffic Club on April 16th. Consumption and pneumonia, caused by air made impure largely by railroads and steamboats, were declared to be responsible for 10,000 deaths in Chicago in the last year.

"The Drainage Canal has done much for Chicago," said Dr. Evans, as reported. "If the railroads will do their part the benefit to health, wealth and population will be incalculable. Railroad and electrical engineers have demonstrated by experiments that electrification of terminals will reduce the cost of operating trains in the city fully 25 per cent. The time has come when Chicago reasonably may ask that the great transportation companies assist in purifying the atmosphere.

"Our atmosphere is befouled with gaseous smoke that causes consumption and pneumonia. Smoke breeds bad air, and a foul atmosphere cannot produce anything but disease. The death rate from tuberculosis and pneumonia is increasing annually. Last year the death toll from these diseases was 10,000, an increase of 900 over 1906. The increase of 1906 over 1905 was nearly as great. The time has come when we must do something, and do it decisively. The Traffic Club can do much to remedy conditions, and I believe its help will not be withheld."

Municipal Plant in New London, Wis.

What appears to be a favorable report for the year ending March 31, 1908, has been submitted by the municipal electric light and water works of New London, Wis. The income of the electric plant from sales of current was $8,489.85; sales of wiring supplies and miscellaneous sources brought the total income up to $9,912.96. The expenses, including insurance, interest, repairs, fuel, labor, etc., amounted to $7,484.34, leaving an apparent net profit of $2,428.62. The waterworks had a total income of $3,042.25 and total expenses of $3,071.93, leaving a net loss of $29.68. The net profit of the combined plants was $2,398.94.

Nothing is allowed for depreciation, nor is it made clear whether the surplus is set aside as a sinking fund for the retirement of the $45,000 bonds outstanding against the plants. The city is supplied with 51 street lights at $60 per year; the commercial rate to private consumers is 9 cents per kilowatt-hour, with a minimum bill of 75 cents per month. The combined plants are controlled by a commission of five citizens. H. C. Sterling is superintendent.

Unusual Plan for Fixing Rates.

The City Council of East Moline, Ill., has entered into a 25-year contract with the United Light and Power Company for lighting the streets and driving the waterworks machinery. At the end of the first five years the rates are to be readjusted. If an agreement on rates cannot be reached at that time, each party is to name three towns in Illinois or Iowa of equal size to East Moline, and the average rate of the six for similar service will be the rate fixed.

The Chicago Convention.

Those who attend the Chicago convention of the National Electric Light Association at the Auditorium, Tuesday, May 19th to Friday, May 22d, will find an unusual opportunity for a free interchange of ideas with the most experienced and most expert men in the electric-light and power business. Every branch, whether financial, executive, managerial, engineering, operating, commercial accounting, manufacturing or selling, will be represented by men successful in the business. It is expected that this will be a businesslike convention, and the tentative programme which has been arranged shows that there will be plenty, but not too much, work. In order to provide relaxation the entertainment committee is preparing ample amusement, and as a large number of ladies is expected, special provision is being made for them.

Following is the tentatively arranged programme, which is subject to slight modifications. The present administration is not in favor of separate organizations and should there not be time to discuss fully the subjects taken up, there will be parallel sessions for Accounting and possibly for a portion of the commercial programme.

MONDAY EVENING.

Reception in new banquet room. Opening of the exhibition.

TUESDAY MORNING, 10 A. M.

President's address.
Report of committee on progress, T. C. Martin.
"Distribution in Suburban Districts," G. H. Lukes.
"Tape," Paul Lupke.
Report of committee on grounding secondaries, W. H. Blood, Jr., chairman.

TUESDAY AFTERNOON, 2:30 P. M.

"Series Incandescent Lighting with Tungsten Lamps," P. D. Wagoner.
"Power-load Development for Central Stations of Moderate Size," "Some Unappreciated Possibilities," J. R. Bibbins and Charles Robbins.
"The Small Station and Its Economical Operation," J. T. Whittlesey and Paul Spencer.
Question Box, A. J. Campbell, editor.
Report of committee on uniform accounting, H. M. Edwards, chairman.

WEDNESDAY MORNING, 10 A. M.

"Low-pressure Steam Turbines," J. W. Kirkland.
Report of committee on meters, L. A. Ferguson, chairman.
Report of committee on gas engines, W. C. L. Eglin, chairman.
"Receiving Stations Operated from High-tension Lines," S. O. Hayes.
"Observations on the Precision of Different Types of Photometer," A. E. Kennelly and S. E. Whiting.
Parallel Session—Accountants, sixth floor banquet hall.

WEDNESDAY EVENING, 8 P. M.

Executive session.
Report of secretary and treasurer and executive committee.
Report of insurance expert, W. H. Blood, Jr.
Report of committee on public policy, Arthur Williams, chairman.
Report of committee on organization possibilities, Henry L. Doherty, chairman.
"The Status and Commercial Possibilities of High-efficiency Lamps," W. W. Freeman.
Report of committee on rates and costs, R. S. Hale, chairman.
Election of nominating committee.

THURSDAY MORNING, 10 A. M.

Commercial Day—C. W. Lee, chairman programme committee; Henry L. Doherty, special chairman.

THURSDAY AFTERNOON, 2:30 P. M.

Report of committee on solicitors' handbook prize award, J. F. Gilchrist, chairman.
Report of committee on co-operative electrical development, W. W. Freeman, chairman.

FRIDAY MORNING, 10 A. M.

"Illuminating Engineering," W. D'A. Ryan.
Report of committee on protection from lightning and [illegible] disturbances, Robert S. Stewart.
"The Value of Care and Maintenance of Meters," H. D. [illegible]
"Some Experiments in Combustion," S. J. Lenher.
"Specifications for Construction on Joint Poles," Paul [illegible]
[illegible] session.—Election of officers. Adjournment.

The secretary of the exhibition committee announces that this year's exhibition of the Class D members promises to be the most successful ever held in connection with the conventions. Nearly [illegible] space has been taken and all lines are represented. The Western Electrician and the other electrical journals will have booths on the [illegible]

[illegible] in the fixed illumination of the exhibition hall, in view of the general interest now being taken in the introduction and [illegible] lamps. Through [illegible] Lamp A[illegible] lighted with [illegible] lamps [illegible] to produce [illegible]

this line the committee on public policy is formulating a report for the convention and will present something of interest to the engineers, commercial men, managers, executive officers and directors.

Hotel reservations can be made by addressing Homer E. Niesz, 139 Adams Street, Chicago. Those who register by mail in advance can go to the secretary's office on the parlor floor and find badges bearing their name awaiting them.

General Meeting of American Electrochemical Society.

Secretary Joseph W. Richards of South Bethlehem, Pa., announces the thirteenth general meeting of the American Electrochemical Society, to be held on April 30th and May 1st and 2d, with headquarters at the Hotel Ten Eyck, Albany, N. Y. Prof. C. F. Burgess, University of Wisconsin, Madison, Wis., is president of the society, and W. R. Whitney of the General Electric Company, Schenectady, N. Y., is chairman of the local committee. Following is the programme:

THURSDAY MORNING, APRIL 30TH.

Place—Hotel Ten Eyck, Albany.
9:30 a. m.—Meeting of board of directors in parlor of hotel.
10:30 a. m.—Session for the reading and discussion of papers in ball-room of hotel.
"Construction and Accurate Measurement of Resistances of the Order of 10,000 Megohms," H. L. Bronson.
"Absorption of Radioactive Emanations by Cocoanut Charcoal," R. W. Boyle.
"Industrial Applications of Aluminum," E. Blough.
"Nature of Surface Film Formed on Aluminum and Magnesium, and the Aluminum-magnesium Cell," H. T. Barnes and G. W. Shearer.
"Mercury Cathodes in Nitric Acid Solution," J. A. Wilkinson.
"Copper Anodes in Chloride Solutions," Paul Dushman.
"Solubility Determinations in Aqueous Alcoholic Solutions," A. Seidell.
"Potential of the Nickel Electrode," E. P. Schoch.

THURSDAY AFTERNOON.

Same place.
2 p. m.—Annual business meeting of the society.
Address of retiring president: subject, "The Corrosion of Iron from the Electrochemical Standpoint," C. F. Burgess. (Open for discussion.)
"Electrochemical Corrosion of the Rochester Steel Conduit," Richard H. Gaines.
"Alloying of Iron and Calcium," A. Hirsch and J. Ashton.
"Preparation of Calcium Alloys for Aluminothermic Work," O. P. Watts and J. M. Breckenridge.
"Distillation of Turpentine by Electricity," F. T. Snyder.
"Waterpower in the Adirondacks and Forest Preservation," E. R. Taylor.
"Power for Electrochemical Industries," J. Meyer.

THURSDAY EVENING.

Same place.
Lecture on "The Electrochemistry of Light," W. D. Bancroft. (Open for discussion. Dr. Bancroft has worked out a new application of electrochemical theory to the problem of understanding the action of light.)
After the discussion, informal gathering in the cafe of the hotel.

FRIDAY MORNING.

Place—Lecture hall of Union University, Schenectady.
"Kinetic Molecular Energy," a lecture by C. P. Steinmetz.
"Heat of Vaporization of Metals and Other Substances," Jos. W. Richards.
"Robert Hare's Electric Furnace," C. A. Doremus.
"Electrochemical Patents," A. B. Marvin, Jr.
"Electrical Testing of Iron During Annealing," E. E. F. Creighton.
"Synthesis of Hydrocyanic Acid in the Electric Furnace," R. S. Hutton.

FRIDAY AFTERNOON.

1:15 p. m.—Lunch in the restaurant (building No. 80) of the General Electric Company's works. The society will be the guests of the company.
2 p. m.—Inspection of the General Electric Company's works. The party will be divided into groups, which will be conducted by members of the staff of the company.
5:45 p. m.—Leave Union Station, Schenectady, by train for Albany.
7:30 p. m.—Informal dinner at the Hotel Ten Eyck.

SATURDAY MORNING.

Place—Lecture room of the Rensselaer Polytechnic Institute, Troy.
"Conduction in Electrolytes," L. Kahlenberg.
"Passage of Direct Current Through Electrolytes without the Use of Electrodes," Carl Hering.
"Reversed Electrolysis," J. W. Turrentine.
"Conversion of Iron Pyrites into a Magnetic Form," O. L. Kowalke.
"Electrolytic Refining of Iron," E. F. Kern.
"Electrolytic Corrosion of Aluminum Bronze," W. S. Rowland.
"Electrolytic Corrosion of the Bronzes," A. T. Lincoln.
"Manufacture of Dry Cells," C. F. Burgess.

SATURDAY AFTERNOON.

1 p. m.—Lunch at the Rensselaer Inn.
2 p. m.—Visit to points of interest in Troy, including Watervliet Arsenal.

Ruhmer and Poulsen Wireless Systems.

The Appellate Division of the German Patent Office has handed down an interesting decision affecting the future development of radio-telegraphy and radio-telephony. The decision has reference to the arc-interrupter patent of the well-known Berlin inventor, Ernst Ruhmer, which materially affects the Poulsen system for the propagation of continuous electrical waves. The Amalgamated Radio-Telegraph Company, which is developing the Poulsen system, admits, it is said, that several Poulsen stations are working under the Ruhmer patent. The German Poulsen patent relating to electrical radio-telegraphy and telephony and the German Ruhmer patent relating to the electrical arc interrupter have within a few days become the property of the C. Lorenz Actien Gesellschaft, Berlin, which will develop the patents in Germany. This amicable arrangement will prevent the contest between the two inventors, which was feared.

Prismatic Globes and Reflectors in the Distribution of Light.

The first regular April meeting of the Armour Institute Branch of the American Institute of Electrical Engineers was held on April 3d, with a large attendance. Mr. C. A. Howe, western manager of the Holophane Company, spoke on "Prismatic Globes and Reflectors in the Distribution of Light."

The idea of prismatic reflectors was first conceived by two professors of Berlin, Blondel and Psaroudaki. They patented what is known as the Holophane system and began to manufacture in Belgium and England. Their first products, while of high economic value, were expensive and given to cracking. The patents in this country were bought up by the Holophane Company, and after some experimenting, a globe was put on the market which surpassed the best results of the foreign makers. Soon the company began to export to France and England.

Holophane glass is a very high grade of glass, holding its luster and brilliancy. The shapes are made by pressing the glass into steel molds. A globe is made up of vertical and horizontal prisms. The vertical prisms reflect the light so that it is diffused over the entire surface of the globe. The horizontal prisms refract the light downward onto the plane of illumination. Mr. Howe demonstrated this by two globes, one having only vertical prisms and the other only horizontal prisms. These two, when combined, make a Holophane globe.

The distribution of the light over the surface decreases the intensity, making the light easier on the eyes when it is in the field of vision. This is apt to lead one to think the amount of light has been decreased, which is not the case.

A very interesting demonstration which clearly showed the concentrating power of Holophane reflectors was the comparison of the illumination from a two-candlepower sign lamp fitted with a three-stage show-window reflector with the illumination produced from the end-on candlepower of a 16-candlepower lamp without a reflector. The illumination from the two-candlepower lamp was so concentrated on a 24 by 18-inch card about 5½ feet distant that it equaled that from the 16-candlepower lamp. This demonstrates clearly that when illumination is desired in one direction it is much more economical to use a small unit with a strong reflector. In the case referred to, the 16-candlepower lamp gives much better general illumination, of course.

Comparisons with reflectors in common use were made to show the saving possible with Holophane ware. It was also demonstrated that artistic effects are possible without a sacrifice of illumination. An interesting discussion followed the lecture, in which Mr. Howe talked on many practical lighting problems.

Programme for the Nebraska Convention.

The meeting of the Nebraska Electrical Association at Omaha, May 6th and 7th, will be the first annual convention of this association. A good programme has been prepared, a feature of which will be the Question Box. Twenty-five pertinent questions have been prepared by the committee, and each one was submitted to a different member, who is to give an answer at the convention. The questions and their answers will then be discussed.

Following are the papers to be read and discussed at the meeting:

"Duties of the Electrical Inspector," by Waldemar Michaelsen, city electrician, Omaha; "Electric Law," by Hon. W. R. Patrick, South Omaha; "Electric Rates," by Homer Honeywell, Lincoln Gas and Electric Light Company; discussion by I. B. Zimman, Omaha Electric Light and Power Company; "The Motor Problem from the Standpoint of Small Central Stations," by V. W. Bergenthal, Wagner Electric Manufacturing Company, St. Louis; "How to Meet Gas and Gasoline Competition in Stores," by J. R. Cravath, Chicago.

Mr. T. H. Fritts of Grand Island, Neb., is president of the association, and Mr. William Bradford of Lincoln is secretary. The meetings will be held in the Omaha Auditorium at the invitation of the management of the Omaha electrical show. The Millard Hotel will be the headquarters of the association. Rates at this hotel are $2 a day, American plan.

San Francisco Electrical Show.

The San Francisco electrical show, scheduled for the week of May 11th, will not be held as planned. In deference to eastern exhibitors, who found the time in which to prepare for a suitable exhibit too short, the directors decided to postpone the event. Plans are now under way for a much larger exhibition to be held in October.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker.

Part IV.

Formulas and Test Constants.

For testing direct-current meters the electrical instruments required are an ammeter, or its equivalent, and a voltmeter. For testing alternating-current meters a wattmeter is preferable. An ammeter equipment consisting of a shunt of suitable carrying capacity and a milli-voltmeter calibrated in amperes is to be preferred to a self-contained ammeter. A reliable stop watch for timing the meter and a slide rule to save time in making computations from the instrument readings complete the equipment of instruments.

In testing a meter it is customary, for the sake of obtaining precise data of the meter's performance in a minimum time, to disregard the register altogether, and count the revolutions made by the disk in a short time, such as a single minute. This may be done accurately by counting the transits of a spot painted on the edge of the disk.

The correct registration of watts by a meter is obtained by multiplying the number of revolutions, R, that the disk makes in a given time, by the watts required to turn the disk through one revolution. That is:

$$\text{Watts registered} = R \times \text{watts per rev.} \qquad (1)$$

But as the watt-hour and not the watt is the commercial unit, we must transform (1) accordingly, by dividing both sides by 3,600, the number of seconds in an hour:

$$\frac{\text{Watts registered}}{3{,}600}, \text{ i. e., watt hours registered} =$$

$$\frac{R \times \text{watts per rev.}}{3{,}600}, \text{ i. e., } R \times \text{watt-hours per rev.} \qquad (2)$$

The number of watt-hours per revolution differs according to the make of meter. It is called the "disk constant" of the meter and is usually denoted by the letter K. Hence (2) becomes:

$$\text{Watt-hours registered} = KR. \qquad (3)$$

Or, in words, watt-hours registered in any given time is obtained by multiplying the number of revolutions in that time by the disk constant.

In the commercial operation of a direct-reading meter, the multiplying of the revolutions of the disk by the "disk constant" K is mechanically effected by the gears that connect the shaft with the register. This constant is often termed the "test constant" or "testing constant," the "calibrating constant," or simply the "constant," in discussing meter testing. It is generally marked on the meter disk or terminal board, and should not be confused with the "dial constant" which is used in some makes of meter and marked on the register as a factor to multiply the dial reading to obtain the true registration in watt-hours.

In checking the accuracy of the meter, the correct watts, observed on the indicating instruments referred to above, are often called the "instrument watts." It is necessary to reduce the observations on the meter under test—the number of revolutions, R, made in T seconds—to watts instead of watt-hours, so that the result (known as the "meter watts") may be compared directly with the instrument watts. The watt-hours registered in any given time obviously equals the wattage through the meter multiplied by the time in hours (or fractions of an hour). If the time is T seconds, we have:

$$\text{Watt-hours registered} = \text{meter watts} \times \frac{T}{3{,}600};$$

substituting in (3) we obtain:

$$\frac{\text{Meter watts} \times T}{3{,}600} = KR, \text{ or}$$

$$\text{Meter watts} = \frac{3{,}600\ KR}{T}. \qquad (4)$$

Having obtained the meter watts in this way, the accuracy of the meter is readily determined by dividing the meter watts by the instrument watts; and the result may be expressed in per cent. by multiplying the quotient by 100, thus:

$$\text{Per cent. accuracy} = 100 \times \frac{\text{meter watts}}{\text{instrument watts}}. \qquad (5)$$

Equations (4) and (5) are of fundamental importance in the use of the indicating instrument and stop-watch method. They are the bases of a number of special formulas given in the bulletins and instruction books of several meter manufacturers.

Note.—This serial article, begun in the Western Electrician of April 4, 1908, is an advance publication of a portion of a forthcoming book by Mr. Baker on the general subject of "Electric Meters." It will be understood that the present serial refers to watt-hour meters used on customers' premises.

Following [illegible] equation (4) and (5). A [illegible] ter having a [illegible] on a given load of 600 watts [illegible] tiplying together the indications of a standard ammeter and voltmeter [illegible] in 60 seconds. Substituting in (4):

$$\text{Meter watts} = \frac{3{,}600 \times [illegible] \times 10}{60} = 570.$$

Substituting this result in (5):

$$\text{Per cent. accuracy} = 100 \times \frac{570}{600} = 95,$$

showing that the meter is 5 per cent. slow.

Equation (4) may be written also in the three other ways following, to obtain, respectively, the revolutions that the meter will make on a given load in a given time (6); the time in seconds that the meter will take to make the given number of revolutions in recording the load (7); and the test constant of the meter that will make the given number of revolutions on the load in a given time (8):

$$R = \frac{\text{meter watts} \times T}{3{,}600\ K} \qquad (6)$$

$$T = \frac{3{,}600\ K\ R}{\text{meter watts}} \qquad (7)$$

$$K = \frac{\text{meter watts}\ T}{3{,}600\ R} \qquad (8)$$

Form (7) is useful in making adjustments in a meter, by rendering it unnecessary to figure out each reading, thereby saving time in the calibration, provided the wattage is steady. The procedure is to keep taking watch readings while making adjustments of the meter, until the desired "seconds" is obtained.

A method that is sometimes used by small central-station companies that have no equipment of testing instruments is to determine the number of seconds that the meter disks should take to make one revolution on a load consisting of a given number of lamps. This method may be applied to give a rough test on an installed meter by turning on the desired number of lamps on the consumer's wiring and timing the meter disk, for, say, 10 revolutions, on a stop-watch, in order to obtain a good average for the time required to make one revolution. By substituting in (7) the value R = 1 we obtain:

$$T = \frac{3{,}600\ K}{\text{meter watts}} \qquad (9)$$

This method is not an accurate one, since it is not safe to assume that a certain number of lamps in commercial use take a definite amount of energy. The lamps may be old, so that the number of watts that they take on standard voltage is far from the wattage of new lamps. Moreover, the method takes no account of the variation of voltage, or of the drop in the consumer's wiring—both of which would, of course, affect the amount of energy.

The method gives accurate results—provided the voltage is known or can be measured—when instead of turning on consumers' lamps a calibrated resistance is used as the load.

Following is a numerical example: A 110-volt, 10-ampere, induction meter having a constant = ½ is to be tested on light load. It is loaded with two eight-candlepower lamps on a standard lamp bank, taking 22.5 watts each at the observed local pressure of 109.5 volts, and shows 43 seconds as the average of 10 revolutions of its disk. Substituting in (9), we obtain as the number of seconds that a meter of 100 per cent. accuracy would take to make one revolution on this load:

$$T = \frac{3{,}600 \times \frac{1}{2}}{2 \times 22.5} = 40.$$

Hence the meter is 3 seconds slow on the one revolution, or 7.5 per cent. slow, compared with the standard; i. e., its per cent. accuracy on a light load equal to about 1/20 full load is 92.5 per cent.

Another way of arriving at accuracy is to determine the number of revolutions that the meter makes in one minute, as timed by the stop-watch, and compare it with the number it should make on the given load in that time, as shown by (6). Substituting in that equation the value T = 60, we obtain:

$$R = \frac{\text{meter watts}}{60\ K}. \qquad (10)$$

The ratio of the observed revolutions per minute to the revolutions as computed by (10), times 100, gives the per cent. accuracy of the meter.

An ingenious pocket device for making meter computations, known as "Cox's wattmeter testing computer," copyrighted by William Cox, New York, is issued by the Fort Wayne Electric Works. [illegible] printed with two circular scales, reading in "watts [illegible] watts, and in "seconds required," respectively. One [illegible] the same diameter as the scales on the fixed part, [illegible] for setting in juxtaposition with the two scales of the fixed card, and reading in "calibrating constants as per table" and "ascertained revolutions," respectively. The other movable part is a sector having a short circular arc of same diameter as [illegible] or zero mark (an arrow) and short scales giving [illegible] mark.

The computer is operated by setting it from the usual data of the meter test, as follows:

Having allowed the meter to make any convenient number of revolutions, under known load, and observed the number of seconds on a stop-watch, the computer disk is set so that the calibrating constant (as found in accompanying tables, for Fort Wayne meters) is opposite the actual value of the load. Opposite the revolutions of the meter, found on the other scale of the disk, will then be found a certain number of seconds, which should correspond to the seconds as observed on the stop-watch. If it does not correspond, however, the meter is either fast or slow, and the error may be found by setting the sector with its arrow opposite the seconds found by the computer and reading the per cent. fast or slow opposite the "stop-watch seconds."

An eight-page brochure, entitled "Meter Instructions for Installing, Reading and Testing," issued by the Duncan Electric Manufacturing Company, contains, among other useful matter, the following table, from which the per cent. error (slow or fast) of a meter may be read off directly, knowing the time in seconds and fractions of a second that the meter actually takes to make the number of revolutions computed by (10). The seconds column gives times from 40.2 seconds to 80 seconds, increasing by steps of fifths of a second, to conform to the construction of most stop-watches, on which the seconds are split to fifths.

Per Cent. Error Table for Fifths of a Second.

Time in Seconds	Per Cent Fast	Time in Seconds	Per Cent Fast	Time in Seconds	Per Cent Slow	Time in Seconds	Per Cent Slow
40.20	49.25	50.20	19.52	60.20	0.33	70.20	14.52
.40	58.51	.40	19.05	.40	0.67	.40	14.77
.60	47.78	.60	18.58	.60	0.99	.60	15.01
.80	47.06	.80	18.11	.80	1.31	.80	15.25
41.00	46.34	51.00	17.65	61.00	1.63	71.00	15.50
.20	45.63	.20	17.19	.20	[illegible]	.20	15.73
.40	44.93	.40	16.73	.40	2.27	.40	15.96
.60	44.23	.60	16.28	.60	2.59	.60	16.20
.80	43.54	.80	15.83	.80	2.91	.80	16.43
42.00	42.86	52.00	15.38	62.00	3.22	72.00	16.66
.20	42.18	.20	14.94	.20	3.53	.20	16.89
.40	41.51	.40	14.50	.40	3.84	.40	17.12
.60	40.85	.60	14.07	.60	4.15	.60	17.35
.80	40.19	.80	13.64	.80	4.45	.80	17.58
43.00	39.53	53.00	13.21	63.00	4.76	73.00	17.81
.20	38.89	.20	12.78	.20	5.06	.20	18.03
.40	38.25	.40	12.36	.40	5.36	.40	18.25
.60	37.61	.60	11.94	.60	5.66	.60	18.47
.80	36.98	.80	11.52	.80	5.95	.80	18.70
44.00	36.36	54.00	11.11	64.00	6.25	74.00	18.92
.20	35.75	.20	10.70	.20	6.54	.20	19.14
.40	35.14	.40	10.29	.40	6.83	.40	19.35
.60	34.53	.60	9.89	.60	7.12	.60	19.57
.80	33.93	.80	9.49	.80	7.40	.80	19.79
45.00	33.33	55.00	9.09	65.00	7.69	75.00	20.00
.20	32.74	.20	8.69	.20	7.97	.20	20.21
.40	32.16	.40	8.30	.40	8.25	.40	20.42
.60	31.58	.60	7.91	.60	7.91	.60	20.63
.80	31.00	.80	7.53	.80	7.53	.80	20.84
46.00	30.43	56.00	7.14	66.00	9.09	76.00	21.05
.20	29.87	.20	6.76	.20	9.36	.20	21.26
.40	29.31	.40	6.38	.40	9.63	.40	21.47
.60	28.76	.60	6.01	.60	9.92	.60	21.68
.80	28.21	.80	5.63	.80	10.17	.80	21.88
47.00	27.66	57.00	5.26	67.00	10.44	77.00	22.07
.20	27.12	.20	4.89	.20	10.71	.20	22.27
.40	26.58	.40	4.53	.40	10.97	.40	22.38
.60	26.05	.60	4.17	.60	11.24	.60	[illegible]
.80	25.52	.80	3.81	.80	11.50	.80	22.88
48.00	25.00	58.00	3.45	68.00	11.76	78.00	23.08
.20	24.40	.20	3.09	.20	12.02	.20	[illegible]
.40	23.96	.40	2.74	.40	12.28	.40	23.47
.60	23.45	.60	2.39	.60	12.53	.60	23.66
.80	23.15	.80	2.04	.80	12.79	.80	23.86
49.00	22.45	59.00	1.69	69.00	13.04	79.00	24.05
.20	21.95	.20	1.35	.20	13.29	.20	24.24
.40	21.46	.40	1.01	.40	13.54	.40	24.43
.60	20.97	.60	0.67	.60	13.79	.60	24.63
.80	20.48	.80	0.33	.80	14.04	.80	24.82
50.00	20.00	60.00	0.00	70.00	14.28	80.00	25.00

Example: If the revolutions to be made in one minute are completed in exactly 60 seconds, the speed is correct and the per cent. error is 0, but if the revolutions were made in 57 seconds, then the meter is running 5.26 per cent. fast; if completed in 58.4 seconds it is 2.74 per cent. fast. When the time exceeds 60 seconds, the meter is slow. If it requires 63 seconds it is 4.76 per cent. slow; if 6[illegible] seconds it is 7.12 per cent slow.

[To be continued.]

QUESTIONS AND ANSWERS.

Corrosion of Storage-battery Terminals.

M. A. L., South Bartonville, Ill.: I have two sets of storage batteries composed of 20 cells each. Each cell has two lead plates in dilute sulphuric acid. At the positive terminal of each set the wire has been eaten away just where it leaves the soldered terminal that projects from the positive plate. There is a salty corrosion on these terminals, while the negative terminals are perfectly clean. What causes this trouble? What can be done to remedy it?

ANSWER.

During the period of charging, and especially near its close, a fine spray will be found rising over a storage battery such as described. This is composed of acid carried up by the many minute bubbles of gas set free during the latter part of the charge. This acid spray settles on all exposed parts of the cell and surroundings and attacks them by chemical action. At the terminals electrochemical action takes place which is most corrosive at the positive side during charge, because the acid radical SO_4 is liberated there by the entering current and attacks the conductor to which the plate terminal is joined. At the negative terminal hydrogen is set free, which has more of a cleansing instead of corrosive action. The corrosion at the positive terminals is objectionable, not only because the screws or bolts used in the connection and the wire are gradually eaten away, but because the products of this corrosion (usually copper sulphate or other salts) are apt to be carried into the electrolyte of the cell and contaminate it.

The most effective way to remedy the trouble is to use lead strip or wire or lead-covered wire as far as there is any likelihood of acid spray reaching it. If bolts are used in the connection, they should be lead-covered and placed out of reach of the acid spray. The reason for using lead is because it is not attacked by dilute sulphuric acid; copper, brass, iron and zinc are attacked. A remedy not so effective is to paint the clean and dry connection with white lead or other heavy non-corroding paint. Among the many things that have been tried and found partly satisfactory are whitewash and vaseline.

Multiple-unit Control Systems.

S. E. M., Chicago: Please explain briefly the difference between the Sprague and Westinghouse multiple-unit systems of control.

ANSWER.

The most striking difference is that the Sprague or Sprague-General Electric system is a purely electromagnetic control, while the Westinghouse system is an electro-pneumatic control. Another difference is that in the former, while the control and power circuits are distinct, both receive current from the trolley or third-rail line; in the latter system the master controller and the control circuit receive current from a 14-volt storage battery carried on each motor car, while the motor or power circuit is supplied from the line.

In the later forms of the Sprague system the master controller controls the current and therefore operates a set of contactors or electromagnetic solenoid switches on each motor car which close or open the various armature, field and resistance switches of the motor circuits for that car; it also operates a reversing switch for so changing the motor connections as to produce reversed rotation.

In the Westinghouse system the master controller (supplied with current by the storage battery referred to) operates a set of about 13 electromagnetic valves that control the admission of air at about 70 pounds pressure from a reservoir to a series of cylinders. The pistons in these cylinders are connected to the motor circuit switches or contactors.

Connections of a Series Motor.

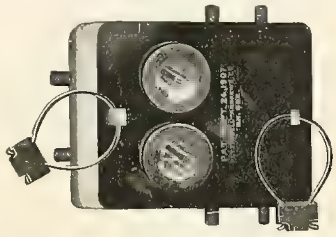
T. J. S., Chicago: [illegible] a series motor be connected with three wires to run either forward or backward?

ANSWER.

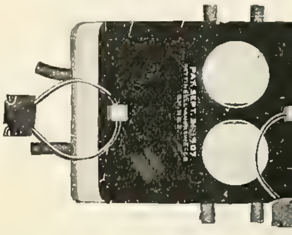
It is not practical to use less than four wires between the motor and the controller in this case since the field connections must be kept distinct from the armature connections in a reversible motor. To reverse the machine, the armature connections are usually reversed at the controller.

Fuse-block Arrangement to Prevent Theft of Current.

It is generally recognized that the central station will always be more or less subjected to danger of current theft, this being especially true if the possibility or opportunity of tampering with the meters is rendered comparatively easy. One of the most prolific sources of trouble in this respect is due to the fact that the ordinary type of porcelain fuse block offers a ready means of tampering with the service or meter connection. The fact that it is easy to loosen up or open-circuit the potential or shunt-wire tap to the meter without opening up the series connection, or to shunt or bridge the



Service Connected.



Service Disconnected.

FUSE-BLOCK ARRANGEMENT TO PREVENT THEFT OF CURRENT.

meter connections, or even entirely to disconnect one of the wires, is a great temptation to many who believe the electric-light company is fair game for sharp practice.

While it is comparatively easy to devise methods of "sealing" the ordinary fuse blocks in such a manner as largely to eliminate the possibility of theft, yet this sealing is often undesirable in that it renders the fuse plug inaccessiible, and in case of a short-circuit resulting in a blown fuse the consumer could not make replacement without calling in the lighting company's wiremen or breaking the seals himself. Either method is unsatisfactory, as in the first place the consumer would be inconvenienced in being obliged to wait for the repair man of the company, and, in the second place, if the custom of breaking seals were permitted, it would simply result in nullifying the object in sealing, as a dishonest person could break the seals for the purpose of tampering with the meter connection and then claim that this breaking was necessary in order to replace a blown-out fuse.

Aside from the necessity of preventing theft of current, it is also desirable in apartment-house wiring and similar classes of service where several customers have meters on the premises, that all live conductors be so covered that it is impossible to connect any extra lamps or other devices without leaving the wiring in such condition that this unauthorized work is readily apparent upon inspection. It is equally desirable, in the case of discontinued services, to be able to seal the branch block so that it is impossible to fuse same or make an illegal connection without breaking the seal.

A modern practical method of accomplishing the desired results is to employ a fuse-block cover or shield which will fit over the ordinary fuse block, sealing all live parts, but allowing ready access to the fuses, except in cases of discontinued service, in which case the fuse blocks should be so arranged that no service connection could be obtained without breaking the company's seals.

A recently developed device which fully meets the requirements outlined above is shown in the accompanying illustrations, one showing the plug fuses in position with service connected, the other showing the fuses removed, the service disconnected and the fuse-block cover again sealed in position. It will be noted that protecting the disconnecting service has been accomplished by simply reversing the steel cover which forms the cover of the fuse block.

The fuse-block cover can be used with all types and sizes of Edison plug fuse blocks, and the porcelain canopy is supported by the same screws, holding this block in place, these screws in turn being covered by the face plate, which is itself held in place by the seal. The seals are attached to metal posts, which form a part of the porcelain canopy.

This new fuse-block cover is applicable to new or old work, and can be adapted to all makes of branch blocks for Edison plug fuses. A screwdriver is the only tool needed to install the cover on existing services equipped with Edison plug cut-outs. The new protection device will be known as the O. K. fuse-block cover, and is being placed on the market by the Central Electric Company of Chicago, general western sales agent for the Okonite products.

Waterpower Grants by Congress.

In vetoing the Bede bill for an extension of time to a private corporation for the construction of a dam in Rainy River of Minnesota, President Roosevelt took occasion to reiterate his policy of insistence on the protection of public interests when grants are made of waterpower privileges in navigable streams. This policy calls for a time limit on every grant, for compensation to the public in return for the use of waterpower and for government regulation to make sure that grantees actually develop power instead of holding a site, as the Rainy River Improvement Company is said to have done during 10 years, merely for speculation.

Conservation of Natural Resources.

A meeting was held on April 14th in the auditorium of the Engineering Societies Building in New York under the auspices of the American Society of Mechanical Engineers, in response to the invitation of President Roosevelt to engineers to co-operate for securing the conservation of the natural resources of the country.

The meeting was presided over by J. W. Lieb, Jr., vice-president of the society, who called attention to the fact that the first president of the United States was an engineer, who was interested in the development of waterways. Dr. W. J. McGee, chief of the Bureau of Soils, Washington, D. C., followed with an address on the "Conservation of the Water and Woods," calling this the most important subject now before the people. The country began with a revolution in which there was war; but it is now time for a great revolution without war in which there shall be an awakening of a moral sense of obligation for the preservation of natural resources. One of the losses confronting the people of the United States is the loss of ground water. Too much flows away in torrents, because of the destruction of the forests. Instead of acting like a sponge, the earth, when stripped of its timber, sheds water like the roof of a building. The fertile soil washed away in the United States represents an annual loss of over $1,000,000,000.

Dr. W. F. M. Goss, dean of the College of Engineering, University of Illinois, spoke upon the "Conservation of the Nation's Fuel Supply," saying that economy in its production and use is to be enforced by a fourfold process. The necessary steps are: Scientific research for the establishment of facts; practical demonstrations of facts thus developed on a scale which will convince men that there is profit, direct or indirect, in a better practice; restrictive legislation which will protect the public from the competition of unscrupulous men, and, finally, effective inspection which will secure an enforcement of law. The process cannot successfully begin with coercion; it must begin with education.

Prof. George F. Swain of the Massachusetts Institute of Technology, Boston, presented the subject of "Stream Flow, Waterpower and Navigation." The most effective way of regulating stream flow is by preservation of the forests, and this produces three effects of great importance. It conserves one of our greatest natural resources—waterpower; it prevents erosion of the soil; and it prevents the silting of navigable rivers and harbors as well as of reservoirs.

The concluding address, by Dr. Henry S. Pritchett, president of the Carnegie Foundation, treated of the attitude of the engineer toward the public. Engineering has grown into a profession that must consider public interests. The practical demonstration of professional ideals lies in the use of fair judgment, a sound sense of justice and quick appreciation of the larger public causes. The engineer not only plans, but carries out great enterprises. If he be a true member of his profession, he will, while serving loyally his employer, keep in mind the honor of his profession, the debt he owes to it, and the service to the larger interests of humanity.

"Wireless" Messages in Canada.

A return which has been issued by the marine department at Ottawa shows that from April 1, 1906, to March 31, 1907, 20,405 messages were transmitted through the Marconi wireless stations in the Dominion. The amount of tolls collected was $9,033. There are in the Gulf of St. Lawrence and on the Atlantic seaboard 13 stations. Three are low-power stations and cost $5,000 each. The 10 high-power stations cost double that sum. The company, while retaining all the tolls, receives $2,500 and $3,500 for operating the low and high stations, respectively.

The Richmond Light and Power Company has secured a franchise for an electric transmission system at Richmond, Cal.

Earnings of Electric Railways.

The returns of the electric railways of the country for the last calendar year are of unusual interest. The statistics embrace 194 roads, and these show aggregate gross earnings of $235,718,432, as against $212,442,906 for the 12 months of 1906, and net receipts of $100,526,762, against $94,778,321. While the increase in the gross reaches $23,275,526, or 10.95 per cent., the increase in the net amounts to $5,748,441, or 6.06 per cent. It is evident from these figures that the electric railways have felt the influence of the higher operating cost resulting from advances in wages and increases in the cost of fuel, materials and supplies, the same as the steam railroads, but not quite to the same extent. In the case of these latter, the review for the calendar year of 1907 showed that a gain of 9.59 per cent. in gross had been attended by an actual falling off in net. On the whole, therefore, the electric railways have been more fortunate in this respect than the steam.

In addition to the roads which have furnished returns of both gross and net, 31 have submitted comparative figures of gross, but not with their net earnings. Adding these on, the number of roads is increased to 225 and the total of the gross raised to $279,023,468 in 1907, as against $254,725,954 in 1906. The increase in this case is $24,297,514, giving a ratio of gain considerably smaller than in the other case, it being 9.54 per cent.

In the table which follows there is given the total of gross and net for the calendar years 1907 and 1906, and then are added two other lines of figures, one recording the earnings of all the roads which have submitted returns for the 12 months ended June 30th and the other the earnings of all the roads for which are reported the figures for the 12 months ended September 30th. The three combined make a comprehensive aggregate.

	1907.	1906.
For calendar year (194 roads)........	$235,718,432	$212,442,906
For year ending Sept. 30 (68 roads).....	22,095,622	21,262,357
For year ending June 30 (93 roads)....	48,452,261	46,433,181
Grand total (355 roads).............	$306,266,315	$280,139,044

Increase (9.33 per cent), $26,127,271.

From the foregoing one gets some idea of the magnitude to which the electric-railway industry has risen. The total of the gross earnings (comprising 355 roads) for 1907 is $306,266,315, against $280,139.044 for 1906, and aggregate net earnings $126,002,304, against $121,050,703. The increase in the gross in this instance is $26,127,271, or 9.33 per cent., while the increase in the net is only $4,951,601, or 4.09 per cent. Here the advance in operating cost is more manifest than in the case of the roads embraced in our tabulations for the calendar year.—From the Chicago Daily News of April 14th.

"Circular Loom" and the Chelsea Fire.

The Chelsea (Mass.) fire of April 12th started about two miles from the factory of the American Circular Loom Company, which it reached about three hours after starting. The Chelsea plant, consisting of the circular loom factory, warehouse, stables and home offices, was completely destroyed. The loss is fully covered by insurance. Factory employes suffered severely; nearly all, living as they did in the vicinity of the factory, lost house and home and all they possessed. Some were injured, and one, a young woman, was burned to death.

The company has lost no time in getting started again. It has already secured a new factory, admirably adapted to its needs, in North Cambridge, Mass. It has established new permanent offices in the International Trust Building in Boston, and is now actively engaged in assembling with all possible speed new machinery for the manufacturing of circular loom. It hopes to be able to supply the demand for circular loom again regularly and promptly within a very short time.

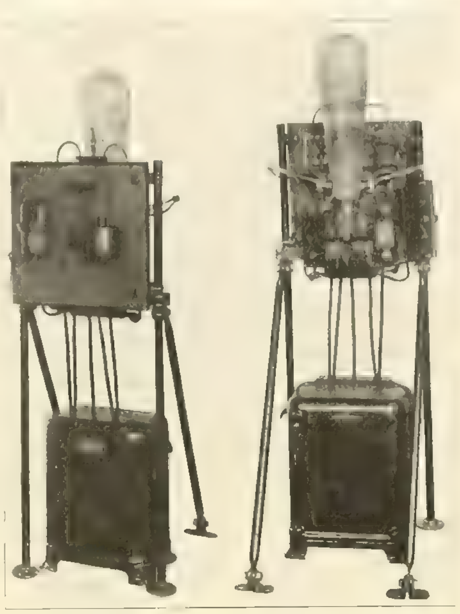
It should be remembered that only the Chelsea plant of the company has suffered from the fire; the "Electroduct" factory at Kenilworth, N. J., is in full operation and the new metal-molding factory, also located at Kenilworth, is now fully completed, including a large electro galvanizing plant. Metal molding will be offered to the trade as soon as the necessary printed matter, which was stored at the home offices and burned up, can be duplicated.

Interesting if True.

An Omaha daily newspaper despatch of April 10th says that Dr. Frederick H. Millener, an electrical engineer at the Union Pacific shops, Omaha, has succeeded in applying the principles of wireless telegraphy to an electric motor and a few days ago a party of electricians was permitted to examine a wireless electric truck which has been in use in the Union Pacific shops for several weeks. The truck is started and stopped from a wireless central station and is said to have a number of unique points.

Mercury-arc Rectifier for Moving-picture Shows.

In Chicago there are [illegible] moving-picture shows, and they all use electricity for the projection. It is surprising to contemplate the rapidity with which the moving-picture show has become popular. The first exhibition of this kind took place in the Bowery, New York, about [illegible] years ago, as an experimental sideshow in one of the museums. From this beginning the moving-picture show started as a distinct enterprise, and now it is said that there is at least one establishment of the kind in every city or village in the United States



Front View. Rear View.

MERCURY-ARC RECTIFIER PANEL.

larger than a hamlet. In the larger places there are several, while in the big cities the number ranges from 100 to 300. Some of the establishments are handsomely fitted up and are as pretentious as small theaters, charging 10 cents admission, or perhaps more. But in the great majority of cases the price of a ticket is five cents; they are the familiar "nickel theaters" of the streets.

The arc lamps which are used as the light source for moving pictures are usually operated from 35 to 60 amperes on alternating current and at about 25 to 30 on direct current. Up to a few years ago they were operated in series with resistances on 115 or 220 volts to bring the lamps to the proper arc voltage. This makes a wasteful consumption of energy, which is considerably more for the alternating-current lamps, on account of the higher amperage necessary for producing a light of sufficient intensity. The problem to overcome this waste of energy has in the last few years been given considerable attention. The current bills of the enterprises form a very large part of their fixed expenses, averaging from about $40 a month for the smaller exhibitions, which operate only three or four times in one evening, to bills of several hundred dollars a month for the large city establishments which give performances during the greater part of the day and night.

Apparatus for efficiently cutting down the voltage on the direct-current lamps must of necessity be a much more expensive and elaborate outfit than a device designed for a similar purpose for alternating current. The initial cost of the former has prevented its general adoption except for locations where only 500-volt direct current is available, as in summer resorts operated by street-railway interests. On the other hand, the problem for overcoming the waste of energy in rheostats on alternating-current lamps has been at least superficially overcome by use of compensators, choke coils and similar devices.

It is of course evident that most of these alternating-current devices, although in certain respects less wasteful than rheostats, possess a low power factor, which makes them inefficient from a central-station viewpoint. It is asserted that some of the large central stations are ordering them removed from their lines, and at least one central station has made a different service rate for establishments using these devices.

The direct-current arc lamp is undoubtedly a better [illegible] reel.

The question, therefore, has arisen, "What is the best way to obtain direct current from alternating for this class of service?"

The General Electric Company has recently designed and sold a number of mercury-arc rectifiers adapted especially for use in supplying direct current to moving-picture arc lamps where only alternating current is available. The back and front views of one of these rectifier sets are shown herewith.

This rectifier set is designed for operation on a 220-volt, alternating-current circuit, and has a continuous capacity of 30 amperes direct current and a capacity of 40 amperes, or slightly more during the starting of the arc. The rectifier is designed to deliver a direct-current voltage equal to that required across the arc, or from 45 to 50 volts. A reactance in series with the alternating-current supply serves to steady and regulate the current taken by the arc lamp. This eliminates the necessity of having a wasteful resistance in the arc circuit.

The rectifier set is similar in some particulars to the battery-charging rectifier now in common use for automobiles. The regulating features and other parts necessary for battery charging, but not required for this service, are omitted, and the rectifier equipment reduced to its simplest form. The rectifier may be installed at a distance from the picture-machine operator; for instance, in the basement. The rectifier may be started by the operator without leaving his booth.

The only operation necessary to start the rectifier, after the supply switch is closed, is to touch the two carbons of the arc lamp together, hold them so for a second or two, and on separating the carbons a direct-current arc will be drawn. The closing of the carbons simply allows the current to flow through the shaking coil on the panel which tilts the mercury tube once or twice and causes it to start. Rectifiers already installed in moving-picture shows are said to have received approval from the owners. The cost of operation is said to be much less than with either alternating current or direct current with a resistance in series with the arc.

OBITUARY.

Charles Williams, who died on April 14th in Somerville, Mass., was a director in the Western Electric Company and had been identified with the telephone instrument industry for years. The first business telephone ever used in Boston or its vicinity was put into operation in his house, then on Court Street, Boston, and connected him with his office. He was associated with Professor Bell in the making of the telephone a practical working instrument for public use.

Lew Conway Carnes, who was one of the best known travelers from coast to coast as the representative of the Crown Electrical Company of St. Charles, Ill., died very suddenly at his home in Aurora, Ill., on April 1st of pneumonia at the age of 36. He was not only popular with the trade but was cordially liked by his brother travelers. His cheery smile and good fellowship will always be remembered. He was buried at Muncie, Ind., beside his father, who was laid away on January 2d last. Besides his wife and two children he is survived by his mother and two brothers.

Edward H. Niesz, formerly of the Chicago Edison Company and more recently with the Federal Electric Company of Chicago, died in Phœnix, Ariz., on April 13th, and was buried in Canton, Ohio, on April 19th. He went to California from Chicago for the Federal Electric Company three years ago. While out there he began to fail in health, and last fall he removed to Phœnix in the hope of bettering his condition, but in vain. Pulmonary tuberculosis was the cause of death. Mr. Niesz was about 38 years of age and unmarried. He was a brother of Mr. H. E. Niesz, assistant to the second vice-president of the Commonwealth Edison Company. The deceased gentleman was a man of bright, engaging personality, with unusual musical talent. He won the warm regard of many friends by his high character and pleasing manners, and his death is truly lamented.

BOOK TABLE.

Harper's Electricity Book for Boys. By Joseph H. Adams, author of Harper's "Outdoor Book for Boys." New York: Harper & Brothers. 1907. Pp. (5½ by 7½ inches), 407, with many illustrations. Price, $1.75.

This is a book written expressly for boys with the object in view of teaching the theory and principles of electricity by means of simple apparatus which can be made at home. Complete drawings, illustrations, etc., are shown and instructions given for making necessary apparatus. The author has written his book so as to leave in the boy's mind a lasting and true idea, through application, of the subjects passed over. At first cells and batteries, then switches, magnets, rheostats, induction and resistance coils are made. After this the boy is taught how to make telephones, wireless telegraphs, dynamos and motors. The book is concluded with a discussion of electric-light, heat and power plants, together with a dictionary of electrical terms.

The Hughes and Baudot Telegraphs. By Arthur Crotch. London: S. Rentell & Co., Ltd. 1908. Pp. (5 by 7¼ inches), 83, with 41 illustrations. Price (in England), 1s. 6d.

This book treats exclusively of type-printing telegraphy and explains this method of communication, the apparatus involved and its theory and manipulation. Two systems only are described, namely, the Hughes system, used extensively on the Continent in general, and the Baudot system, which receives favor in France.

The illustrations possess clearness of detail and these together with the concise explanations of the workings of the parts of the apparatus and of the systems present the subject in a manner so that anybody not familiar with this particular branch of science will find little difficulty in understanding the intricacies of these systems of telegraphy.

Electric Railways. By James R. Cravath. With a short chapter on The Single-phase Electric Railway, by Harris C. Trow. Chicago: American School of Correspondence. 1908. Pp. (6½ by 9½ inches), 153, with 125 illustrations. Price, $1.00.

This is one of a series of practical handbooks dealing with the elements of engineering work, the particular volume being one of the best in the series. The principal features of electric-railway work are treated in a practical manner. The chief topics described are: The power equipment of the cars (motors and controllers); brake mechanism; general car construction; overhead and third-rail line construction; trackwork and bonding; multiple-unit systems; comparison of the direct-current and single-phase systems. On the whole the book is a useful one for a student who wishes to get a general idea of the subject.

The Electric Telegraph. Part I. The Electric Telegraph. By Chas. Thom. Part II. Wireless Telegraphy. By A. Frederick Collins. Chicago: American School of Correspondence. 1908. Pp. 138, with 91 illustrations. Price, $1.

This book also belongs to the series referred to above and is prepared along similar lines. Types of circuits ranging from a simple electric bell circuit to various forms of quadruplex are clearly described in detail. The Morse code and various special codes are explained. A great many typical messages are given for the different classes of service. The second portion of the book deals with the phenomena of high-frequency electric waves, the various methods made use of and the applications of these methods in a number of the best known systems of wireless transmission.

Both this book and the one above could be improved by the division of the text into properly headed chapters, a continuous numbering of the pages and a more complete index. In each book, for some unknown reason, the division of the text into Parts I. and II. does not agree with that set forth in the table of contents.

Telephone News from the Northwest.

[illegible] P. Wainman, vice-president of the Northwestern Telephone Exchange Company of Minneapolis, appeared before a council committee in opposition to the rate-reducing ordinance. The proposed ordinance fixes the maximum price of business telephones at $48 per year and resident telephones at [illegible]

[illegible] C. [illegible] of Glendive, Mont., and Edward [illegible] of [illegible], N. D., are interested in [illegible] telephone line from Glendive to Miles [illegible]

[illegible] Telephone Company of [illegible] has been [illegible] J. C. Hastings [illegible]

[illegible]

Henry Bergh vice-president, Thomas Carley secretary and Erick Sutherland treasurer.

The Portland Center Telephone Company of Portland, Iowa, has been incorporated by George Steiner and others. R.

Canadian Telephone Items.

Sealed bids addressed to John Stocks, Edmonton, deputy minister of public works for Alberta, will be received until noon, April 30th, for the necessary materials for the construction of 700 miles of rural telephone lines. Specifications may be seen at the department of public works, Edmonton, or at the office of the inspector of public works, Armstrong block, Calgary, Alb. Successful bidders will be required to put up a bond of 10 per cent. for the prompt delivery of materials at points designated.

The municipality of Wallace, with offices at Virden, Man., has disposed of debentures to the value of $50,000, the money to be used entirely for telephone construction, the municipality having decided to construct its own telephone system. J. P. Menlove is secretary and treasurer.

Six rural telephone companies are being organized around Land, Sask., for the purpose of building rural telephone systems radiating from Land. H. E. Anderson, Land, Sask., may be addressed.

The Manitoba government has provided $300,000 for extensions to its telephone system during the present summer, and judging by the plans of the commissioners this amount will be entirely used up. Two new switchboards have been ordered for Winnipeg at a cost of $100,000, in addition to $110,000 to be spent for aerial and conduit work. For the installation of telephones for new subscribers throughout the province $25,000 is allowed in addition to $15,000 for cable extensions to a number of the larger exchanges in the province outside of Winnipeg. The private companies operating at Gladstone, Crystal City and Neepawa will be given connections with the government long-distance lines, a privilege they did not enjoy under the Bell ownership. In addition the province is planning the construction of a number of long-distance lines and some half dozen municipalities have completed or are about to complete arrangements for their own systems. Recently one of the members of the Manitoba telephone commission stated that during the summer the government will keep fully 1,000 men employed on extension work throughout the province in addition to the municipal systems which will be built under government supervision. R.

Indiana Telephone Notes.

In the city of Goshen the Central Union and the Home telephone companies having merged interests, the former company will maintain only about a dozen telephones to hold its perpetual franchise. Most of the Central Union instruments have been removed from the business houses and residences. Patrons are expressing considerable satisfaction over the arrangement since it means not only a saving but adds to the convenience of the service.

The board of trustees of Danville has granted the Farmers' Mutual Telephone Company a 25-year franchise. Before the admission of the Farmers' company the Consolidated company of Danville had a monopoly in the territory. This cut the Farmers' off from free connection throughout the county. The Farmers' proposes to connect a number of farmers' co-operative lines in Hendricks and adjacent counties so as to give the patrons both free and long-distance service in the territory.

Plans are being perfected for the establishment of a toll-line traffic association or clearing house for making settlement through one central office of all toll business handled over Independent lines in the state. The business of the clearing house will be to issue the necessary tariff and routing book, rate sheets, blanks for making reports, schedules, check all business in which two or more companies are interested and make proper settlement on a mileage basis. It will make toll rates uniform and in general supervise the entire toll-line business. S.

GENERAL TELEPHONE NEWS.

The Pine Bluff (Ark.) Telephone Company has purchased the holdings of the Pine Bluff and Cleveland County Telephone Company, and will have 200 miles of line.

The work of repairing the telephone cables in Havana, Ill., was undertaken recently, and the task was found to be an unusually difficult one. The work, however, was completed in so short a time and with such entire satisfaction as to attract the attention of telephone managers in other cities. When the job was started it was found that every cable, 10 in number, had from one to 75 bad pairs, caused by lightning or by contact with electric-light wires. In just four weeks practically every pair had been re-covered and the entire exchange put in as good condition as when new [illegible] years ago. The work was done by Johann & Johann, cable and switchboard experts, of Pekin, Ill.

CORRESPONDENCE

Continental Europe.

Paris, April 7.—An experiment of some interest is soon to be tried upon the Paris Subway, with a view of adopting a system of electric elevators or movable inclines in the stations, which lie at a considerable depth. At present the passengers are obliged to mount up several flights of staircase, and in many cases this is quite fatiguing, for the distance to be climbed is equivalent to the stairs of a three-story house. Owing to the complaints which have arisen from this cause, it has been decided to take some measures to remedy this state of affairs. Two stations, where the movement of passengers is considerable, are to be chosen for the experiments in order to see what will be the result in practice. One of them will be fitted with an electric elevator of large capacity, while the other will have an inclined moving platform of the usual type. The trials will thus bring out the relative advantages of the systems, after which the best one will be applied to a number of the underground stations.

The city of Geneva recently held a concourse of plans relating to the new hydraulic plant which it is proposed to erect upon the Rhone near the city, not far from the point where the river flows out of Lake Leman. The Chèvres plant, which is a large one, is also located on the Rhone, but it is found necessary to erect a new plant in order to secure a greater amount of current, which is needed at present. According to the conditions of the concourse, the plant must be operated on the two-phase, 5,000-volt system, with a pole line working at 25,000 volts. The turbines, of the vertical-shaft type, are to be double wheels, one wheel working in periods of high water and the second for low-water periods. Several projects were presented for a plant of this kind. The best one called for a dam having five openings of 10 meters each, with double gates. In the turbine house are installed 12 main groups of 2,500-horsepower each and four exciter groups of 400 horsepower. This project received the first prize of $2,200, and its author is Mr. Zschokke of Aarau.

At Lyons the tramway company is engaged in the construction of a new single-phase traction system. It will be applied on two suburban lines leading from the city and having a total length of 13 miles. The track will be standard gauge, using the overhead trolley. In a sub-station the current at 600 volts direct current, which is received from the mains, is converted into single-phase current by rotary groups. These consist of a shunt-wound direct-current motor coupled to a single-phase alternator of 660 volts. The current is sent from the latter directly into the feeders of the tramway lines, and there are no sub-stations along the line. The overhead wire is hung on the single catenary plan. At the start the company will use 15 motor cars fitted with two Westinghouse motors of 50 horsepower each.

Budweis, in Austria, expects to secure a large amount of current from three hydraulic plants which are to be erected not far from the city. The International Electric Company of Vienna has applied for the concession for this enterprise, and the plants are to be located on the Wottawa River. This stream, with its affluents, will afford three different falls. The largest of the present plants will be placed near Neustadtl and is expected to give 12,000 horsepower.

Work on the new Lötschberg tunnel in Switzerland, which is to rival the Simplon tunnel, advanced satisfactorily during the month of February. Since then an avalanche threw the work back somewhat. During February the tunnel advanced by 281 meters, which brings the total to 3,317 meters. There were 940 men employed within the tunnel and 460 men in the outside work.

A. de. C.

Great Britain.

London, April 10.—Since the House of Commons rejected the proposal of the House of Lords to commit the bills relating to electric power supply in the metropolis to a joint committee of both houses about six weeks ago, very little has been heard of the manner in which these bills were to be dealt with. Apparently, in the circumstances, the House of Lords realized that there was nothing to be done but follow the ordinary procedure of sending the bills to separate committees of both houses, and so it is that the announcement comes of the appointment of a committee of the House of Lords which will commence consideration of the bills soon after Easter. The chairman is to be Lord Cromer, who has recently returned from Egypt, where he has been the British representative for several years.

At a time when electric carriages in London are making pronounced headway it is interesting to note that one of our oldest established electrical engineering firms has evolved a new type of electrically driven vehicle, after experiments which have lasted over two years. The firm in question is the India Rubber, Gutta Percha and Telegraph Works Company, and the vehicle has been specially de-

signed for town work. A feature of the car is that the driving can be effected by means of the four wheels altogether, or by means of the two rear wheels only. A motor is attached to each of the axle castings, and each is capable of withstanding an overload of 50 per cent for long periods. The controller provides six forward positions, three brake positions and four reverse positions. The battery is manufactured by the Electrical Power Storage Company.

The first direct means of tramway communication between the north and south of London was put into operation today, via the Kingsway subway, which has been extended from the northern side of the Strand on to the Victoria Embankment, there joining up with the southern system. At the end of March last the total amount raised by the London County Council for tramway purposes was $42,500,000, of which over $5,000,000 has been repaid. While considering the financial position of the undertaking to be satisfactory, the highways committee thinks it would be imprudent at the present moment to consider any question of reducing fares or of taking in hand any extensive additions to the system.

A press view was held this week of the National Telephone Company's latest telephone exchange, known as the Gerrard exchange. This, of course, is equipped on the central-battery system, and at present there are 6,708 subscribers' lines working and the ultimate capacity of the exchange is 10,400 subscribers' lines. This is the largest exchange but one in the United Kingdom. The cost of the exchange amounted to $460,000, while the staff numbers 326. There are 34 underground and six overhead cables. The average number of calls dealt with during a day is 175,000, and it is computed that one operator can handle 145 calls at the busy period per hour.

Lord Kelvin's will has now been proved at $810,000. His will, to which there are three codicils, was made in December, 1905.

In a special report, the highways committee of the London County Council recommends the purchase of the Highgate Hill cable tramway at a cost of $57,500, with a view to its reconstruction, either upon the conduit or trolley system, in order to make it an integral part of the Council's tramway undertaking. This line is the oldest cable tramway now remaining in England and is not at present allowed to be worked on account of its dilapidated condition. G.

Eastern Canada.

Ottawa, April 18.—English capitalists are back of the project to build an electric railway between Ottawa and Brockville, making use of the waterpowers between the two places.

The Ontario government, the Ontario Power Company and the Electrical Development Company are now negotiating, and it is understood that there will be no duplication of the latter companys' transmission. The Ontario company will take the western half of the province of Ontario and the Electrical Development Company the eastern half. The government will control the rates.

The municipal street-lighting plant which the City Council of Hamilton, Ont., proposes to install in that city will add greatly to the present lighting. Some 400 electric and 250 gas lamps are now used to light the streets, the gas lamps being equivalent to about 100 electric lamps. Under the new system the city will be lighted by 900 electric lamps.

The Hydroelectric Commission of Ontario has two experts in the United States investigating the new high-voltage systems being installed in various places where power has to be carried long distances. It is understood that if the report is satisfactory tenders will be at once called for and the erection of a transmission line will be undertaken. The present low price of copper and iron may induce the commission to hurry the contracts for the transmission line, as the present prices would mean a saving of nearly one-half on the cost of such work when compared with the cost of the work done a few years ago by the Electrical Development Company. W.

New England.

Boston, April 18.—Arguments by counsel for the New York, New Haven and Hartford Railroad Company in the suit brought by the attorney-general of Massachusetts to determine the status of the company in its control of street railways in this state were heard before the full bench of the Supreme Judicial Court today. Col. J. H. Benton, attorney for the railroad corporations, set forth the contention that under the laws of Connecticut, from which state the company derives its charter, the holding of trolley lines is authorized, and that whatever it has done in respect to such holdings has been done in that state. Furthermore, it was argued, the state of Massachusetts had given to the defendant, by act of the Legislature in the past, the same corporate rights in this state which it possessed in Connecticut. The decision of the court on this point is awaited with great interest, as the right of the New York, New Haven and Hartford to own and control Massachusetts trolley lines is virtually dependent, it is understood, upon the way to which the [illegible]

[illegible] were burned, wires were melted and tracks warped. Traffic was suspended in the burned district until Tuesday morning, by which time two miles of double-track road had been entirely reconstructed, so that cars were running again as usual.

The Worcester Consolidated [illegible] and Leominster trolley roads have asked for the freight-carrying privilege.

The Old Colony Street Railway Company is authorized to issue 5,000 shares additional stock at [illegible] B.

New York.

New York City, April 18.—Commissioner Maltbie of the Public Service Commission announces an agreement whereby the New York Edison Company will furnish breakdown or emergency service on a rate basis of maximum demand. The agreement is to last for one year, during which time the company agrees to place recording devices upon every breakdown connection and take the record of the current furnished under the supervision of the commission for the purpose of determining a fair charge for the service. For two years the company refused to supply emergency service. Last January the company announced that it would give breakdown service on the basis that if a hotel, for instance, doing a transient business needed emergency service it would have to pay a rate based on the supposition that every light in the house was burning at once. Business men who owned private electrical plants declared that this rate was prohibitive. After prolonged negotiation the Edison Company agreed to fix the rate on the basis of maximum demand.

The engineering force of the Public Service Commission has made a comprehensive map of the transfer points affected by the cutting off of transfers between the Metropolitan and Third Avenue systems. Transfers have been abolished at 48 points and continued at 57 points. Most of the places where they have been continued are on the horse-car lines, on which no one wishes to ride who can help it. As the receivers acted on the authority of Judge Lacombe of the Federal court in cutting off the transfers, it has not been decided yet by the commission what it can do to relieve the present disheartening condition.

Ten locals of the Commercial Telegraphers' Union, in addition to the New York local body, have indorsed the resolution of the Chicago local declaring a strike against the Western Union Telegraph Company on June 1st unless the wage rates existing before the last national strike are restored. Charles P. McInerney, secretary in this city, made the announcement on Tuesday. He said the new movers for a strike were the locals in Montreal, Atlanta, Milwaukee, Pittsburg, Memphis, San Francisco, Los Angeles, Albany, Hamilton, Ont., and Winnipeg.

The Pennsylvania Railroad Company has made public the results of a special investigation it has been conducting for the purpose of developing an improved steel rail. The company has worked independently of the committee appointed by the American Railway Association, but it is reported that the latter has reached practically the same conclusion as the Pennsylvania committee. It is expected that the report of the American Railway Association committee will be submitted at a meeting of the association to be held in this city next week. An experimental order for 10,000 tons of the improved rails was placed last December. Tests of them have led to some slight changes in the specifications as originally drawn up. The price of the improved rails has not yet been agreed upon between the manufacturers and the consumers.

Alderman Michael Zimmer thinks the speedy completion of subways is possible by a plan by which the money received as compensation from the street railways could be used to build the underground passages without preventing it from being applied ultimately to the purchase of the street-car lines by the city. Alderman Zimmer's plan has not been worked out definitely as yet, but appears to him to be feasible. W.

Ohio.

Toledo, April 18.—Officials of Toledo have announced their purpose to enforce the ordinance which provides for the removal of all telephone and electric-light poles from the center of the city.

Lima will issue bonds for the erection this summer of a municipal electric-lighting plant. This is done in an effort to secure cheaper lighting for the city and follows the refusal of the Ohio Electric Company to reduce the price of $85 for each street arc.

A temporary order was issued recently by Judge Mansfield restraining the directors of the Mansfield Railway, Light and Power Company, which operates the street-railway line in the city of Mansfield, from entering into a contract for $100,000 worth of additional machinery to furnish power on the [illegible] that the directors refused to pay the dividend due [illegible] the defendants are interested, contrary to the in- [illegible]

[illegible] many of which have been newly fitted out with electric whistles, the ban recently put upon electric [illegible] Commerce and Labor will be not lightly felt here. James Stone, supervising the ninth district, has always held that the electric whistles were all right until the acting inspector-general at Washington reversed the ruling to the sorrow of hundreds of launch owners who have recently supplied their craft with new electric whistles. Many local dealers will also be affected, as a number of these were heavily stocked with the latest devices in whistles.

The Lake Erie, Bowling Green and Napoleon Railway Company has been granted a franchise from Bowling Green to the county line at Grand Rapids. Seven miles of the track to Tontogany will be built this summer. This will connect with the Lima and Toledo line from the north and south and give a much improved connection with the county seat from the western part of the county. H. L. S.

Michigan.

Detroit, April 20.—Work has been commenced on the dam on the Manistee River two miles above Sherman, in Wexford County. It is to be 40 feet high and 800 feet long and will cost about $400,000. Four thousand horsepower can be developed continuously. The plant will have a capacity of 8,000 horsepower, and the large storage capacity will permit this amount to be developed during peak loads. This is the first of a number of dams on the Manistee River, several sites having been surveyed.

The Michigan State Telephone Company will reconstruct the entire system at Ludington. The building will be remodeled and a complete common-battery, switchboard installed. The plant will be modernized in every respect and the service brought up to the standard of the larger cities.

The Michigan Power Company of Lansing, successor to the Piatt Power and Heat Company, expects to build a new waterpower plant at Dimondale and a steam plant on the Grand River in Lansing. The steam plant will have a capacity of 2,350 horsepower and will be an auxiliary to the waterpower plant and replace the two steam plants now in service. The new dam on the site of the old Piatt plant is nearly completed. This plant will have a capacity of 2,000 horsepower in two units.

Work on the Jackson-Lansing electric railway, which was stopped last fall, will be resumed within three weeks. The line will be completed as far as Mason. D.

Indiana.

Indianapolis, April 18.—The Grand Central Traction Company has filed an $8,000,000 note and mortgage with the county recorder of each of the several counties between Indianapolis and Evansville, through which the company proposes to build a traction line. The company's line when completed will connect many of the principal cities and towns between Indianapolis and Evansville.

The construction of the Mattoon-Shelbyville-Pana-Hillsboro electric railway is said to be assured. This line, when completed, will connect a number of towns and cities in Western Indiana and Eastern Illinois, and make it possible to travel by interurban from Indianapolis to St. Louis without changing.

The commissioners of Adams County have ordered a subsidy election on May 14th to vote upon the proposition of a tax in aid of the construction of the Fort Wayne and Springfield Railroad. If this tax is voted, it will stimulate the immediate building of a branch of the same system south from Decatur to Richmond.

It is said that A. A. Boyd, R. F. Garrettson of Michigan City and W. L. Taylor of Indianapolis have purchased the plant of the Madison Light and Railway Company of Madison, Ind. It is the purpose of the purchasers to improve the plant and equip it with modern machinery.

The city of Greenfield has just put in operation the new machinery and equipment in the city lighting plant. This reconstruction has been going on for a year, and it is now declared that the plant will be of ample capacity to take care of the growth of the electric-lighting business in the city.

The commissioners of Vanderburgh County have granted a right-of-way to the Evansville Terminal Railway Company for the construction of a line from Evansville to Newburg.

The Chicago, Lake Shore and South Bend Interurban Company has obtained the contract for car-

rying the United States mail between East Chicago, Indiana Harbor and Hammond.

The General Managers' Association, composed of the managing officials of the traction companies controlled by the syndicate which owns the Fort Wayne and Wabash Valley Traction Company, will meet in Fort Wayne on the 21st in the offices of General Manager C. D. Emmons. The purpose of the organization is to economize in the purchase of supplies. The syndicate owns and controls six interurban lines throughout the county. John Blair McAfee of Philadelphia is president.

The Terre Haute, Robinson, Olney and Southwestern Railway Company, incorporated to construct an interurban line between Terre Haute, Ind., and Springfield, Ill., has secured a right-of-way on the boundary line to the city of Mt. Vernon, thence to Springfield.

An election will be held on the 23d inst. at Redkey to vote on the proposition to issue bonds for the purpose of building an electric-light plant. The estimated cost of the plant is $15,000.

The Indiana Municipal League will hold its annual convention in Laporte on June 16th. An excellent programme has been prepared and many questions relating to public utilities will be discussed.

S. S.

Illinois.

Peoria, April 18.—The Alton, St. Louis and Cairo Railway Company of East St. Louis has been incorporated with a capital of $100,000. It is proposed to build a road from Alton to Cairo, with a branch to Columbia, Waterloo and Mammoth Cave. The board of directors include B. L. Renfrew and C. H. Walters of Springfield.

The Woodstock and Sycamore Traction Company of Chicago has been incorporated with a capital stock of $1,000,000 to build a line from Woodstock to Sycamore. Clinton G. Lumley and E. C. Spinney are among the directors.

The Village Board of Manito has voted to bond the town for $3,500 to buy and assume control of the electric-light plant. J. N. Smith, owner, stopped work with the poles set and part of the machinery in place. The village will pay him $1,600 for his part of the plant and advertise for bids for the completion of the work.

At Chapin the people are considering the extension of electric lights to the residence part of the town.

G. M. Gest has resumed the laying of the conduit system of the Peoria Gas and Electric Company in this city. As soon as the main conduits of the system are laid the work of connecting the consumers with the service boxes will be taken up. The work on installing the wires will commence upon the completion of the underground conduits.

The interurban road between St. David and Canton will be in operation about the first of May.

A public safety ordinance regulating wiring in the city of Peoria has been introduced into the City Council and referred to a committee. The ordinance places the inspection of the wires under the charge of the city electrician and provides the necessary fees for the work of inspection, together with the licensing of both the master electricians and the journeymen.

V. N.

Oklahoma.

Oklahoma City, April 18.—The Detroit Interurban Railway Company is receiving material for work on the line between Sulphur and Chickasha. E. M. Hopkins of Detroit, Mich., is president of the company.

John W. Shartell, general manager of the Oklahoma Street Railway Company, has just returned from the East and has made arrangements for several new extensions to the system just as soon as the new power plant is complete, which may be within 30 days.

The Wandell Motor Plow Company has been incorporated with a capital stock of $500,000. The incorporators are H. A. Thompson and Edward Croin of Brooklyn, N. Y., and Fred P. Owen of Oklahoma City.

The Oklahoma Telephone, Electric Light and Power Company has been incorporated with a capital stock of $20,000. A. P. Cash, J. W. Keller, L. D. Keller and H. E. Cash, all of Maysville, Okla., are the incorporators.

The rural telephone companies at Augusta, Okla., are considering a proposition to organize and build an exchange in Augusta. There are six rural companies which own systems centering in Augusta with over 500 subscribers. George A. Duel is sec[illegible]

K.

Western Canada.

[illegible] The [illegible] Iron Works Company of this city has just completed the installation of electric motors throughout its shops, having discarded steam except for heating pur[illegible]

[illegible] and Lake Winnipeg street railroad will shortly be operated by electricity. The installation is complete and officials of the company made a trial trip over the lines which for the last two years have been operated by steam. Wilford Phillips, Winnipeg, Man., has control of the road, it being a subsidiary company of the Winnipeg Electric.

The taxpayers of Indian Head, Sask., have voted in favor of spending $10,000 for extension to the civic electric-lighting plant. O. J. Godfrey is town clerk.

At a meeting of the civic sub-committee of the City Council of Winnipeg it was decided to notify all companies having wires to place them underground within a year from date. F. E. Cambridge is city electrician.

Messrs. Skinner & Colison of Estevan, Sask., are considering the installation of an electric-lighting plant at Killarney, Man.

At a meeting of the Town Council of Selkirk, Man., it was decided to purchase the electric-light and power plant owned by a private company in that town. The company is willing to sell.

The Bull River Power Company, now constructing a plant near Cranbrook, P. C., has built a bed for its big flume nearly two miles long. When the plant of the company is completed it is expected that electricity will be supplied to almost every city and town in the Kootenays as well as to all the logging and mineral camps. The capacity of the plant is estimated to be about 10,000 horsepower. George Henderson is manager of the company

The people of Pincher Creek, Alb., are anxious to install an electric-lighting system and have sent Mayor James Scott on several inspection trips to see plants in adjacent towns.

R.

Northwestern States.

Minneapolis, April 18.—The Mitchell Gas Company of Mitchell, S. D., will become the property of the Mitchell Illuminating and Power Company after May 9th. The gas company started the 24-hour electric-light service recently.

The village council at Perham, Minn., has placed the management of the electric-light and water system into the hands of a commission, consisting of J. P. Coughlin, Dr. E. C. Schoonmaker and J. W. Donahue.

The state railroad commission at Madison, Wis., has denied the petition of the city of Chilton, Wis., for the erection of a municipal lighting plant, to compete with the Wisconsin Electric Service Company of that place.

The city power plant at Caledonia, Minn., was put into operation recently. The estimated cost is placed at $8,000.

The new block-signal plant recently completed by the Great Northern Railroad between Minneapolis and St. Paul is in operation at a cost of $100,000.

The Langlade Power Company of Langlade, Wis., has been incorporated with a $300,000 capital for the purpose of furnishing electric power from Gardner dam on the Wolf River to Shawano, Wis., and other points.

The perfection of an electric-lighting system at Wolsey, S. D., is contemplated.

G. W. Scott, consulting engineer of Waterloo, Iowa, estimates the cost for the construction of an electric road from Waterloo to Des Moines at $3,868,600.

The proposition for a municipal lighting system at Cameron, Wis., was defeated at the election.

R.

Pacific Slope.

San Francisco, April 15.—An interesting state of affairs is said to prevail in the management of the San Francisco Gas and Electric Company, of which the Pacific Gas and Electric Company is the holding corporation. While a prominent eastern official of the Standard Oil Company has denied the truth of the reports recently published in this city to the effect that the Standard had acquired the control of the Pacific Gas and Electric Company in connection with the new financial plan and consolidation of the leading electric power interests in San Francisco territory, an impression remains here that there was much truth in the story. While the Standard Oil corporation may not directly own the electric companies involved, it is considered probable that individuals prominent in the big oil concern will in future dictate the policies of the Pacific Gas and Electric Company and its allied corporations.

The only independent electric-lighting and power concern is now the City Electric Company, which has a 10,000-kilowatt generating station in the northern part of the city. The Stanislaus Power Company, which will have a hydro-electric power plant of 30,000 horsepower completed within a year, is now in the "combine." Three 10,000-horsepower tangential waterwheels have been completed by the Pelton Water Wheel Company in San Francisco and will be shipped to this company's power station near Vallecito at once. The Great Western Power Company, which will, according to statements of its engineers, have a 60,-[illegible] hydro-electric power plant completed at the Big Bend of the Feather River late this fall, will be one of the most important factors in the great consolidated system. Rapid work will have to be done in the construction of the steel towers that support the transmission lines if current is to be transmitted to San Francisco before January 1st next.

Shipley & Co. of San Francisco have completed estimates for the proposed municipal electric-lighting plant for the city of Pendleton, Ore. The estimate places the cost of the plant at $101,360.

J. W. Roper of the Midas Gold Mining Company of Chico, Cal., states that the company will spend between $40,000 and $50,000 on the erection of a power plant on Bee Gum Creek in Shasta County to develop power for the company's mining property. Representatives of the company have filed on 5,000 inches of water in Bee Gum Creek. The plans of the company involve the building of a transmission line seven miles long. The initial installation will generate 800 horsepower, to be increased later to 2,000 horsepower.

General Manager F. E. Fitzpatrick of the Coast Counties Power Company states that the company's transmission line will be completed to Santa Cruz, Cal., within the present year. Another steam turbine is to be added to the company's beach plant.

The Rawhide Light and Power Company has been granted a franchise for an electric transmission system in the new mining camp of Rawhide, Nev. The plant will be erected at once. The necessary poles are already on the ground and the engines and other equipment have been bought.

S. C. Moore has returned to Klamath Falls, Ore., and has resumed operations on Moore Bros.' power plant, preliminary work on which was begun last fall.

The board of regents of the Washington State University, Seattle, Wash., has approved plans for a new power plant at the university. The plans involve an expenditure of between $75,000 and $100,000.

The Clatskanie Electric Light Company of Clatskanie, Ore., is planning to remodel its steam generating plant and to install an auxiliary engine to furnish power in the daytime. A 60-horsepower dynamo has just been received.

J. S. N. Smith of Coos Bay, Ore., says that surveys for the Coquille Valley Power Company's pipe line, power house and flumes have been completed and that work on the plant will begin within two weeks. The company has contracted to furnish power to the towns of Myrtle Point, Bandon, Marshfield and North Bend. The initial installation will provide for the generation of 4,000 horsepower of electric current. The transmission line of the company planned for immediate construction will be 33 miles long

The Hallatin Valley Electric Company has been incorporated at Bozeman, Mont., for the purpose of constructing 26 miles of interurban electric road from Bozeman as a terminal.

J. N. Wilmot, representing the Seattle Electric Company, has applied for an electric-railway franchise through the town of Wenatchee. In its application, the company states its purpose of running a line from Wenatchee to the towns of Monitor, Cashmere and Leavenworth.

A.

PERSONAL.

Mr. George E. Colgate of Batavia, N. Y., will assume the management of the Ontario Light and Traction Company and the Canandaigua Gas Light Company on May 1st, and will cause radical changes to be made in the lighting plants of Canandaigua. Mr. Colgate has been general manager of the Consolidated Gas and Electric Company of Batavia.

Mr. J. M. Schilling, who for the last two years has been connected with the detail and supply department of the Chicago office of the Westinghouse Electric and Manufacturing Company, covering the Illinois territory, was transferred to the lamp department on April 1st and will look after the Chicago territory.

Mr. Edward C. Folsom has resigned as general superintendent of the railway department of the Saginaw-Bay City Railway and Light Company and will leave Saginaw, Mich., to go to Cleveland, where he will superintend the manufacture of a number of street-railway improvements which he has recently invented and had patented.

Mr. William A. Jackson, chairman of the executive board of the Michigan State Telephone Company, declined re-election at the annual meeting in Detroit on March 14th and retired from the company. Mr. Jackson has been prominent in the telephone field for nearly 30 years. To succeed him as chairman, Mr. John T. Shaw of Detroit was elected. Mr. W. L. Burrows succeeds Mr. Shaw as treasurer of the company.

Mr. W. A. Blonck, consulting electrical engineer, Chicago, left this week for Europe, his principal object being to visit the old homestead at Wriezen, Germany, where his mother, brother and sister reside. Mr. Blonck only recently recovered from a severe illness and operation for appendicitis. Before returning from Europe, in about six weeks, he will visit a number of large cities in order to

bring with him any new ideas [illegible] in the foreign electrical field.

Mr. C. W. Burkett, for the last five years chief engineer of the Wisconsin Telephone Company, with headquarters at Milwaukee, has been appointed chief engineer of the Pacific Telephone and Telegraph Company, with headquarters in San Francisco.

Mr. Arthur R. Kahl of Louisville, Ky., has been appointed to a position as engineer for the General Electric Company, at Manchester, England, and sailed from New York for that city April 16th. He has been for the last three years at Rochester, N. Y.

Mr. Henry Floy, consulting engineer, has been retained in a consulting capacity by the city of New York in connection with the removal of the aerial lines of the New York Central Railroad within the city limits. This case is now on hearing before the Public Service Commission for the First District of the State of New York. Mr. Floy has removed his offices from the St. Paul Building, 220 Broadway, to the City Investing Building, 165 Broadway.

ELECTRIC LIGHTING.

Wahoo, Neb., has voted bonds to the amount of $15,000 for an electric-light plant.

The St. James (Mo.) Ice and Power Company has been incorporated and will put in a lighting plant.

The Columbus Electric Light and Power Company of Columbus, Mont., has been incorporated with a capital stock of $20,000.

The Eureka-Blue Springs Water Company has been organized and will put in a waterpower electric plant at Eureka Springs, Ark.

The dedication of the new street-lighting scheme on Felix Street in St. Joseph, Mo., a few nights ago was the occasion for a big parade and general celebration. The street is called the Way of Light, and the scheme is to be adopted by merchants on other business streets.

The village of Orion, Ill., is raising $5,000 in subscriptions of $100 each—accepted in the nature of loans—for the rebuilding of the village electric-light plant, which was destroyed by fire. The village owes $1,875 in bonds on the old plant. The boilers were not damaged by the fire. If the dynamo can be repaired it is estimated it will cost $3,800 to put the plant in good shape.

A 30-day option on the plant of the Hot Springs Electric Light and Power Company at Thermopolis, Wyo., was taken recently by E. J. Thompson of Billings, Mont., who agrees to pay $30,000 for the plant. The Hot Springs company's power is derived from the hot springs belonging to the state and is said to be the only one known to be operated by water subterraneously raised to the boiling point.

The annual report of the Philadelphia Electric Company submitted by President McCall showed gross receipts of $4,984,350.61 for 1907. The net income after paying all operating expenses, taxes, fixed charges and depreciation was $909,349, an increase over 1906 of more than 10 per cent. There was paid in dividends $499,935. There was added to surplus account $409,414, making a total surplus of $2,141,934. There was expended on construction account $2,316,544. There has been expended up to the present for construction $10,811,647. The real estate holdings and buildings aggregate $2,262,545.

The newly erected Japanese hydraulic plant at Ushigawa, which supplies the city of Tokio, contains six main turbine sets of 3,000 kilowatts. It is run on the 6,000-volt, three-phase system. A bank of nine transformers in the station gives 60,000 volts for the pole line, which runs for 36 miles to Tokio. Here there is a sub-station which receives the line and in turn delivers current at 11,000 volts. Underground cables lead from this point throughout the city, where there are 11 substations. The latter are designed to supply current at 2,000 volts for the city mains.

ELECTRIC RAILWAYS.

Plans are under way for the building of a union terminal station for the use of the electric interurban railways that are soon to radiate in every direction from Kansas City. Agents have been busy obtaining a site for the new terminal station to be located on the west side of Baltimore Avenue, between Twelfth and Thirteenth streets.

John I. Beggs of Milwaukee has expressed the belief that within a few years the State Legislature of Wisconsin will demand that the electric railways of the state carry freight and baggage, which today they are prohibited from doing under the franchises under which they are operating. The electric lines will probably soon take charge of the transportation of all the milk supply of cities which are connected with electric roads. The garbage question may also be solved, as ashes and [illegible]

The line of the Washington, Baltimore and Annapolis Electric Railway Company [illegible] and 15 minutes. It is unlikely that any effort will be made now to reduce the time, although [illegible]

The Tri-City Railway Company [illegible] to the guests one of the best river entertainments they have ever enjoyed. The employes in the three cities, Davenport, Rock Island and Moline, have many friends extending to all sections of the community, and it is expected that a large attendance will be secured.

The plan of having electric-motor cars used in the suburban service of the Baltimore and Ohio Railroad in the vicinity of Pittsburg, Pa., and on some other sections, was considered at a staff meeting in Pittsburg a few days ago. In addition to this there was considerable discussion as to improving the suburban service in various parts of the country. The plan to use electricity on the Pittsburg section may, it is said, be put into effect in the near future.

The Underground Electric Railways Company of London has been placed in the hands of Sir George Gibb as receiver and general manager on an application made by Speyer Brothers, bankers, New York, on behalf of themselves and other holders of the temporary profit-sharing secured notes of the company. There was no opposition to the application, which is necessary for the carrying out of the scheme for the readjustment of the company's finances. The unsatisfactory condition of the Underground company's finances is said to be due to the competition of the motor omnibuses and the municipally owned electric street railways. The district railway, which the late Charles T. Yerkes took over, also has been losing money since electricity was installed as a motive power, and the other tubes which Mr. Yerkes estimated would be completed early in 1906 are not yet in operation. The company's issued capital amounts to $61,000,000.

POWER TRANSMISSION.

The Little Wolf River Power Company has been incorporated at Oshkosh, Wis., capitalized at $250,000. Leander Choate is president, and the other officers include Casper Faust, Frank H. Josslyn and E. H. Steiger. The company owns four dams on the Little Wolf River and will unite the waterpower for a light and power plant.

Argument on the suit by the state to enjoin the completion of the Economy Light and Power Company's dam at Dresden Heights, on the Desplaines River below Joliet was begun before Judge Julian W. Mack on April 20th. Walter Reeves of Streator, Ill., who made the opening argument for the state, declared that the Desplaines River has at all times been a navigable stream and that it was not within the power of the canal commissioners to grant the privileges conveyed to the light and power company. It may require two weeks to hear the case.

The 70-foot dam of the Helena Power Transmission Company on the Missouri River 15 miles below Helena, Mont., broke a few days ago, causing much damage to property. The flood caused by the release of the water of Hauser Lake destroyed the entire village of Craig, and its 40 houses were carried away. Buildings and live stock of numerous ranches are said to have been destroyed. The telegraph and couriers were employed to warn people in the path of the water. At Great Falls, Mont., the plant of the Boston and Montana smelter was saved from serious damage by hundreds of men who worked all night on the construction of a wing dam. M. H. Gerry is general manager of the company. The dam will be rebuilt at once. It is said that the construction company will be liable for the damage done by the breaking of the dam.

PUBLICATIONS.

In a neat catalogue, No. 7C, Mathias Klein & Sons, 87-89 West Van Buren Street, Chicago, list an attractive line of high-grade linemen's tools. This company carries a full line in stock, and its goods are well known.

The Worcester Electric Manufacturing Company, 42 Lagrange Street, Worcester, Mass., is sending out an illustrated folder calling attention to its line of switchboards, panel boards, fuse blocks, starting panels, front and back-connected switches, etc.

Directions for setting the valves of Reynolds heavy-duty and Reliance Corliss engines are given in a leaflet issued by the Allis-Chalmers Company, which it offers to send to engineers and others interested. A thorough knowledge of the design and adjustment of valves is essential to the engineer, [illegible]

[illegible] vitrified-clay conduit. This company is a specialist in conduit manufacture. The annual capacity of [illegible]

[illegible]

The Hyatt Roller Bearing Company of Newark, N. J., has just issued Bulletin No. [illegible] of the Hyatt roller-bearing bushing. This company has now standardized its products, and as the result of some 15 years' experience is now prepared to offer the trade over 300 sizes of standard Hyatt bearings, each providing for the different conditions of speed and load. Each bearing is provided with a capacity rating which enables the prospective user to determine what would be the most efficient and suitable size. These bearings will be reasonable in cost and will be carried in stock by agents in the United States and Europe. The bulletin is well illustrated and gives much information on bearings and frictional resistance.

Five new bulletins received from the Crocker-Wheeler Company, Ampere, N. J., are of interest. Bulletin No. 95 tells of a belted type alternating-current generator designed upon entirely new lines. Bulletin No. 97 is devoted to direct-current switchboard panels, 125-250 volts. Form L machines are described in Bulletin No. 98. These machines are of the belted type, direct current, the motors ranging from one-twentieth to five horsepower and the generators from 0.6 to 25 kilowatts. An interesting description of Crocker-Wheeler motors in the Bethlehem rail and structural mills is given in Bulletin No. 99. In Bulletin No. 100 the belted type, direct-current form I machines are described. Of these machines the motors are 5 to 45 horsepower and the generators 4½ to 40 kilowatts.

The Expanded Metal and Corrugated Bar Company, Frisco Building, St. Louis, has just issued a handsome book devoted to corrugated bars for reinforced concrete construction. There is a general and rapidly increasing use of reinforced concrete for all classes of buildings and other structures. The corrugated bars made by this company adapt themselves to building work admirably and appeal to architects and engineers. Four types of bars are made, rolled to different sizes and weights. The book gives details of floor construction, building construction, foundations, railroad structures and miscellaneous structures, with tables, formulæ and other valuable information. There are many drawings showing details of construction and more than a hundred interesting illustrations of reinforced-concrete buildings and structures in which corrugated bars are used.

Rather curiously, two magazines bearing the title Popular Electricity appear at the same time, one in Chicago and one in New York. The former contains 60 and the latter 36 pages of reading matter. Both of these first issues bear date of May, 1908, the Chicago publication issued by Popular Electricity Publishing Company and the New York one by Electricity Publishing Company. Both are intended to be "popular" rather than technical, with easy reading, stories and jokes, particular attention being paid to children and young people. The Chicago magazine is well printed and illustrated and has the first chapter of a serial on "Elementary Electricity" by Dr. E. J. Houston. In the New York magazine there is a department with the candid title of "The Editor's Lucid Intervals." It was evidently in one of the other intervals that a page was prepared from two articles that had originally appeared in the Western Electrician, but for which no credit is given.

SOCIETIES AND SCHOOLS.

The next annual meeting of the Michigan Electric Association is announced for August 18th to 21st, at Grand Rapids, Mich. Mr. A. C. Marshall of Port Huron is secretary, and Mr. H. W. Hillman, Grand Rapids, president.

"The New Haven System of Single-phase Distribution" was the subject taken up at a meeting of the Boston Section of the American Institute of Electrical Engineers held on April 15th, in the auditorium of the Edison Building, 39 Boylston Street. A discussion dealt particularly with the balancing of three-phases.

The next meeting of the Chicago Section of the Illuminating Engineering Society is to be held May 14th, and will be devoted to the subject of "Wrinkles" in connection with the illumination of residences and small stores. The object is to bring out methods which have been used to advantage in improving illumination in old installations at a

minimum expense. Members are requested to prepare short descriptions of such "wrinkles" with sketches for the transactions of the society and to bring or send them to this meeting. These papers should be submitted in writing, so as to minimize the stenographic work, and to make certain that the descriptions are correct.

Lehigh University, at South Bethlehem, Pa., has now a list of 118 candidates for degrees in science and engineering to be conferred this coming June. They are classified as follows: Master of science, 6; civil engineer, 40; mechanical engineer, 28; engineer of mines, 19; electrometallurgist, 1; electrical engineer, 18; bachelor of science in chemistry, 3; chemical engineer, 3.

Purdue University's annual catalogue for 1907-1908 gives the names of 2,085 students, of whom 59 are graduates. The school is located at Lafayette, Ind., and is exclusively under state control. It aims to afford the young men and women of Indiana an opportunity to acquire a good college education, particularly such as will fit them to engage in practical industries. There is a regular course in electrical engineering and a telephone-engineering course. A separate electrical engineering building is well equipped with apparatus. The associate professors of electrical engineering are J. W. Esterline and H. T. Plumb, while A. N. Topping is assistant professor.

The regular meeting of the Minneapolis Electric Club, held in the assembly room of the Minneapolis General Electric Company on April 10th was of unusual interest because of the demonstrations accompanying the papers. One of the features of the meeting was the demonstration of the Monson automatic telephone by A. M. Severson. This was preceded by a paper on "The Wireless Telephone," by E. C. Clarke. Others who read papers were George Raymond, on "Joint Pole-line Construction," and Albert Christianson, on "Electric Light as Applied to the Propagation of Plants." A few minutes was given over to answering queries contained in the question box. President W. O. Hartig presided over the meeting.

The semi-annual meeting of the American Society of Mechanical Engineers will be held in Detroit, Mich., on June 23d to 26th. Among the papers to be presented are: "Clutches," with special reference to automobile clutches, by H. Souther; "Horsepower, Friction Losses and Efficiencies of Gas and Oil Engines," by Prof. L. S. Marks; "The Thermal Properties of Superheated Steam," by Prof. R. C. H. Hock; "A Journal Friction Measuring Machine," by Henry Hess; "A By-product Coke Oven," by W. H. Blauvelt; "Tests of Some High-speed Steam Engines," by F. W. Dean. There will be a symposium upon machinery for conveying materials, with papers by several authorities. The Society for the Promotion of Engineering Education and the Society of Automobile Engineers will also hold their annual meetings in Detroit at this time.

TELEGRAPH.

Vice-president and General Manager E. J. Nally of the Postal Telegraph Company has been in Goldfield, Nev., where he arranged with F. Y. Williams and T. G. Waterhouse of Tonopah, directors of the Southern Nevada Telegraph and Telephone Company for the use of this company's lines for the Postal service in Southern Nevada. The line will follow the right-of-way of the Santa Fe Railroad in Southern Nevada, and after being firmly established in that portion of the state the company will extend the lines into Reno, it is said.

MISCELLANEOUS.

One of the poles supporting the telephone wires which span the ship canal at St. Catherines, Ont., is made of reinforced concrete. It is 150 feet high, said to be the longest concrete pole in the world. The pole weighs 45 tons and tapers from 31 inches at the bottom to 10 inches at the top, the base [illegible] set 10 feet deep. It was made in a horizontal position and raised in one [illegible]

A workman of the Chicago City Railway Company was killed by an electric shock in an abandoned cable vault at Wabash Avenue and Twenty-first Street a few days ago. He entered the vault to remove an old cable guide wheel, around which the street-car cable used to turn on its way to the power house. The wheel probably became [illegible] feed wire. When found the man was dead, but standing erect and still clutching the wheel.

[illegible] are still coming in. This is the first annual electrical show to be given by the Nebraska Electrical [illegible]

Taft banquet will be left as they were. The exhibitors are making an especial effort to show latest machines and methods. A complete six-room electric cottage will be placed in the center of the floor. Electric heating and cooking will be demonstrated.

In designing lightning arresters, the engineers of the General Electric Company have considered the great variety of conditions and phenomena produced by lightning when the term is used in its broadest sense, including all effects of abnormal voltage. The graded shunt resistance multigap lightning arresters for 1908 are described in a recent bulletin, as well as low-voltage arresters, static dischargers, constant-current horn arresters, disk-connecting switches, choke coils and the type M, form D-2 direct-current arrester for voltages up to 6,000. The multigap arresters for high voltages consist essentially of a series of knurled cylinders placed closely together, the discharge taking place across the path of gaps thereby produced and being extinguished before the dynamic current can follow it for more than half a cycle by reason of the peculiar composition of the metal making up the cylinders. The multiple connection of the arresters allows them to relieve strains between line and line as well as between line and ground. An important feature of their design is the absence of series resistance, which gives a free discharge at high frequencies as well as a free discharge of large quantities of lightning.

TRADE NEWS.

On April 22d the offices of the Excello Arc Lamp Company in New York city were moved to 30 and 32 East Twentieth Street.

The Electric Light and Waterworks Department (H. C. Sterling, superintendent) of New London, Wis., will be in the market in about three weeks for a 100-horsepower Corliss engine and an 80-kilowatt generator.

Franklin S. Beardslee, president of the Beardslee Chandelier Manufacturing Company, has purchased the property at 176-178 South Clinton Street, Chicago, which has been occupied by the company under a lease for two years. The building is five stories and basement and occupies a lot 44 by 160 feet.

The executive offices of the Westinghouse Electric and Manufacturing Company, now at 111 Broadway, New York, N. Y., and the New York sales offices and export offices of that company, now at 11 Pine Street, were removed on April 20th to the new City Investing Building, No. 165 Broadway, New York.

The General Electric Company says that it has obtained very satisfactory results with the tungsten lamp. It has shipped over 75,000 to all parts of the country, and the breakage in shipment is below 1½ per cent. The company adds that it is issuing a new bulletin covering tungsten lamps, both series and multiple, and is in position to make prompt shipments.

The Bureau of Manufactures has received a communication (file No. 2099) from a resident of France, in which he states that he is thoroughly acquainted with the most active industrial and mining sections of that country. He desires to correspond with manufacturers of electrical and industrial supplies with a view to exploiting the surrounding territory in this line of goods.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 3 p. m. on May 20th for the installation of a conduit and electric wiring system for the United States postoffice and courthouse building and extension thereto at Tyler, Tex., in accordance with drawings and specifications to be had at the supervising architect's office, or at the office of the superintendent of construction, Tyler, Tex.

The Crocker-Wheeler Company has just moved its New York city office across the street to new quarters at 32 Cortlandt Street, in the Cortlandt Building, Hudson Terminal. This 22-story building, the largest in the city, bids fair to be the machinery headquarters of New York. The new location is of special convenience to customers and to the company, as it brings the New York office into closer touch than ever with the works and main office at Ampere, N. J.

BUSINESS.

The latest monthly stock list of Wickes Brothers, machinery manufacturers and dealers, Saginaw, Mich., contains a large list of boilers, engines, generators, motors and miscellaneous machinery and material.

The Herman Andrae Electrical Company of Milwaukee recently gave a housewarming to employes at the company's new quarters, which was followed by a dinner at the Bismarck. About 50 men participated, Herman Andrae presiding at the head of the table. Interspersed among the different courses were interesting talks on different phases of electrical construction. It is the intention of the company to assemble the officers and men frequently.

J. N. Kelman, 1000 North Main Street, Los Angeles, Cal., is a maker of high-voltage switches that have attracted attention. His oil circuit-breakers in the Fernando (Cal.) sub-station are built to break 75,000 volts.

The Benjamin Electric Manufacturing Company of Chicago and New York is much gratified at the interest taken in its "tungsten arc" fixture. This fixture possesses many features which will readily appeal to users of tungsten lamps, and the company will be pleased to forward complete description on application.

The MacGillis & Gibbs Company, Milwaukee, Wis., announces that in addition to its large stock of white cedar poles it has in its yards at Gladstone and Daggett, Mich., a choice stock of Northern Michigan white cedar ties. The company is in a position to furnish special ties seven feet and eight feet long for electric railways for city and interurban use.

A late circular from the H. W. Johns-Manville Company, 100 Williams Street, New York, is devoted to Vulcabeston packings. The sheet packing is an asbestos fibrous packing, vulcanized under extremely heavy pressure, and has great tensile strength. It makes tight joints on smooth or rough flanges, is pliable and will not harden, char or crack. The rope packing is exceptionally well adapted to meet conditions of high pressure or superheated steam, hot water, acids, ammonia, etc. It is composed of long fibers of pure asbestos vulcanized, with only enough organic matter to serve as a binder.

Dossert & Co., 242 West Forty-first Street, New York city, have received an order from L. K. Comstock & Co. for solderless connectors and terminals for use in the Silversmiths Building, Maiden Lane, New York city. L. K. Comstock & Co. have also ordered a large number of Dossert lugs of 1,500,000 circular-mil size for the generators and generator panels in the City Investing Building. The San Francisco Gas & Electric Company has received a large shipment of Dossert solderless cable taps, comprising 200 for No. 0000 cable, 100 for No. 0 cable and 100 for No. 2 cable for the Underground Department. Dossert & Co. have also received a large order for solderless connectors and terminals to be used in the wiring of the beautiful new office building for the Senate in Washington, D. C.

The Chicago branch of the Excello Arc Lamp Company, located in the Electrical Building, 118-132 West Jackson Boulevard, is moving into larger and more convenient quarters on the second floor of the same building. This change was made necessary owing to the remarkable demand for Excello lamps, brought about by the persistent and able efforts of Western Manager Armstrong. The new quarters will enable the company to handle its constantly increasing western business in a manner pleasing to the customer as well as to the manufacturer. The new quarters are about three times as large as the old ones and will give the company every facility for demonstrating the merits of the Excello lamp, and filling orders promptly. A complete stock of lamps is carried by the Chicago office.

DATES AHEAD.

Missouri Electric Light, Gas and Street Railway Association, Marquette Hotel, St. Louis, April 23d, 24th and 25th.

American Electrochemical Society (general meeting), Hotel Ten Eyck, Albany, N. Y., April 30th and May 1st and 2d.

Omaha Electrical Show, Auditorium, Omaha, Neb., May 4th to 9th.

Nebraska Electrical Association (annual meeting), Omaha, Neb., May 6th and 7th.

Missouri Independent Telephone Association, Kansas City, May 6th and 7th.

Southwestern Electrical and Gas Association (annual meeting), El Paso, Tex., May 7th, 8th and 9th.

Grand Rapids Electrical Show, Grand Rapids, Mich., May 11th to 16th.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 13th and 14th.

National Electric Light Association (annual convention), Auditorium Hotel, Chicago, May 19th to 22d.

Oklahoma Electric Light, Railway and Gas Association (annual convention), Guthrie, Okla., May 25th, 26th and 27th.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

Michigan Electric Association (annual meeting), Grand Rapids, Mich., August 18th to 21st.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay Island, August 25th, 26th and 27th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 14, 1908.

884,353. Electric Switch. Herbert H. Berry, Enfield, England. Application filed December 16, 1905.

A case with a hinged cover has a switch member arranged within it. A sliding plunger is movable in the cover and adapted to contact with the switch member in the case when the cover is in the closed position. Means prevent the closing of the cover as long as the movable member is in the "on" position.

884,358. Electrically Synchronized Time-measuring Instrument. Bahne Bonniksen, Coventry, and Frederick A. Chandler, Leamington, England. Application filed August 9, 1904.

In combination with the clockwork mechanism is a magnet, an armature, a stud adapted to move therewith, a part adapted to rotate quickly and a contracting radial guide adapted to rotate with this part and to be traversed by the stud.

884,367. Electrical Water Heater. Edward J. Condon, New York, N. Y., assignor of one-third to Eleazer I. Rains and one-third to George W. Ruppert, New York, N. Y. Application filed June 8, 1907.

A number of chambers are arranged in a series so that the water passes through all of them. Conducting and heating pipes also carrying water are mounted in the centers of the chambers. These pipes are electrically heated.

884,381. Telegraph Transmitter. Mark S. Haling, Weaver, Minn. Application filed May 22, 1906.

In this telegraph key there is a spring-actuated vibratory member, a bar carried thereby, a yieldable spring contact supported by the vibrator, and a block adjustable on the bar and having a notch or recess for the reception of the contact spring.

884,397. Overhead Trolley. Allen P. Lord and Nathaniel Wilkins, Bradford, Pa. Application filed January 11, 1907.

This wheel has a rotatable center with a shallow groove, stationary plates on each side of the center for maintaining the wire in the groove, and rotatable circular disks located on opposite side of the non-rotatable plates and having their edges projecting slightly beyond them.

884,424. Electrical Fluid Heater. Mark T. Seymour, Bemus Point, and Alton W. Ball, Stowe, N. Y. Application filed December 2, 1907.

The heater consists of an open-ended metal tube of equal diameter throughout, spiders or racks of insulating material supported within the tube, a metal rod connecting the spiders, tubular carbon sections around the rod, and separate wires connected to the metal tube and rod.

884,441. Coin-controlled Apparatus. John A. Weser, New York, N. Y. Application filed June 23, 1906.

The apparatus has an electric motor, traveling contacts in its circuit, actuating means for moving the contacts in one direction and by a single operation through a number of steps to start and continue the operation of the motor, and independently actuated means for moving the contacts successively in the opposite direction in a series of step-by-step operations until the motor is brought to rest.

884,456. Insulating Compound. Nathan Booth, Alexandria, Ind., assignor to the Banner Rock Products Company, Alexandria, Ind. Application filed April 20, 1907.

The compound comprises mineral fibers bound together with a binder consisting of approximately 25 per cent. peat, 25 per cent. wood pulp, 37 per cent. grease and 13 per cent. flour or other gluten.

884,458. Electric Current Regulator. Arthur W. Brice, Rochester, N. Y., assignor to the Rochester Surgical Appliance Company, Rochester, N. Y. Application filed March 20, 1905.

An incandescent lamp has a resistance coil wound on a drum in the socket. The coil has a series of contacts engaged by a circumferentially moving contact arm.

884,466. Switch-box. Thomas J. Cleland, Chicago, Ill. Application filed June 3, 1905.

The switch casing is formed of two sections, each having an insulating base carrying a switch terminal. The sections have openings in their walls to accommodate conductors, and are arranged to telescope one within the other, transversely to the direction in which the supply wires enter the casing.

884,470. Coin Collector. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 13, 1906.

In a coin collector for telephones in combination with a temporary receiver for a number of coins are deposit and refund chutes, electromagnetic mechanism for discharging the coins into the refund chute, the mechanism being also adapted to discharge the coins one at a time into the deposit chute, and a register operated each time a coin is thrown into the deposit chute.

884,499. Electric Spark-gap for Interrupters. Thomas B. Kinraide, Jamaica Plain, Mass. Application filed April 24, 1906.

The apparatus comprises opposite discharge electrodes, and means for interposing a film of moisture between them at the moment of current discharge.

884,500. Telephone Desk Stand. Anton M. Knudsen, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed September 2, 1904.

In combination with a hollow standard and a thin metal-supporting base is an interior base having an [illegible] thread [illegible] abutments [illegible].

884,501. Means for Measuring the Degree of [illegible] of a Selenium Cell. Arthur Korn, Munich, Germany. Application filed August 1, 1906.

There are provided [illegible] a separate source of [illegible] the receiving end of the [illegible] measured, and a galvanometer adapted to [illegible] the [illegible] of light in accordance with [illegible] selenium cell.

884,511. Self-starter. Walter O. Lum, Schenectady, N. Y., assignor to the General Electric Company. Application filed August 6, 1906.

An automatic circuit controller has a number of electromagnetic switches, and thermostatic devices in series with the magnet coils of the switches for successively controlling the same.

884,514. Automatic Electric Switch. Andrew H. Miller, Chesaning, Mich. Application filed March 30, 1903.

An incandescent lamp is provided with a thermodynamic switch, a co-operating electric heater arranged to close and open the lamp circuit to periodically cause a flash, and means for mounting the switch and heater within the socket, where they are inclosed and protected.

884,516. Machine for Printing from Films or Plates. Clyde G. Morgan, Mount Vernon, Mo. Application filed August 8, 1907.

The casing has a door which closes the circuit of an electric lamp when it is closed and breaks the circuit when the door is opened again. The lamp is mounted within the casing.

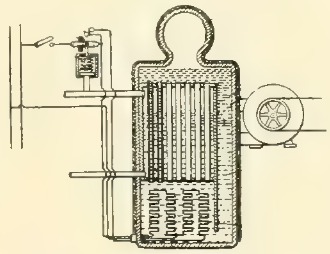
884,517. Conduit Electric Railway. Lewis W. Musick, Crescent City, Cal. Application filed August 9, 1906.

A shallow conduit between the rails has a series of contact bars mounted on rocking arms that can engage the conductor as the car passes over, thus forming a sectional contact railway.

884,519. Fuse-holder for Electric Circuit Conductors. Patrick McDonald, Rochester, N. Y., assignor of one-half to George Herbert Smith, Rochester, N. Y. Application filed October 2, 1905.

A seat piece is provided with a recess. A cap piece having a similar recess and an insulating shell having ends adapted to fit the recesses are provided with notches. Spring fingers on the seat and cap pieces co-operate with the notches to detachably secure the parts together. A fuse wire contacts with the seat and cap.

884,540. Electric Heater. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company. Application filed October 13, 1906.



NO. 884,540.—ELECTRIC HEATER.

This heater comprises a receptacle, containing oil with a high-flashing point and means for circulating it, a resistance conductor immersed in the oil and adapted to heat the same, and a heating system partially within the container and arranged to receive its heat from the circulating oil. (See cut.)

884,541. System of Control for Electric Motors. Leonard A. Tirrill, Lynn, Mass., assignor to the General Electric Company. Application filed February 8, 1906.

The method of operating a reciprocating motor-driven member such as a planer adapted to move at different speeds in the several directions of its travels, consists in connecting the operating motor as a compound-wound motor and then reversing the relative connections of the armature and series field windings and operating the motor as a series motor, a high resistance being then put in series with the shunt field.

884,546. Trolley Wheel. Frederick G. Walker, Cleveland, Ohio. Application filed May 18, 1906.

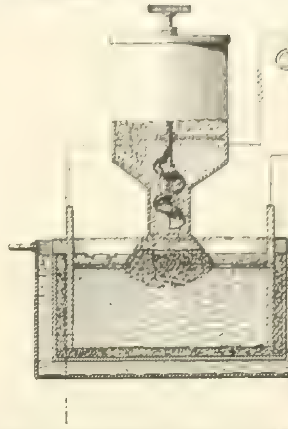
The wheel is in two complementary parts, each having a bushing forming a bearing for the center pin. The two wheel parts contain an inclosed oil cell.

884,555. Regulation of Dynamo-electric Machines. Charles E. Barry, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 20, 1905.

The machine has a main field winding supplied with current from its armature, a resistance in series therewith having a high positive temperature-resistance coefficient and an opposing winding in shunt to the resistance.

884,560. Stacker. Hiram W. Blaisdell, Los Angeles, Cal. Application filed June 22, 1906.

An apparatus for discharging material from a con- [illegible]



NO. 884,563. APPARATUS USED IN FUSING CORROSIVE MATERIAL.

A process of fusing corrosive material consists in fusing, without decomposing the same, in the presence of air by maintaining an alternating current of low density in the fused material in contact with the electrodes and of a high density in that part of the bath where the unfused material is added to the mass. (See cut.)

884,568. Machine for Making Incandescent Lamps. William R. Burrows, Newark, N. J., assignor to the General Electric Company. Application filed November 25, 1903.

In this sealing-in-machine there are supports for holding the bulb and stem in alinement with each other and permitting relative adjustment thereof, means to heat the glass, and separate connections for admitting gaseous pressure to the bulb and stem respectively in any adjusted position.

884,592. Pressure Gauge. James S. Kennedy, New York, N. Y. Application filed May 4, 1906.

A gauge for indicating pressures has in combination an electrical circuit, a transmitting device wherein the circuit is opened and closed by pressure fluctuations, a receiving device provided with indicating means and operating synchronously with the transmitter, together with means whereby the indicator has a verification pause.

884,595. Carrier System. Sam H. Libby, East Orange, N. J., assignor to the Sprague Electric Company. Application filed June 17, 1905.

A train of carriers is suspended from a supporting rail and adapted to travel thereon. There are receptacles suspended from the carriers, motors on the several carriers for driving them along the rail, a second set of motors on the several carriers for hoisting the receptacles, a source of current for the motors, an operator's carrier, and means on the operator's carrier for controlling all of the motors.

884,607. Telephone Fire-alarm System. William S. McLewee, Yardley, Pa. Application filed April 9, 1906.

A lever connected with one of the wires of the circuit is arranged so it can contact with a terminal on the wire and thus, closing the circuit, actuate a signal at the telephone exchange.

884,622. Electric-railway Signal. George A. Stafford, Belcherville; Ira P. Whitaker, Alvord and John L. Lopp, Greenwood, Tex. Application filed July 26, 1907.

A receptacle for holding an incandescent lamp is formed in two sections. A tube is detachably secured to the upper and the lower section, forming a reflector and has means for reflecting the light vertically and in front and rear of a locomotive.

884,624. Socket Cap. William S. Stapley, Bridgeport, Conn., assignor to the Bridgeport Brass Company, Bridgeport, Conn. Application filed October 22, 1907.

The cap has a central opening with an inwardly turned flange. A threaded hub fits into the opening and is locked in place by having a flange turned over the other flange.

884,630. Trolley Pole and Head. August F. Bauer, Philadelphia, Pa. Application filed November 27, 1907.

A trolley head is provided with pivoted spring-actuated harps carrying wheels and means for adjusting the harps independently.

884,641. Hanging Insulator. Walter G. Clark, New York, N. Y. Application filed October 6, 1906.

The insulator comprises an inner shell adapted to receive a hanger and merging into an outer spreading petticoat, a second shell receiving the lower end of the hanger and fitting over the inner shell, the second shell merging into a second inner petticoat, and a body portion fitting on over the second shell and having a wire-receiving means at its lower end.

884,644. System for Electric Railways. Arthur C. Eastwood, Cleveland, Ohio. Application filed October 25, 1906. Renewed September 16, 1907.

In combination with a train of cars are motors and controlling devices therefor on certain cars of the train, a control conductor along the railway and in connection with the controlling devices, and means for altering the difference of potential between this conductor and the rails of the railway so as to cause operation of the controlling devices.

884,645. System for Electric Railways. Arthur C. Eastwood, Cleveland, Ohio. Application filed February 2, 1907.

A train of cars carries a source of electric power and electric driving motors on certain of the cars. A stationary power conductor along the railway is adapted to connect the driving motors with the traveling source of power.

884,646. Electric Railway. Arthur C. Eastwood, Cleveland, Ohio. Application filed February 23, 1907.

The stationary conductor referred to in the two preceding patents is divided into insulated sections connected by normally open switches.

884,653. Electrolytic Cell. George A. Gabriel, New York, N. Y., assignor to the Bleach and Caustic Process Company, New York, N. Y. Application filed November 23, 1906.

The sides of the cell are formed of metallic plates comprising rectangular marginal portions and offset central portions forming closed cathode chambers, the cathode and diaphragm of the cell being held by the rectangular portions over the recesses formed by the offset portions.

884,664. Depolarizer for Galvanic Batteries. Ernst W. Jungner, Kneippbaden, Norrköping, Sweden. Application filed May 14, 1907.

A depolarizer for galvanic elements consists of nitrosyl-sulphuric acid dissolved in concentrated sulphuric acid and air supplied to this acid.

884,681. Shoe. Adam Reed and David A. Reed, Los Angeles, Cal. Application filed June 29, 1907.

In combination with a pair of shoe bottoms is a conductor comprising an electric element connecting the upper and lower sides of one bottom and arranged to contact at its lower end with an electrolyte, and a conductor comprising an opposite electric element in the other bottom.

884,684. Trolley Harp and Wheel. Edward D. Rockwell, Bristol, Conn., assignor to the New Departure Manufacturing Company, Bristol, Conn. Application filed June 1, 1906.

The wheel has a fixed journal whose ends project into recesses in a pair of journal boxes fitted into guides in the harp.

884,721. Paper Rewind Mechanism for Adding Machines. Shelby J. Davidson, Lexington, Ky. Application filed March 13, 1906.

Electromechanical means energizable from a moving part of the adding machine are arranged to automatically impart a step-by-step rotation to a rewind roll to take up the slack of the record strip as it comes from the impression platen and thus to store it in roll form.

884,731. Electric Igniting Device. Roy E. Hardy, New York, N. Y. Application filed December 18, 1905.

A sparking plug has one electrode in the form of an exterior metallic shell secured in the projecting end of the casing about an induction coil, and an insulated metallic conductor secured within the shell forming the other electrode, the exterior shell forming an air space between it and the induction coil and being provided with an annular recess in the adjacent end of the shell around the inner electrode.

884,737 and 884,738. Signaling System. Edward E. Kleinschmidt, New York, N. Y., assignor to George M. Seeley, New York, N. Y. Applications filed March 7 and September 1, 1906.

In a selective signaling system there are a number of signal stations, signal devices adapted when released to move automatically to stop position, a wire connecting the stations and normally carrying current, electromagnets at the several stations connected to the wire and normally holding the signal devices at clear position, and electrically actuated step-by-step devices adapted to release the signals selectively.

884,742. Electric Typewriter. Joseph Lemblé, Sennheim, Germany. Application filed May 25, 1907.

A movable contact wheel connected to a rocking shaft is adapted to control three contacts in such a manner that on striking and releasing any of the key levers the contact wheel is displaced so as to directly control a first contact for the type-carrier adjusting device, a second contact for the paper carriage controlling device and a third contact for the type-carrier return and locking devices.

884,750. Trolley. Louis C. W. Mitchell and John A. Fretz, Philadelphia, Pa., assignors of one-third to Edward J. Mitchell, Philadelphia, Pa. Application filed March 27, 1906.

The trolley harp has at its base a cap with a [illegible] having an annular groove. This [illegible] in the top of the pole. [illegible] amount of movement [illegible] pole.

884,763. Electrolytic Reduction of Metallic Compounds. [illegible] Philadelphia, Pa., assignor to the [illegible] Storage Battery Company, Philadelphia, Pa. Application filed May [illegible]

[illegible]

884,783 and 884,784. Signal System for Railways. Maximillian G. Voigtlander, Harrison, Ohio, assignor of one-half to James A. Graft, Harrison, Ohio. Applications filed August 9, 1906.

faces of a connecting bar extending between the blades.

The track is divided into blocks, a local contact in advance of any given block having electric connection therewith. A traveling recorder is arranged to make electric connection with the local contact. A local-recorder contact for each block is distanced from the first-named local contact, and a local recorder is in circuit with the local-recorder contact.

884,825. Automatic Electric Crossing Gate. Frank G. Layher, Jackson, Mich. Application filed November 27, 1905.

An electric circuit including a relay terminates at contact points on the base and spring. A rotatable shaft carries radial arms and curved arms at their ends, the curved arms respectively forcing the contact points of the base and spring into and out of contact with each other.

884,831. Alternating-current Generator. Carl A. Lohr, Wilkinsburg, Pa. Application filed February 2, 1906.

In combination with two alternating-current lines of different frequency and a generator having alternating-current windings on both of its members are means for alternately connecting at will the windings of both members to one of the alternating-current lines, or the winding of one member to the other of the lines, having the winding of the other member of the generator closed upon itself. (See cut.)

884,843. Money-drawer Alarm. Sillus Da Costa Newman, Jellico, Tenn. Application filed June 3, 1907.

An electric drawer alarm comprises a drawer support, an alarm in an electric circuit, and a series of independent contacts in the circuit between the drawer and support, each forming part of the circuit and being adapted to be successively closed as the drawer is opened.

884,919. Process for Making Nitrogen Oxides from Air. August Grau and Franz Russ, Vienna, Austria-Hungary. Application filed October 8, 1907.

The process consists in passing air into an electric arc flame and withdrawing the treated gases directly from the central zone of the electric flame substantially to the exclusion of gases from the outer zones and immediately cooling the gases.

884,920. Apparatus for Making Nitrogen Oxides from the Air. August Grau and Franz Russ, Vienna, Austria-Hungary. Application filed October 8, 1907.

This apparatus has in combination with an electric furnace for producing the arc flame, an exit tube for the treated gases of substantially the same diameter as the inner zone of the flame and projecting into the inner zone of the flame.

884,930. Electrode for Reversible Galvanic Batteries. Ernst W. Jungner, Kneippbaden, Norrköping, Sweden, assignor to Nya Ackumulator-Aktiebolaget Jungner, Stockholm, Sweden. Application filed September 20, 1904.

An electrode for storage batteries having an alkaline electrolyte contains an active mass of oxygen compounds of a metal mixed with flake graphite, the particles of which have a thin coating of nickel, the coating and active mass being insoluble in the electrolyte.

884,969. Thermostatic Circuit Closer. Jay O. Woods, Riverside, Wash., assignor of one-half to Joseph W. Graham, Riverside, Wash. Original application filed October 5, 1906. Divided and this application filed May 10, 1907.

This consists of a thermometer tube hermetically sealed and containing a mercurial column, two wires forming the terminal contacts of an open circuit and entering the tube above the mercury, a rod of insulating material adapted to be lifted by the mercurial column, the upper end of the float being provided with conducting material, whereby expansion of the mercury above a predetermined degree will cause the rod to bridge the ends of the terminal wires and close the circuit.

884,973. Automatic Indicator or Thermoscopic Signal for Heated Tools and Vessels. James I. Ayer, Cambridge, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed May 16, 1907.

A signal lever stands up when the article, such as an electric flat iron, becomes heated. When cool it lies flat.

884,978. Cut-out. John H. Booth, Frank E. Blausey and Arthur M. Smith, San Pedro, Cal. Application filed January 19, 1906.

The base has a line terminal and an instrument terminal, the former being below the latter and comprising a lug, a drop lever pivoted thereto, a fuse connecting the instrument terminal with the free end of the drop lever, a circuit including a signal having its terminals on the base, and an arm connected to the drop lever and normally retaining the terminals out of contact with each other.

884,981. Separable Attachment Plug. Owen E. Kenney, Toledo, Ohio, assignor to the Yost Electric Manufacturing Company, Toledo, Ohio. Application filed March 16, 1906.

The base has a recessed end provided with oppositely disposed contact terminals having inwardly projecting spring arms. A [illegible] of insulating material [illegible] recessed end, [illegible] for lead wires and [illegible] are adapted to interlock with the terminals of the base.

884,986. Wireless Telegraphy. Guglielmo Marconi, London, England, assignor to the Marconi Wireless Telegraph Company of America. Application filed November 28, 1902.

At a receiving station in a wireless-telegraph system there are provided means for producing a varying magnetic field, a coil surrounding a core of magnetic material, an oscillation-receiving conductor connected to one end of the coil, and a capacity connected to the other end of the coil.

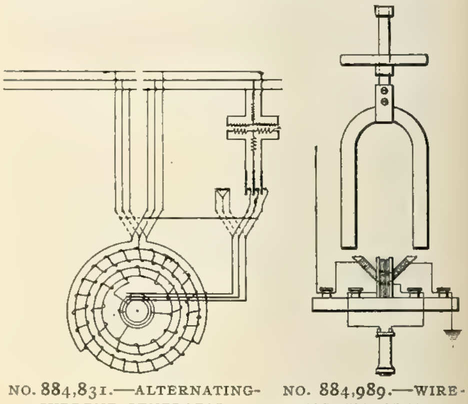
884,987. Wireless Telegraphy. Guglielmo Marconi, London, England, assignor to the Marconi Wireless Telegraph Company of America. Original application filed November 28, 1902. Divided and this application filed February 2, 1903.

This is a modification of the above patent.

884,988. Detecting Electrical Oscillations. Guglielmo Marconi, London, England, assignor to the Marconi Wireless Telegraph Company of America. Original application filed November 28, 1902. Divided and this application filed February 2, 1903.

This method of detecting electrical oscillations consists in receiving the oscillations by means of a coil maintained in a magnetic field, which is created independently of received oscillations and of the apparatus which renders received oscillations intelligible by being periodically reversed.

884,989. Wireless Telegraphy. Guglielmo Marconi, London, England, assignor to the Marconi Wireless Telegraph Company of America. Original application filed November 28, 1902. Divided and this application filed February 2, 1903. Again divided and this application filed February 9, 1904.



NO. 884,831.—ALTERNATING-CURRENT GENERATOR. NO. 884,989.—WIRELESS TELEGRAPHY.

In a wireless-telegraph system, the method of detecting electrical oscillations of high frequency consists in creating a rotating magnetic field at a receiving station, abruptly varying the field by the received oscillations, and utilizing the variations in the field to create intelligible signals in a telephone. (See cut.)

REISSUE.

12,779. Process of Plating Metallic Bodies. George A. Goodson, Minneapolis, Minn., assignor to the Goodson Electric Galvanizing Company, Minneapolis, Minn. Application filed November 24, 1905. Original application filed March 31, 1904. Divided and application filed June 9, 1904. Original patent No. 789,690, dated May 9, 1905.

This process of plating wire or other metallic bodies, consists in drawing the same, under a continuous movement, through an attenuated body of plating metal, and in passing an electric current simultaneously through the plating metal and the metal to be plated.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 21, 1908:

450,613. Electric Railway. F. S. Culver, Eau Claire, Wis.
450,615. Means for Communicating Information. P. B. Delany, New York, N. Y.
450,626. Safety Device for Overhead Electric Wires. M. Kerstein, Boston, Mass.
450,628. Wall Socket for Incandescent Electric Lamps. P. Lange, Pittsburg, Pa.
450,630. Printing Telegraph. S. R. Linville and L. F. Hettmansperger, Philadelphia, Pa.
450,631. Printing Telegraph. S. R. Linville, Philadelphia, Pa.
450,639. Electric Motor or Generator. J. F. Seiberling, Akron, Ohio.
450,641. Self-exciting, Alternate-current Electric Generator. W. Stanley, Jr., Great Barrington, Mass.
450,645. Railroad Signaling Apparatus. J. D. Taylor, Piketon, Ohio.
450,646. Electric-railway Block Signal. J. D. Taylor, Piketon, Ohio.
450,742. Electrical Propulsion of Vehicles. E. H. Johnson, New York, N. Y.
450,744. Power-transmitting Device for Electric Railways. E. H. Johnson, New York, N. Y.
450,834. Method of Making Plates of Secondary Batteries. S. C. C. Currie, Philadelphia, Pa.
450,840. Galvanic Battery. C. Willms, Baltimore, Md.
450,872. Electric Valve Controller. C. B. Reardon, Franklin, Pa.
450,875. Electrically Propelled and Steered Torpedo. W. S. Sims, Newark, N. J.
450,923. Electromagnetic Apparatus. L. G. Woolley, Grand Rapids, Mich.
450,965. Elevator Valve Controller. E. S. Mathews, Cincinnati, Ohio.
450,966. Electromagnetic Apparatus for Operating Stop Watches. F. A. Mathews, Providence, R. I.
450,975. Dynamo-electric Machine or Motor. A. L. Parcelle, Boston, Mass.
450,985. Electric-current Regulator. J. A. Williams, Cleveland, Ohio.

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Removable Switch Gear for Electric Power Stations.

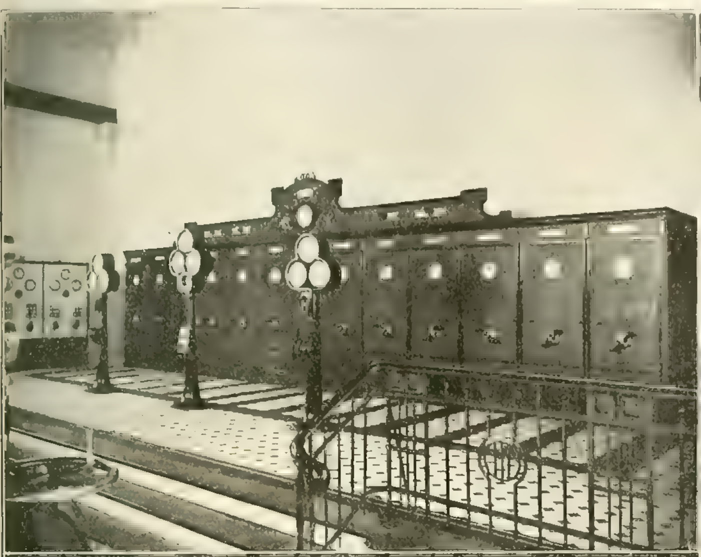
By Dr. Alfred Gradenwitz.

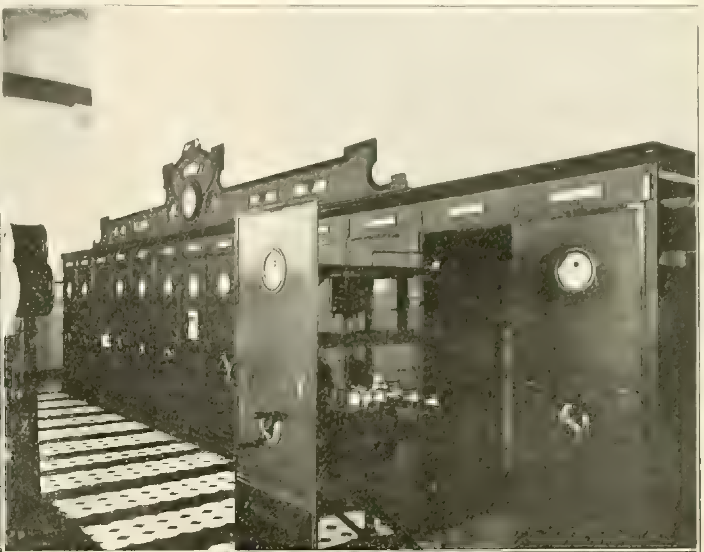
Attention is paid in an ever increasing degree to the design of the switching plant of the electric power house, for it is mainly responsible for the safety and simplicity of service. In many cases it is found advantageous to divide the switching plant into various groups, the number and composition of which are adapted to local conditions.

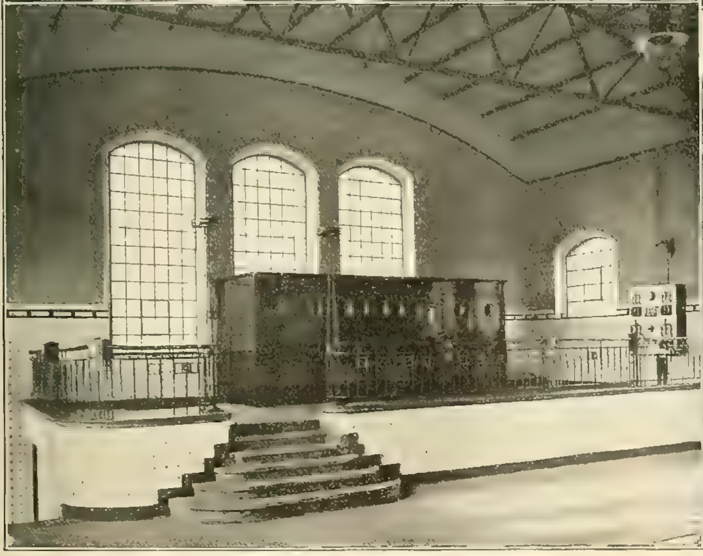
Figs. 1 and 2. Here the generating plant includes a Zoelly steam turbine of 2,500 horsepower, turning at 1,500 revolutions per minute and operated at a steam pressure of 12 kilograms per square centimeter and 300 degrees superheat. This turbine is directly coupled to a generator, with output of 1,800 kilowatts at $\cos\varphi = 0.85$, wound for 2,100 volts and a frequency of 50 cycles. The armature of a small exciter dynamo is mounted on an extension of the shaft of the main unit.

The polyphase current generated is conducted by

Elek. Westphalian Electric Works, the conductors of which communicate with the bus-bars proper of the switching panel through a third panel, viz., the meter panel. This is fitted with four meters, two of which serve to gauge the energy yielded by the mining plant to the central station, while the others record the opposite consumption. This arrangement adequately complies with actual demands and allows energy to be either yielded to the central station or derived from the latter for operating the mine.







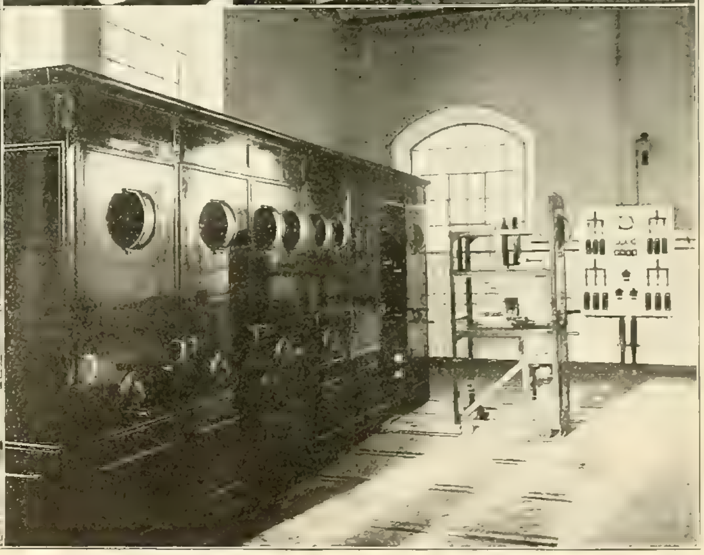


Fig. 1. Switchboard at Dorstfeld Mine Power Plant.
Fig. 2. Switchboard at Dorstfeld Mine with One of the Panel Cabinets Drawn Out.
Fig. 3. Switchboard at Ludwig Mine Power Plant.
Fig. 4. Switchboard at Ludwig Mine with One Cabinet Drawn Out.

REMOVABLE SWITCH GEAR FOR ELECTRIC POWER STATIONS.

According to a very practical design, each group is constructed as a removable switching panel cabinet which, without any interruption in the regular service, can be withdrawn from and inserted into the plant. At the very moment such a cabinet is removed its connection contacts are automatically disengaged, thus cutting the current out of that special part of the switching plant.

One advantage of this arrangement is the perfect absence of danger in handling any one of the branch circuits, these being under no current, while the remainder of the plant is kept in full operation. Any parts carrying high-tension currents are situated behind the front walls of the switching cabinets, and accordingly are inaccessible when in circuit, which dispenses with any special high-tension department. There is one switching cabinet for each branch circuit, the aggregate of which constitutes a convenient and practical switchboard.

A switchboard arranged on the above lines has been recently installed by the Siemens-Schuckert Works at the power house of a mining plant in the neighborhood of Dortmund, Germany, as shown in cables laid below the floor of the engine room to the switchboard installed at one of the ends of the room on a platform (Fig. 1), thus enabling the superintendent to obtain a ready view of the whole of the power station. The switching gear comprises the switchboard proper and some switching columns installed in front of these, the end columns controlling, respectively, the present generator and another to be installed. The columns are provided with measuring instruments, including ammeter and voltmeter, in addition to a hand lever for operating the dynamo switch and handwheels for operating the rheostat. The central column comprises all instruments required for parallel connection.

The switchboard, situated behind the switching columns, comprises in the present case 13 panels, containing switches and instruments for each of the branch circuits. Each panel is designed as a removable switching cabinet, constituting a self-contained unit. The order of the boxes from left to right is as follows:

The first two panels contain connections to the

The next three panels are intended for branch circuits leading to transformers as well as to the motor driving the condenser. Immediately adjacent is a panel for insulation tests. The next two panels belong to cables leading to machinery used in the plant, while the adjoining panel is a spare one. Next in order are two panels set apart for by-product motors. Finally the last panel at present serves as a reserve.

A similar design of switchboards, comprising removable boxes, can be used in connection with sub-stations. An interesting instance of this is a plant recently installed (Figs. 3, 4 and 5) at one of the mines of the Gutehoffnungs-Hütte, Germany, where the current, supplied by cables, is branched off at a pressure of 5,000 volts to the various centers of consumption. The switchboard here comprises seven switching cabinets of similar design to those of the plant above described, but edgewise instruments being used in this case. The various switching cabinets from the right to left serve for receiving the switches, instruments and measuring

transformers for the following branch circuits, respectively:

The first two panels, equipped only with switches and voltage indicators, receive the terminals of the two feeding cables, while the third panel contains such meters as are required to check the energy consumption. The remaining panel cabinets serve

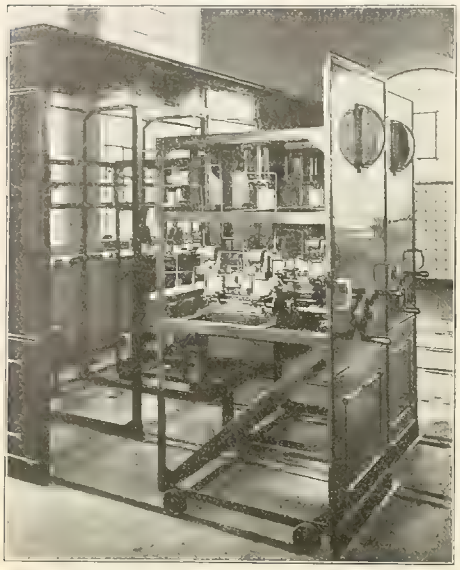


FIG. 5. SWITCHBOARD PANEL CABINETS AT LUDWIG MINE POWER PLANT.

for the branch circuits of the power transformers, the two lighting transformers and a lifting pump, respectively.

Fire and a Bursting Flywheel Wreck the Old Waukegan Electric Plant.

The old electric plant of the North Shore Electric Company at Waukegan, Ill., was badly wrecked by fire and a flywheel accident resulting therefrom at a little after 11 p. m. on April 22d. Fire from some unknown cause suddenly started back of the switchboard; the engineer on duty immediately began to open the line switches cutting off the load and generators and then summoned assistance by telephone. The fire spread so rapidly that he was unable to reach the throttle valve to shut down the 300-horsepower Corliss engine then running. In a short time the belt on the 18-foot flywheel was ablaze and then quickly burned through. As soon as this happened the engine began to race and in what seemed only a few moments the wheel, whose normal speed was 80 revolutions per minute, had attained such a speed that the rim burst with explosive violence, scattering its parts for several blocks, killing two men, injuring two others and damaging adjoining property.

The fire was put out shortly afterward. With the exception of the boiler room the plant was nearly destroyed, the loss being about $30,000.

After the fire it was found that the automatic safety stop on the engine governor, which should have stopped the engine when it began to race, had been prevented from acting by a pebble that had lodged in it. This had probably dropped from the roof during the rapid spread of the fire. At any rate the governor had acted all right when the load was thrown off and the engine did not race till the belt broke.

This plant was to have been shut down in a few weeks on the completion of the new Waukegan plant. In the latter had been set up a 250-kilowatt engine-driven generator and a new Curtis turbo-generator of 1,000 kilowatts capacity; the foundations had been completed for a 500-kilowatt turbo-generator that was to be moved there later from the [illegible] plant. The 1,000-kilowatt unit was practically ready for its preliminary tests; it had not yet been run, however, nor its connections verified. A tie line connecting the new Waukegan [illegible] had not been quite completed.

[illegible] plants [illegible] Superintendent G. H. Lukes and their assistants. Before dawn [illegible] of its linemen and other available employes and [illegible] panel there more easily and dismantled more quickly than its duplicate at Evanston, which was intended to be used originally. The Maywood unit was then carrying the night load; it was ordered shut down and dismantled immediately. The speed with which this was done is shown by the fact that about 24 hours afterward the machine arrived at Waukegan, some 45 miles away, aboard two flat cars.

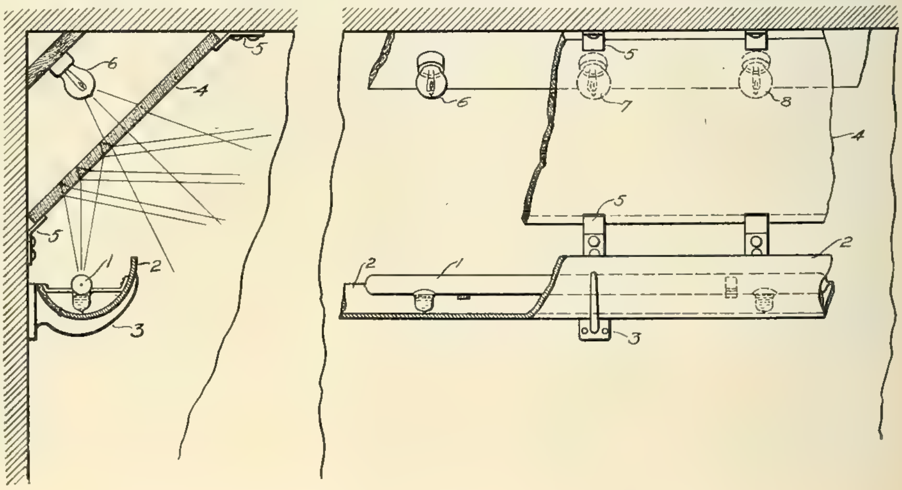
Meanwhile the engine-driven generator and the 1,000-kilowatt turbo-generator had been connected up and started. With scarcely any initial tests the load was taken up by these machines and within seven hours after the fire the commercial lighting service was begun again. The power service was started a few hours later. The street lighting was delayed most. However, within 40 hours after the accident all lines were operating as usual throughout Waukegan and adjacent suburbs.

A Plan to Improve the Color of Light from Mercury-vapor Lamps.

The light given off by mercury-vapor lamps is particularly strong in blue and green rays but deficient in red and yellow rays. The consequence is that when such lamps are used for purposes of illumination there is practically a total elimination of the red and yellow colors from the objects illuminated. This characteristic of the mercury-vapor lamp is a source of objection to its general adoption for purposes of illumination where color values are of importance.

A system of lighting has been invented by Walter C. Fish of Lynn, Mass., which provides a means whereby light rich in red and yellow rays may be combined with the blue light from a mercury-vapor lamp or other source deficient in such rays, thereby producing a resultant beam with proper proportion of the various solar colors. For this purpose the light of the mercury-vapor lamp is projected upon a glass reflector in such a way that the reflected rays mingle with light passed directly through the light-transmitting reflector from a source located on the opposite side. This system has just been patented in this country and the patent assigned to the General Electric Company.

The left end of the drawing is a sectional view showing the arrangement of the reflectors and the two light sources; the right end is an elevation with certain of the parts broken away.



A PLAN TO IMPROVE THE COLOR OF LIGHT FROM MERCURY-VAPOR LAMPS.

The mercury arc lamp or other vapor electric lamp (1) is suitably supported and concealed by the reflector (2), which is secured by a bracket to a vertical surface, as, for instance, the side wall of a room. A light-transmitting reflector (4) of glass or other light-transmitting material is mounted above the vapor electric lamp in position to reflect the light from the lamp and its reflector (2) to parts of the room shielded from the direct rays of the lamp. The reflector (4) consists preferably of opal or frosted glass, as such material assists materially in proper diffusion, reflection and combination of the light rays of the two different sources. This reflector may be supported in the angle between the wall and ceiling of a room by brackets or clips engaging the edges thereof.

A number of incandescent lights (6), (7) and (8), or other sources of light capable of yielding red and yellow rays, or other rays suitable for blending with the light from vapor electric lamps, are located above the light-transmitting reflector or on the side opposite from that occupied by the vapor lamp. By suitably arranging the incandescent lamps a mellow diffused light is transmitted through the opal or frosted glass reflector toward the center of the room, but on leaving the surface of the glass these rays from the incandescent lamps are blended with the reflected rays emanating from the mercury-vapor lamp, thereby producing an indirect illumination of the room below.

While the drawing shows only a single vapor lamp of tubular form, it is evident that a number of these lamps might be arranged along the wall of the room, and if desired might completely encircle it, thus producing an even distribution of the light throughout the room and securing the advantage of the high light efficiency of the mercury lamp without subjecting the occupants of the room to the annoyance of unnatural color effects usually incident to illumination with these lamps. The reflector (2) completely conceals the mercury-vapor lamp from below, so that any flickering and pulsating occurring in such lamps is not noticeable.

Mr. Fish says that this system of illumination is readily adapted for a great variety of purposes. It is believed to be of particular value in drafting rooms and other places of comparatively large area where an even distribution of the light and complete freedom from shadows is desired.

Municipal Plant in Paris, Tenn.

The annual report of the municipal water and light plant of Paris, Tenn., shows gross earnings for the year ended March 31st of $19,718.85; the net earnings were $7,003.21. This amount of net earnings includes $3,802.31 spent for extensions to the plant, principally for an additional deep well costing about $1,700, and for 150 meters. There are about 400 water customers connected, practically all on flat rates, and about 225 customers for light, all on meter. Rates for lighting are eight cents per kilowatt-hour to everyone, with discounts ranging from 5 to 25 per cent., depending on the size of the monthly bill. The minimum bill is $1 per month. Twenty-four-hour service is given with direct current at 120 and 240 volts. A number of motors are connected. There has not been an interruption of more than five minutes in the service for the last five years, and not over twice in that time.

The city pays $60 per annum each for 21 arc lights, and $400 per annum for 32 fire plugs. In the above figures nothing is allowed for depreciation or interest. The plant is under the supervision of the Board of Public Works, consisting of three members, but the practical management of it is left in every way to Mr. M. W. Younkin, superintendent. Mr. Younkin makes this interesting statement: "While we have had very good success in every way, personally I am not in favor of municipal ownership."

Few Electrical Fires in Boston.

In the annual report of the Wire Department of the city of Boston for the year 1907, James E. Cole, the acting commissioner of wires, says: "During the year there has been no electrical fire due to wiring approved by this department, and I am pleased to be able to report that, with the exception of four fires in stations of the public-service corporations, with a reported insurance loss of $11,383, the total reported insurance loss for the electrical fires in this city during the year was but $160."

Sewage Pumping Stations at Dayton.

The city of Dayton, Ohio, lies in a valley surrounded by hills whose slopes drain very rapidly. At this point several streams unite to form the Great Miami River. This river in summer is of insignificant proportions, but in late winter and early spring after a sudden rain or melting snow it rises in a few hours to the proportions of a great river. To protect the city from inundation levees are maintained, but a rise in the river cuts off the sewers, and it is necessary to close the

LEHMAN STREET PUMPING STATION IN DAYTON

gates at the outfalls to prevent the river backing up into the streets and houses. At such times it is necessary to raise the sewage and discharge above the flood level.

After careful investigation and some costly and unfortunate experiments with steam pumps and pneumatic ejectors, which either required too much attention or were too expensive or uncertain in operation, the city of Dayton decided to install automatic electric pumps, and awarded the contracts to the Dayton Hydraulic Machinery Company, builders of the "Brooks" and "Dayton" centrifugal pumps.

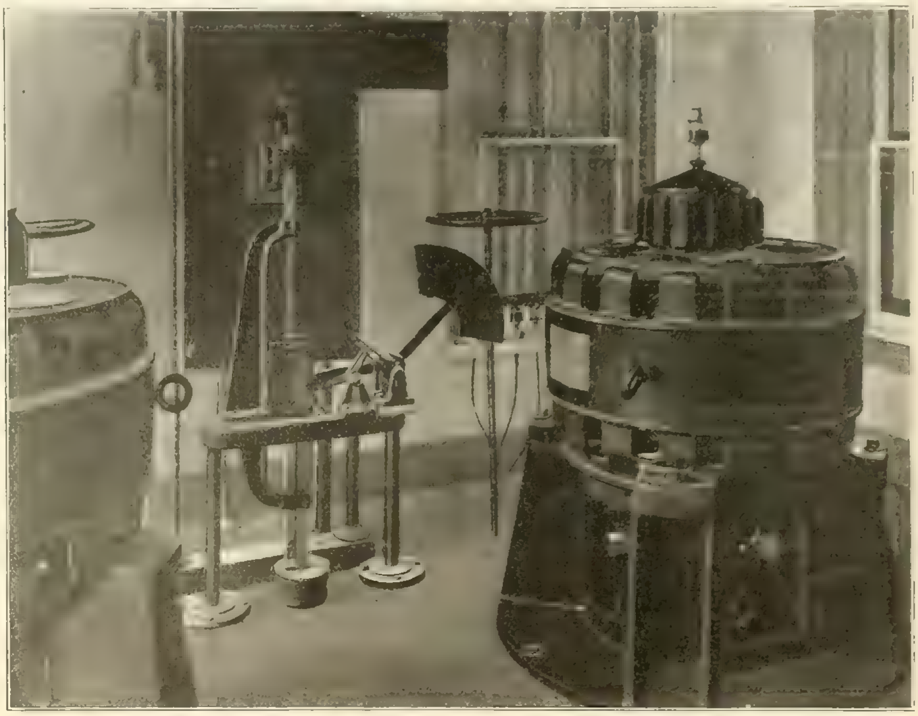
When electric motors were decided upon as the driving power, central-station power was also accepted as the only satisfactory generating source, since power can be obtained on a moment's notice at any time, night or day. Consequently there is the entire elimination of steam boiler and engine troubles, as these are all cared for by the central station, which is running at all times whether the water in the river is high or low. Were any other power adopted for the pumps the maintenance and operating charges would be increased.

ONE OF THE 4,500-GALLON CENTRIFUGAL PUMPS IN LONGWORTH STREET ELECTRIC SEWAGE PUMPING PLANT.

Three pumping stations have so far been constructed in various sections of the city. The first [illegible] chinery Company under its patents. The lift is variable, averaging about 20 feet. The discharge is through a check valve at a point below extreme high water. The operation of these pumps is entirely automatic, it being only necessary to inspect them occasionally and keep the oil receptacles filled. Upon notice of a rise in the river the gates are closed and the current turned on, after which the pumps cut in and cut out automatically with the rise or fall of the sewage in the pits.

The second station, at Longworth Street, has three units, and the third station, at Lehman Street, two, each consisting of a double-suction vertical submerged 4,500-gallon Brooks centrifugal pump direct-connected to a 40-horsepower, vertical, three-phase, 60-cycle, 2,080-volt Westinghouse motor.

The starting apparatus at these stations consists of floats which operate the valves on a hydraulic piston, using water under pressure from the city mains. On starting this piston raises the lever on a Westinghouse auto starter to the starting position, at the same time rotating an arm carrying a heavy counterweight, which, by the time the motors have picked up speed, falls, and by means of a pawl drops the lever to the running position. On stopping, the reverse motion given the counterweights moves the lift to the cut-out position. The operation of this apparatus is entirely satisfactory and the motors cut in and cut out automatically with great regularity and smoothness. During a heavy rain, when the river was quite high, one pump was sufficient to take care of the flow in the sewers at the Lehman Street station when running three minutes out of each ten, being idle the remaining seven minutes.



INTERIOR OF LEHMAN STREET ELECTRIC SEWAGE PUMPING PLANT, SHOWING AUTO STARTER AND THE TWO 40-HORSEPOWER MOTORS.

Government Wireless Control.

The reports of the War and Navy departments and the Department of Commerce and Labor on the international wireless telegraph convention signed at Berlin November 3, 1906, were sent to the Senate by President Roosevelt on April 25th. All three departments recognize the necessity for some rules governing the exchange of aerial messages and applaud the convention. The need is urgent, for the reason that there are said to be in the United States 97 wireless shore stations. Of these 40 are operated by the navy, 16 by the army and 41 by private concerns. A bill is now under consideration by Congress providing for rigid governmental control of wireless communication and fixing penalties for private persons who interfere with government messages or indulge in "fake" messages.

What is the Cost of Municipal Street Lighting in Chicago?

[illegible] Busse appears to be determined to find out what the plant is worth and how much it actually costs to produce the street lighting. In a message sent to [illegible]

"The city of Chicago has been in the electric-lighting business for about twenty years, yet I have been unable to acquire from the city records exact information as to the municipal lighting plant's value or the cost of the electric lighting which the city does for itself. The records simply show from year to year the cash appropriated and expended for material and labor in the maintenance and operation of the electric-lighting plants. No attempt has been made apparently to ascertain the exact cost. The city should know how much its municipally owned and operated utilities are costing and how much it has invested in such undertakings."

The mayor's request for the appointment of experts to make the investigation was sent to the finance committee.

Telephone Clearing House for Indiana.

The Indiana Independent Telephone Association held district meetings last week at Indianapolis for the Seventh District, at Princeton for the Ninth District, and at New Albany for the Tenth District. The attendance was good, and the reports show the condition of Independent telephone companies in the respective districts to be satisfactory. The principal topic discussed at each of these meetings was that of the advisability of organizing a clearing house for the Independent telephone companies in Indiana. At each of these meetings the clearing-house proposition was presented by J. W. Coffey, who is connected with the Indianapolis Telephone Company and the New Long Distance Telephone Company of the same city. The purpose of a clearing house is to equalize the toll receipts of the Independent companies over the entire state. Mr. Coffey said that the plan would enable the association to maintain toll stations at points scarcely self-sustaining, and which are now probably kept up for convenience only. Mr. Coffey's paper was received with favor, and at each meeting a committee was appointed to consider the subject at the annual meeting of the association to be held at Indianapolis on May 13th and 14th.

Missouri Electric Light, Gas and Street Railway Association.

The annual convention of the Missouri Electric Light, Gas and Street Railway Association was held on April 23d, 24th and 25th at St. Louis, Mo. The headquarters were at the Marquette Hotel. At the first meeting of the convention after an address of welcome by W. A. Layman of St. Louis and a response by Dr. J. D. Porterfield, the president of the association, a business session was held at which the reports of the officers were read and routine matters disposed of. At the afternoon session two papers were read, one by Hugo Wurdack of St. Louis, Mo., on "Economical and Secondary Distribution," and the other by R. L. Lanphier of Springfield, Ill., on "Recording Wattmeters." Both these topics met with some discussion. In the evening a "get-acquainted" smoker provided the members with opportunities for swapping stories and reminiscences.

On the morning of the second day two papers were read. E. W. Haughton of Chicago treated of the developments in incandescent-lamp manufacture in his paper on "High-efficiency Lamps." A paper on "Incandescent Lamp Development," by F. R. Willcox of Harrison, N. J., was read in the absence of the author by G. C. Osborn also of Harrison, N. J. This paper was also read before the Iowa state convention and is given in abstract elsewhere in this issue. A good discussion followed the reading of these papers. This had reference particularly to the tungsten lamp. A number of mooted questions on the life, economy and effect on business of these efficient lamps were discussed. It was quite generally conceded that gas should not be considered as an illuminant; it was all right for heating, and its use for this purpose should be pushed. One manager of a combined gas and electric plant reported that when he assumed control of the plant 30 per cent. of the gas was sold for heating and 70 per cent. for lighting. At the present time 63 per cent. is used for heating and 37 per cent. for lighting. Next year he hoped to report 100 per cent. for heating. P. A. Bertrand of Jefferson City contended that gas lighting was not so inferior as seemed to be generally believed; most of the defects are due to cheap mantels. If consumers would buy 30 or 35-cent mantels they would get much better and more economical light. He admitted the electric light filled certain fields where gas was not suited.

At the session in the afternoon two papers were read—"Central-station System and Records," by Horace W. Beck of St. Louis, and "Popularizing the Use of Electricity," by E. L. Callahan of Chicago. The latter paper appears also in the report of the Iowa convention. A fair discussion followed these papers. In the evening a "rejuvenation and joviation of the Sons of Jove" was participated in with all that it implies.

On Saturday morning a long paper on "Alternating-current Motors" was presented by W. Robbins of St. Louis and followed by a general discussion. A number of inspection trips to the various power plants and other points of engineering interest about St. Louis were arranged. The convention closed with a banquet tendered to the members of the association by the electrical interests of St. Louis on Saturday evening. Under the leadership of "The St. Louis E. M. F.," R. V. Scudder, as toastmaster, a number of impromptu talks were given. The retiring president, Dr. Porterfield, spoke of the benefits of the association and urged that its work be extended. Mr. E. L. Callahan, when called on as "Mayor of San Antonio," said the manufacturers and supply dealers are trying to find out the troubles of the central-station men. In order to get the most out of such a convention it was desirable to have free discussions and freedom in asking questions.

The following-named gentlemen were elected to the principal offices for the ensuing year: President, W. B. Hays, manager Poplar Bluff Lighting Company, Poplar Bluff; secretary, Claude L. Clary, manager Sikeston Electric Light and Power Company, Sikeston, Mo.

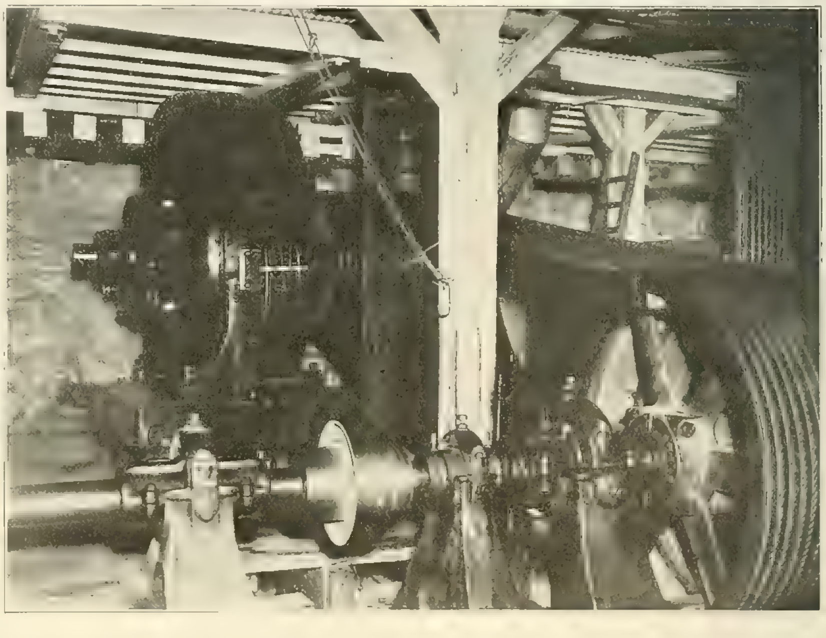
Electric Law in Oklahoma.

The Oklahoma Supreme Court has upheld the decision of the lower court and awarded T. M. Sears $6,668 damages against the Shawnee Light and Power Company. In its decision the court holds that an electric-light company using the pub- [illegible] for its poles, wires and appliances, in conducting its business, is required [illegible] of care and to maintain in the best possible condition the best appliances known to the science, to render its business safe, and to use that degree of care, caution and circumspection of the business, but it is not an insurer against unforeseen and unavoidable accidents. In consideration of the dangerous char- [illegible] electric-light company, and the high degree of care required of it to protect the public from injury [illegible] shown in a case against it, by the evidence, that [illegible]

insulation or derangements of the company's appliances, a presumption of negligence arises which casts the burden on the defendant of showing that it exercises due care.

Large Electric Motors in a Concentrating Plant.

The concentrating plant of the Anaconda (Mont.) Copper Company's famous Washoe smelter is one of the first in the country to be driven by electric power exclusively, four large induction motors being used for this purpose. The concentration building is 600 feet long, with the steam plant, heretofore used for driving it, located in the center. The jigs, tables, etc., are driven from a main line shaft 500 feet long, to which the engines have been connected by rope drive and friction-clutch pulleys. It is intended to leave this steam plant intact, to be used as a reserve in case the electric power fails. The mill as a whole is divided into eight sections, four on each side of the engine room. Two Allis-Chalmers induction motors are installed in each half of the mill, and connected to the main shaft by rope drive and friction-clutch pulleys. Each motor has a 1,200-horsepower output at 360 revolutions per minute, synchronous speed, and will furnish power sufficient to operate easily two mill sections. Connection is made to the main shaft by 18 two-inch ropes, and the pulley dimensions are such that the main shaft is driven at 250 revolutions per minute.



A 1,200-HORSEPOWER INDUCTION MOTOR DRIVING CONCENTRATING MILL AT ANACONDA, MONT.

These large motors are notable not only on account of their large capacity, but also because of their having squirrel-cage rotors, something unusual in motors of this size. Their guaranteed full-load efficiency is 91 per cent. and full-load power factor 92 per cent. Squirrel-cage motors were chosen for this installation because the conditions under which they have to start are favorable and also because of the higher power factor of this kind of motor as compared with the wound-rotor type.

In addition to the four large motors, there is also provided a 200-horsepower, variable-speed, 60-cycle, 2,080-volt induction motor for operating the pumps in the mill. This motor is of standard type with wound rotor and collector rings for the insertion of resistance in the secondary. The normal speed is 450 revolutions per minute, and can be reduced to 225 revolutions per minute by means of a grid-type resistance, furnished with the motor.

This plant is also equipped with three synchronous motor-generator sets of 300 kilowatts output each, and one small induction motor-generator set for starting and exciting the synchronous sets. The 300-kilowatt sets are driven by 12-pole, 2,080-volt, 60-cycle synchronous motors and run at a speed of 600 revolutions per minute. The direct-current generators for these sets are compound wound for 550 volts and are able to carry 50 per cent. overload for two hours without heating more than 55° C. and without sparking. At normal full load the temperature rise does not exceed 35° C. in any part. These units are to operate crane motors throughout the plant and also furnish power for other purposes.

The fields of the synchronous motors are excited from a 120-volt, 25-kilowatt, direct-current generator driven by an induction motor. The same motor is also coupled to a small 500-volt, direct-current machine. This machine has commutating poles, and a very large current can be taken from it for short intervals without sparking at the commutator or undue heating in any part of the machine.

Formerly all the power required by the Washoe smelter, which has been equipped throughout with electric drive, was obtained from steam engines, and a certain amount of steam power will probably always be used, as some of the steam boilers utilize the heat contained in the waste gases from the furnaces. However, this power, obtained as a by-product, is not nearly sufficient to operate the whole plant, and all additional power is now supplied by current transmitted from a hydro-electric plant on the Missouri River.

Cahill's Telharmonium.

Sir W. H. Preece delivered a lecture on "America Revisited, 1907," before the British Institution of Electrical Engineers on March 12th last. What he says of the telharmonium is of some interest.

"Dr. Cahill's new apparatus is a synthetical method of building up all that makes for pure and emotional music. It is a practical mode of demonstrating the absolute accuracy of Helmholtz's theory of the quality of sound. The keyboard is like that of a piano or organ, but each key is a simple switch which completes an electric circuit. A low-voltage continuous current operates a relay, bringing into action a fundamental note and certain selected partials compounded of alternating currents of variable frequency. The action of the relay is mechanical. It lifts a balanced strip of wood, along which are fixed contact pieces which set up the fundamental note and its required partials. The keys respond promptly. The energy is entirely in the electrical form, and is not heard until the very last operation is performed upon an iron disk at a distance. The manipulation of the keyboard and the use of pedals and stops set up electric waves which are the exact counterparts of the sonorous aerial vibrations it is desired to excite. These waves are transmitted through insulated wires buried in the streets all over a certain district in New York.

"There are 144 inductor alternators in the New York machine. A long shaft rotates with uniform velocity. It has mounted on it 144 toothed rims which correspond with each fundamental note it is desired to transmit. The rotation is produced by a continuous-current motor of 185 horsepower. The pitch is the frequency, the quality or timbre is the form of the wave, modulation of loudness is obtained by varying the strength of the currents, expression by the use of stops which mix the tones.

"The effect is quite wonderful. The tones of a piano, violin, violoncello, harp, trumpet, clarionet, flute, and all kinds of music, separate or in orchestral form, are manufactured in electric currents of varying frequency, amplitude and duration, and the result is a new music. It requires great skill to perform, but the purity of the notes and the quality of the music emitted are superb. The receiver that produces the music is a large Bell receiver. Notwithstanding the wonderful effect, I am not impressed with the commercial value of this music, and it does not seem to be making progress."

IOWA ELECTRICAL CONVENTIONS AT DES MOINES.

The Iowa Electrical Association [illegible] a well earned reputation for getting results, and it is often remarked that its conventions are of the best among the [illegible] organizations. The [illegible] gathering was the banner meeting in the history of the association. It was the eighth annual convention and was held in Des Moines on April 22d and 23d.

Three hundred electrical men were in Des Moines to attend the conventions, some of them, however [illegible] [illegible] April [illegible] [illegible] [illegible] [illegible] [illegible] automobile ride through the principal streets of the city and to surrounding points of interest. On [illegible] [illegible] City Railway Company, all the members and guests [illegible] [illegible] [illegible] the corporations, as the people have been led to believe. Wouldn't there be a remonstrance from the country if laws were enacted placing values of [illegible] holding up corporations as a menace to the welfare of the country. I think we all realize that this is an age of improvement; that large interests of the present day cannot be financed by one man; that it requires the wealth of hundreds and even thousands of people to successfully carry on the business of some of our large companies. This capital may be represented in bonds, which are not only sold here but in many parts of the world, and also in stocks which are likewise distributed among all classes. We cannot condemn because the stock is controlled by some one interest; it cannot be otherwise and be a success. Let me ask you, Do you know of a successful organization unless the ones in control have made it so and shown by their knowledge and judgment to continue to do so? This rule you will find will apply whether the company has a capital of one thousand or one million dollars. It is unreasonable to condemn a company because the nature of its business makes it necessary to control large interests to make it successful.

L. D. Mathes, President Iowa Electrical Association.

W. N. Keiser, Secretary Iowa Electrical Association.

P. P. Crafts, President Iowa Street and Interurban Railway Association.

OFFICERS ELECTED AT THE IOWA CONVENTIONS AT DES MOINES.

being attracted by the almost simultaneous convention of the Iowa Street and Interurban Railway Association, whose meeting is recorded on another page of this issue. But excluding the street-railway men, there was a record attendance at the electric-light convention, the register showing 150 central-station men, including a few of their guests, and 100 supply men.

The various sessions were well attended and the programme was an excellent one. Papers of a high order were read and had the desired effect of bringing out spirited and instructive discussion. Probably no subjects attracted more attention than those of tact and system in the conduct of public-utility industries and a review of the development in incandescent lamps. These two subjects were ably presented in papers, respectively, by J. W. Ferguson of the Commonwealth Edison Company, Chicago, and F. W. Willcox of the General Electric lamp factory, Harrison, N. J.

The officers and committees of the association deserve much credit for the success of the eighth annual convention. The retiring president, George S. Carson of Iowa City, is a man of executive ability and business experience, and with the co-operation of Secretary W. N. Keiser and the other officers he had the satisfaction of seeing his administration rounded out with a meeting of unusual size and value.

The exhibit of electrical appliances and supplies made by manufacturers and dealers was attractive and conveniently arranged. All the booths were in one large room on the same floor with the convention hall in the Savery Hotel, thus making it easy for the members and guests to attend the sessions of the convention and return again to the exhibits at their close. It is probable that two years hence the convention will be held in Des Moines in connection with a large electrical show. The Des Moines Commercial Club and the Greater Des Moines Association are preparing to build a large exhibition building with every modern convenience. This proposed building has been offered for an electrical show with no charge to exhibitors for space. The electrical association also is offered free accommodations for its convention during the time of the show.

The association elected one of its best-known and most popular members, L. D. Mathes of Dubuque, as its president for the ensuing year. It also showed its appreciation of the energetic and efficient work of W. N. Keiser and W. A. Mall by re-electing them secretary and treasurer, respectively. O. E. Brownell is the new vice-president, and the executive committee, besides the officers, will have the services of Thomas Sloss, F. L. White and J. F. Porter.

Action was taken establishing a permanent date for the annual conventions, which in the future

On Friday afternoon the lighting and street-railway men enjoyed the courtesy of the Fort Dodge, Des Moines and Southern Railroad in a 35-mile trip to Ames over the company's interurban road. General Manager J. L. Blake and General Superintendent Frank Arnold were in charge of the party.

The first session of the convention of the Iowa Electrical Association was called to order at 10 a. m., April 22d, by the president, George S. Carson, president of the Iowa City Electric Light Company of Iowa City. Mr. Carson expressed the honor he felt in having been the president of the association during the last year. He then read the annual address, as follows:

President Carson's Address.

Many changes have taken place since our first convention, and many new problems are constantly coming up for consideration and solution. The use of electricity in the homes for lighting, heating and cooking has placed more responsibility upon the central station, which must prepare for the new conditions. The use of electric power in factories, now being so largely supplied by central stations, has placed greater duties upon them and made necessary larger outlays of capital to meet the demands.

With all these inward troubles which the corporations must assume and prepare for if they shall continue in business, now comes an outward one that promises to cause more dissension and unrest than all others combined. I refer to the present agitation against all corporations in general, and those of the public service in particular. The people are worked up to such a condition that all corporations are placed in the same class, and are assumed to be dishonest. This is a wrong state of affairs entirely, and I hope for some solution of the question which will show the injustice of this broad attack and will allow money invested in corporations the same consideration as if invested elsewhere. Unless this is done, and done soon, their service will be crippled and become inefficient, with complaints from the public caused by none but themselves. It may go this far before public opinion changes, but change it must, before confidence is restored and business conducted on a sound basis.

The cause of the late financial troubles is attributed to corporations and overcapitalization. We know that there have been dishonest methods used in some cases, and there is just cause for prosecution in such, but it does not warrant the accusation that most of them are not managed as honestly and fairly as any other lines of business.

Many of the most severe critics are land owners, who have taken the position that only the cost of duplication of the corporate property should be capitalized, not taking into consideration the cost of getting the business, as well as the costs entailed by the many changes necessary in its growth to the present time. To apply this same principle to their land would place a value of $1.50 an acre, the price paid the government, instead of $125, present value. The same comparative increase of values can be shown on city real estate, yet both

I think we have a natural law which will limit the size of corporations, and that when they become too large for control by one mind, disintegration will surely follow. Some of them today are so large that the head officers are breaking down under the loads and responsibility they must carry, new men are placed on the firing line to keep the wheels moving. This cannot last always, and I predict that contraction will follow.

We cannot, however, give up the idea that in the end justice will be done, and, if not, we can rely upon the courts that a square deal will be given all.

We have a more encouraging outlook for the future to increase the lighting business by means of the tungsten incandescent lamp, which is now being introduced in the United States, after having been tried out abroad. Its efficiency of 1¼ watts per candlepower should be able to displace even gasoline competition, with which many of our smaller companies have had to compete.

In conclusion, I will ask that a free discussion of the papers be given by all members. Don't hesitate to ask questions of the authors on any points of interest. Remember it is these informal talks which are of much benefit to every operating company, whether it be large or small.

I wish to thank our secretary, Mr. Keiser, for his very thorough work; also to thank the members and others who have contributed papers and given their time and assistance in other ways for the good of the association. Co-operation means success. Let us all work with a greater will to make the Iowa Electrical Association the most progressive state association in the country.

New Members.

The preliminary proceedings were disposed of, including the report of the secretary and treasurer and reports of the various committees. The membership committee reported the following-named new members: Manchester Light, Heat and Power Company of Manchester, Osage Electric Light, Heat and Power Company of Osage, Citizens' Gas and Electric Company of Council Bluffs, Ida Grove Electric Company of Ida Grove, Storm Lake Electric Light and Power Company of Storm Lake, Keokuk Electric Railway and Power Company of Keokuk, Pella Electric Company of Pella, Anamosa Electric Light and Power Company of Anamosa, F. R. Payne Company of Williams.

The nominating committee, whose report was accepted at the executive session, consisted of L. D. Mathes, Austin Burt, W. J. Greene, F. L. White and Thomas Crawford.

Popularizing the Use of Electricity

"Popularizing the Use of Electricity" was the title of the first paper on the programme, read by E. L. Callahan of the Chicago office of the General Electric Company. The paper showed that it is being realized that all great enterprises depend ultimately upon the people and that the people should be taken into partnership, so that their confidence

[Continued on page [illegible].]

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—was about three hundred, which is a creditable number in a state without very large cities. A number of good papers were presented and discussed, and there was an instructive display of electrical appliances. The Electrical association elected Mr. L. D. Mathes of Dubuque as its president and the Street-railway association similarly honored Mr. P. P. Crafts of Clinton. Both of these gentlemen are alert and enterprising representatives of electrical operating undertakings and do credit to the industries they stand for and the state of Iowa. Cedar Rapids will entertain the next convention, while in 1910 the associations will undoubtedly return to Des Moines.

BOSTON is proceeding steadily with its systematic work of placing underground nearly all wires used for carrying electricity. The work has been under way for nearly ten years, a certain district being assigned for each year's operations. During the year ended January 31, 1908, for instance, the amount of wire removed by the Wire Department of the city amounted to 291,860 feet, or over 55 miles. During the year the various electrical companies have opened 116 different streets for the purpose of laying new conduits for underground wires or for extending or enlarging existing conduits. The Wire Department's underground-district inspectors made no less than 9,400 inspections as the result of the 1,497 permits issued for underground work on the 116 streets affected. In all 207,159 duct-feet of conduit was laid, not including 11,511 feet of solid Edison tube.

The work seems to be done carefully and thoroughly, and, spread over a term of years, the electrical companies are able to adapt themselves to it without hardship. It is a pleasure to observe the favorable and rational progress of the undertaking as shown in the annual reports of the Wire Department.

MANY interesting points are made in Mr. Willcox's paper on "The New Incandescent Lamps," particularly in that portion of it devoted to central-station policy. The author says that the tungsten lamp should be used primarily to secure new business. "Let your old customers know that you have the tungsten lamp and that they may get them at a price, but push them with the unsecured fellows and see the result." With the new lamps free renewals will be impracticable. Tungsten series lamps are valuable for street lighting and will compete with gas-mantle lamps for that purpose. Altogether, central stations have great cause for rejoicing over the new developments "which have given them a lighting device of such efficiency and simplicity and low cost as will enable them to compete effectually on the basis of cost against gas and other illuminants." Electric lighting is now only limited "by the capacity of the central-station company to supply the service."

Of course Mr. Willcox speaks with the enthusiasm and energy of the lamp manufacturer. Nevertheless, there is little doubt that in the tungsten lamp the electric-lighting industry has in its possession the most formidable weapon for fighting gas illumination which it has ever possessed.

SAHARA will before many years cease to be the remote and trackless waste it long has been supposed to be. As one step in the direction of connecting it with civilization, Mr. Etiennot, postal and telegraph director of the Department of Oran (Algeria), has submitted to the governor-general of Algeria a complete project for the installation of a telegraph line across the desert. At present there is a line between Oran, on the Algerian coast, and Beni Abbes and a second between Algiers and Timmimoum. It is now proposed to extend one of these lines as far as Adrar, the last point toward the south which is occupied by the French troops, and which is 750 miles distant from the coast. From this point the line will be continued in the direction of the Niger as far as Bourren, or 840 miles from the coast, comprising 600 miles in French [illegible] Soudan. On the second [illegible] fortified post and three ordinary posts at 50-mile to 120-mile intervals. A mehari camel can cover 60 miles a day, and it must not take over 24 hours to proceed from one of these posts to a break in the line. Lastly, at Bourren, the line will fork in one direction toward Timbuctoo, so as to connect with Senegal, and in the other so as to reach Zinder and the Lake Tchad region. Thus the line will serve all the Soudan region, besides Dahomey and the Ivory Coast. The wires of the telegraph line will be mounted upon metallic poles, and these are to be spaced 300 feet apart, with the lines placed at least 14 feet above the ground.

AN OLD FRIEND presents itself in the electric gun, which is attracting some attention in the English papers. This time the claim is no modest one. The gun is to hurl a projectile weighing 2,000 pounds to a distance of 300 miles. The inventor, or shall we say the re-inventor, is Mr. W. S. Simpson, "the well-known English metallurgist." Mr. Simpson has great faith in this gun. He is quoted in a London paper as follows:

"Electricity has not been used in this special direction yet; its possibilities are so great that it will be difficult to suggest when or where its application will reach perfection. There is, in fact, no limit to the powers of electricity. It is quite as easy for my weapon to project 50 shells of 500 pounds each per minute as to throw 50 of 50 pounds each, and to drop a shot at 100 miles distance as at 100 yards; distance is practically no object. Its cost will be cheaper than the existing artillery, while its life will be at least a hundred times longer than the best weapons now in use."

Mr. Simpson is right in one thing; electricity has never been used as the propelling force in guns. He might have added that although the theory was broached twenty years ago or more and has cropped up at intervals since it has never had any practical development, simply because it won't work. The "electric gun" is only another of the widely heralded newspaper inventions that are merely "iridescent dreams."

IN A RECENT REPORT of the work performed at the government fuel-testing plant at St. Louis, Mr. Joseph A. Holmes, in charge of the work for the United States Geological Survey, makes a brief reference to the outlook for the future. The more important of the problems needing immediate investigation are, broadly, the lessening of the waste in mining and greater efficiency in the utilization of the coal that is mined. It is estimated that the waste in mining alone now exceeds 400,000,000 tons of coal yearly. To utilize to better advantage the coal that is mined a number of investigations will be undertaken.

A branch chemical and physical laboratory will be maintained at the Norfolk fuel-testing plant for the purpose of experimenting on the gases in different portions of the combustion chambers of steam boilers and of gas producers, analyses to be made of the gases at high temperatures, and the highest temperatures to be measured. It is expected that the results of these investigations may have an important bearing on the methods of construction of combustion chambers and the relation of the heat-transmitting surfaces to the fuel bed.

The smoke-abatement investigations at public buildings will be supplemented by more detailed experiments along the same lines at the Norfolk plant, where different methods of handling boilers will be attempted. One of the boilers will be hand fired, one fired with mechanical overfeed, and one with a mechanical underfeed stoker. All three are equipped for natural draft, for forced draft and for induced draft, and it is believed that it will be possible to show just how each type of fuel should be burned in order to secure the highest efficiency.

A gas producer will be run on prolonged tests with a view to determining along commercial lines the fuel values through the gas engine of the various fuels tested; also with a view to determining the possibility of utilizing the different classes of fuel through the gas producer for naval purposes.

These investigations are of much practical importance, both to power producers and power users, and the government is entitled to hearty encouragement for its valuable work in this direction.

Committees of Underwriters' National Electric Association.

Following is a list of the various [illegible] committees of the Electrical Committee of the Underwriters' National Electric Association which have been appointed for the year 1908. Chairmen are named first, and their addresses are given:

Signs and Outline Wiring—J. C. Forsyth, [illegible] Nassau Street, New York; J. E. Cole, Boston; William Carroll, city electrician, Chicago; J. R. Strong, New York; Arthur Lewis, Wilkes-Barre, Pa.

Rule 64, Signaling Systems—F. E. Cabot, [illegible] Kilby Street, Boston; Ralph Sweetland, Boston; E. A. Fitzgerald, Syracuse, N. Y.; C. H. Hill, Philadelphia; [illegible], New York; C. C. Johnson, New York; H. S. Warren, New York.

Transformers—C. H. Hill, 316 Walnut Street, Philadelphia; H. R. Sargent, General Electric Company, Schenectady; C. E. Skinner, Westinghouse Electric and Manufacturing Company, Pittsburg; G. S. Lawler, Boston, Mass.; Dana Pierce, Chicago, Ill.

Telephone Switchboard Lighting—R. P. Strong, 809 Hibernia Building, New Orleans; W. H. McDonald, Rochester, N. Y.; W. S. Boyd, Chicago.

Electric Cranes—G. S. Lawler, 31 Milk Street, Boston; J. G. Emery, Jr., Shaw Electric Crane Company, Muskegon, Mich.; A. G. Wilbor, Hartford, Conn.

Rule 2a, Conductors—G. E. Bruen, 135 William Street, New York; Arthur Williams, New York; F. A. C. Perrine, New York.

Switches and Cut-outs—H. O. Lacount, 31 Milk Street, Boston; J. E. Cole, Boston; Dana Pierce, Chicago; Ralph Sweetland, Boston; F. E. Cabot, Boston.

Variable Speed Motors—H. O. Lacount, 31 Milk Street, Boston; C. E. Skinner, Pittsburg; H. R. Sargent, Schenectady.

Approval of Laboratory Reports—George E. Bruen, 135 William Street, New York; Dana Pierce, Chicago; J. C. Forsyth, New York.

Fixture Wire—Dana Pierce, 382 Ohio Street, Chicago; E. A. Fitzgerald, Syracuse, N. Y.; W. S. Boyd, Chicago.

Auto Starters—C. H. Hill, 316 Walnut Street, Philadelphia; Dana Pierce, Chicago; F. E. Cabot, Boston.

Re-codification of Code—G. M. Goddard, 55 Kilby Street, Boston; H. O. Lacount, Boston; J. E. Cole, Boston; W. H. Blood, Jr., Boston; E. McCleary, Detroit, Mich.

Details of Switchboards—Ralph Sweetland, 55 Kilby Street, Boston; H. O. Lacount, Boston; G. E. Skinner, Pittsburg; H. R. Sargent, Schenectady, N. Y.; W. Devereux, Philadelphia.

Cut-out Cabinets—A. R. Small, 382 Ohio Street, Chicago; W. S. Boyd, Chicago; R. A. Smith, city electrician, Norfolk, Va.; A. F. Hills, Crouse-Hinds Company, Syracuse, N. Y.; J. R. Strong, New York.

Rule 13a, Grounding of Low-potential Circuits—C. M. Goddard, 55 Kilby Street, Boston; F. E. Cabot, Boston; E. V. French, Boston.

Specifications for Stage and Elevator Cables—J. E. Cole, 11 Wareham Street, Boston; H. C. Harris, Columbus, O.; William Carroll, Chicago.

Rheostats—George E. Bruen, 135 William Street, New York; J. C. Forsyth, New York; A. R. Small, Chicago.

Induction Motors as to Wires and Fusing—F. E. Cabot, 55 Kilby Street, Boston; H. O. Lacount, Boston; H. S. Wynkoop, Brooklyn; C. E. Skinner, Pittsburg; H. R. Sargent, Schenectady, N. Y.

Circuit-breakers—A. M. Schoen, 339 Equitable Building, Atlanta, Ga.; Dana Pierce, Chicago; H. Ward Leonard, Bronxville, N. Y.; A. W. Berresford, Cutler-Hammer Manufacturing Company, Milwaukee; T. S. Perkins, Westinghouse Electric and Manufacturing Company, Pittsburg.

Mercury-vapor Lamps—J. C. Forsyth, 32 Nassau Street, New York; E. A. Fitzgerald, Syracuse, N. Y.; William McDevitt, Philadelphia.

Street-railway Property—Ralph Sweetland, 55 Kilby Street, Boston; William McDevitt, Philadelphia; B. E. Loomis, New York; O. B. Johnson, Boston; H. F. Strickland, Toronto, Canada.

Theater Wiring—J. E. Cole, 11 Wareham Street, Boston; H. C. Harris, Columbus, O.; William Carroll, Chicago.

Death of Eugene Munsell.

Eugene Munsell, well known in the mica business, met a tragic death early in the morning of April 25th. He had of late been a sufferer from illness. While in distress on the morning in question he evidently fell from the window of his apartments on the seventh floor of the Hotel Van Dyck in New York city. Since the death of his partner, Frank Brooks, two years ago, Mr. Munsell has been engrossed with business responsibilities that wore down his health. With L. W. Kingsley he formed the copartnership of Eugene Munsell & Co., dealers in mica and mica products. He was president of the Mica Insulator Company, maker of mica and micanite for electrical purposes. He was also a director of the Manufacturers' Stove Repair Company. Mr. Munsell was 56 years old and had been in the mica business before it bore any relation to the electrical industry. He was a man of very kindly disposition and was beloved by all with whom he came in contact, even by his business competitors.

Deplorable Waste of Volts.

From a northwestern county in England the Electrical Times of London appears to have heard of a striking exposure of electrical extravagance. The discovery was made public, it would seem, at a taxpayers' indignation meeting, which is thus, in part, reported:

"Orator: 'There is another striking illustration of the waste; I will say the outrageous waste (cheers) going on in our electricity undertaking. I have found out that the electric current leaves the station at a pressure of 2,000 volts. Very well. When it reaches us consumers, what do we find? Those 2,000 volts have been frittered away to a paltry 220. And what, you ask, has become of the rest? Ladies and gentlemen, it has been simply lost, wasted!' (Groans)."

Photographing Electric Waves.

Experiments have recently been made by Joseph Rieder at Steglitz, near Berlin, in photographing electric waves [illegible] in connection with radio-telegraphy. A [illegible] made by [illegible] colophony solution over a glass plate sprinkled with aluminum powder before becoming dry, [illegible] brought into contact with a highly sensitive photographic plate in [illegible] of a slide protected against light waves. [illegible] having then been subjected to electric waves, the record was found to be distinctly produced on the photographic plate after this had been developed. According to a correspondent of the London Times, the experimenter at first assumed that the aluminum powder had exerted some reaction of its own on the silver bromide. As, however, no trace of a photographic record was observed in connection with checking tests in which no electric waves were transmitted, the hypothesis that the picture was really due to electrical action was considered proved.

One curious point in connection with these experiments is that the metal powder at the places of strongest exposure showed the smallest density of aggregation, in opposition to what might have been expected. Nor was it found necessary to de-cohere by shocks before submitting the apparatus to a new experiment. In fact, whenever the plate was subjected to electric waves, a photographic record, the more intense as the action was stronger, could be observed. Again, the effects were found to be stronger when the back of the glass plate was coated with metal.

On the basis of the above observation the following arrangement was adopted: Some colophony solution was pressed with a rubber stamp on a slightly heated glass plate, and the surface of the latter was powdered over with aluminum powder, while the back of the glass was provided with a thin copper coating and brought into contact with a silver-bromide plate in a light-proof slide. Sparks were produced by means of a small influence machine.

The results of those experiments exceeded all expectation. The machine being located at Mr. Rieder's house, somebody would take the slide down to the street to a distance of about 70 meters, from which a picture of the writing was obtained on the photographic plate.

The arrangement described accordingly affords an excellent means of detecting electric waves. In fact, the apparatus even allows the duration and intensity of the waves to be gauged. The character of a thunderstorm can, for instance, be fixed most accurately, according to the duration, number and intensity of discharges.

A glass plate sprinkled with metal powder, coated at the back with a metal sheet, which in turn communicates with an antenna, should be used for this purpose, the thunderstorm being characterized by the length and intensity of the dots and dashes recorded on a Morse ink-writer or similar device.

As the apparatus does not comprise any complex mechanical parts, it would seem to be of remarkable safety, and as the purely chemical process is free from any delay due to de-cohering and to the mechanical recording, the speed of signaling according to the new process would seem to be superior to that of all other systems, provided the sensitiveness of the receiver be sufficient.

Whether these possibilities may be realized will be ascertained by the more extensive experiments recently undertaken by Mr. Rieder.

Creosote as a Wood Preservative.

Creosote is, of course, a valuable agent to preserve wood against decay. The Forest Service of the United States is disseminating information about it. A recent pamphlet is "The Analysis and Grading of Creosotes," by Arthur L. Dean and Ernest Bateman. The following paragraph is an extract from this publication:

"A pure coal-tar creosote will protect properly treated timber for a great many years. What protection will be afforded by the distillates from other kinds of tar is as yet an open question, but the increased production of these tars and the growing practice of distilling them make it imperative that definite information regarding their preservative value should be acquired. At present, despite the apparent approximation to the composition of coal-tar creosotes by the creosotes from oil or water-gas tars, the known preservative value of the pure coal-tar creosotes makes them of greater market value. We must, therefore, regard the creosotes obtained by the distillation of properly made coal tars as the highest grades for preservation. It is, of course, well known that by varying the conditions under which coal is decomposed tars are obtained which differ in composition. With distillations at low temperatures the production of aromatic compounds is reduced, and the resulting tar contains compounds analogous to those present in crude petroleum; hence the single specification that a creosote shall be distilled from pure coal tar does not necessarily assure a high-grade oil. In addition to being a pure distillate from coal tar, the creosote must also possess a composition which gives it properties falling within narrow limits."

End of the Lipsey Case.

[illegible] Ralph Lipsey [illegible] April 18, 1907, [illegible] Lipsey's attorney, prayed for a rehearing, which was denied by the Supreme Court on June 5, 1907.

Before Lipsey could be taken to the penitentiary his attorney filed a petition for issuance of a writ of habeas corpus before Judge McEwen of the Superior Court of Cook County. The hearing on the writ was opposed by a representative of the attorney-general's office and also by Assistant State's Attorney James J. Barbour of Cook County. After several hearings the matter was taken under advisement, and not until December, 1907, did Judge McEwen deny the writ, whereupon Lipsey was sent to the Joliet penitentiary. There he remained about 30 days, when his attorney again presented a petition for habeas corpus before Judge McEwen, who at once entertained jurisdiction of the case, and Lipsey was released from the penitentiary and placed in the county jail in Chicago.

At this stage of the proceedings the state's attorney's office in Chicago, assisted by the attorney-general's office at Springfield, at once applied to the Supreme Court for a writ of certiorari, by which the Supreme Court required the Superior Court of Cook County to send to the former the record of the proceedings had thus far before the Superior Court. The matter came on for a spirited hearing before the Supreme Court, Judge McEwen being represented by counsel as was the defendant Lipsey, while the People appeared by the attorney-general of the state as well as by Mr. Barbour.

The Supreme Court on April 23, 1908, handed down a decision declaring that it would not permit its decisions to be reviewed by an inferior court under the guise of habeas corpus proceedings, and Ralph Lipsey was ordered to forthwith return to the penitentiary, there to serve an indeterminate term.

James J. Barbour, assistant state's attorney, is entitled to credit for his clever handling of the case and for perseverance in fighting all of the maneuvers of the defense, with the result that Lipsey is now paying the penalty for handling property which he knew had been stolen from the Electric Appliance Company. To Frederic P. Vose, general counsel for the National Electrical Trades Association, is given credit for running down and unearthing Lipsey's "fence," which was a menace to the electrical trade of Chicago and elsewhere; and it was on Mr. Vose's testimony very largely that Lipsey was convicted.

Municipal Street Railways in Sheffield.

In a recent lecture by the general manager of the Sheffield (England) tramways it was stated that Sheffield was the first municipality to own its tramways; not to own and operate them, Huddersfield claiming that distinction, whereas Sheffield constructed the tramways and leased them to a company. The city corporation began working them as a municipal undertaking July 11, 1892. There are 268 passenger cars, 100 being covered top cars, 110 open top, and 58 single-deckers; a new car costs $3,800 and weighs about 10½ tons.

The department has direct control of the generating station. While the power costs Sheffield 1.316 cents per kilowatt-hour, Manchester pays 2.518 cents, Bradford 2.28 cents, and Liverpool 2.354 cents. At the Manchester rate the cost to Sheffield would be $156,340 more than at present. Seventy-three miles of trolley lines are in use, 25 miles of which have been renewed during the last year.

The average number of cars working each day approximated 185. On an average each car runs 117 miles per day.

The entire system furnishes regular employment for 1,500 men, and the weekly wage bill is $12,165, an average of $8.11 per man. During the time of municipal management the hours of labor have been reduced 40 per cent. In 1907 the total number of miles run was 7,000,000; passengers carried, 74,000,000; receipts, $1,396,542; working expenses, $827,220; average length of two-cents stage, 2½ miles. The receipts per car-mile run are 19½ cents and the total working expense a fraction under 12 cents, leaving 7½ cents to meet interest, sinking fund and all other charges.

The tramway permanent way has cost since 1896 $2,126,442, a large amount of which has been spent in paving a portion of the street surface on 35 miles of street. In addition to $53,651, which is paid by the department in general district and poor rates, a further tax is made upon the tramways for street improvements, the tramways paying interest and sinking-fund charges on $1,315,913 on that account at the present time.

The Iowa Conventions.

[*Continued from page 341.*]

will be secured, their suggestions utilized and their support assured. This principle applies with particular force to public-service corporations. Real public service means co-operation, which should bring with it legitimate profit.

Mr. Callahan showed by letters from a number of large and small stations that a daylight service supplying heating and cooking current-consuming devices is profitable. The companies should also enter into the sale of the devices. He said that most stations have done little in the way of securing a daylight heating and cooking load in comparison with the efforts to get motor, sign and lighting load; and the development of this load spells "profits." It was stated that in small cities approximately 95 per cent. of the residences are not wired, and in larger cities about 98 per cent., indicating that the field for profitable residence business is almost unlimited. The circuits to the residence lamp sockets should not lie idle 16 to 18 hours out of each 24. There is a great need for special solicitors, and the value of demonstrating to a new customer the advantages of a new device must not be overlooked. Next in importance to a good solicitor comes the show room. These electric household conveniences play an important part in satisfying customers and usually increase the lighting load. Mr. Callahan presented figures showing the current consumption for doing all the cooking and baking in his home for a period of 21 months. The total kilowatt-hours was 1,278; total single-person days, 1,725; total single-person meals, 4,891; average watt-hours per meal per person, 261.29.

In discussing the paper L. D. Mathes said that perfection of service is the first necessity to gain business and good-will. There should be a hearty co-operation between the central station and the dealer supplying current-consuming devices. Austin Burt inquired if it would be good practice in a small town to run during the daytime one day a week, and have it understood among the users of flatirons and other current-consuming devices that they let their work accumulate for this day. The answer was that many stations had tried this plan and some of them eventually worked into a profitable continuous 24-hour service.

Thomas Ferris said that companies which do not see their way clear to a 24-hour service could work up a profitable motor and heating load by starting up earlier in the evening and running to 8 or 9 o'clock in the morning. This practice would also gain the good will of lighting customers, and many of them would use more current.

Where a company has not sufficient funds to build circuits to all the business offered, Thomas Crawford of Clinton thought it unwise to attempt a daylight service. There is enough business, but the cost of scattering lines in towns of 1,500 or so is too great for a company with restricted finances. Messrs. Burt and Zinn found that the 24-hour service was one of the greatest factors in wiping out flat rates; and the meter method is better for all concerned. G. Deiderich of Avoca said that for one or two lights it does not pay to put in a meter, and Mr. Burt suggested that his company does not take business of less than four lights in one installation.

Fraternalism.

The first session of Wednesday closed with a short paper on "Fraternalism," by Gus Lundgren of Cherokee. The speaker urged the importance of co-operation among central-station men.

Tact and System.

At Wednesday afternoon's session J. W. Ferguson of the Commonwealth Edison Company, Chicago, read a carefully prepared and instructive paper on the subject of "Tact and System." The association tendered a vote of thanks to Mr. Ferguson and his company for the valuable paper. The paper will be printed in full in a future issue. Messrs. Burt and Mathes commented briefly on the paper. The latter said that one dissatisfied customer retained is better than two new ones.

Economical Operation.

Austin Burt of Waterloo gave a short talk on the economical operation of a 200-kilowatt station, [illegible] [illegible] as he considered this one of the most important [illegible] service is the aim. The consumer practically con- [illegible] must be met whenever he wants the service. The [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

duced peak. In these two months the improvement was 23 per cent. over what it was in 1902. A day load will increase the load factor, and this will save expenses. A small and large unit in a station is better than one still larger unit. Mr. Burt showed some interesting curves taken in his plant, and he showed how he had straightened out the load. A curve-drawing wattmeter is invaluable in aiding to increase the load factor. The average condition of load factor was said to be about 20 per cent.

Grounded Secondaries.

Thomas Sloss of Cedar Rapids read a paper devoted largely to a description of the methods of grounding the secondary in the Cedar Rapids system. Mr. Sloss has given the subject much thought, and he, as well as those who discussed the paper, believed it the best practice to ground the secondaries. The only, and as yet unsolved, question is the best way to do it. In Cedar Rapids every transformer is grounded. Copper plates are generally employed for the ground, but in some instances water pipes are utilized; the gas company's pipes are never used. The copper plate method seems to be the best, but it has the disadvantage of high cost due to deterioration. The discussion resolved itself into a question of how to ground and not whether to ground. A committee was then appointed to investigate the methods of grounding and make an early report to the association. This committee consists of Mr. Sloss, J. A. Innes of Eagle Grove and Prof. T. A. Fish of Iowa State College, Ames.

Incandescent Lamp Development.

The subject of incandescent lamp development leading up to the tungsten lamp was one of much interest to the central-station men. The subject was brought before the convention in an excellent paper by F. W. Willcox of Harrison, N. J. In the absence of the author the paper was read by George C. Osborn of the General Electric lamp factory at Harrison. The paper is printed elsewhere in this issue.

George Loring of the National Electric Lamp Association gave an interesting talk on the paper. He spoke of the excellent quality of the tungsten light, the improvement in the durability of the filament and the adaptability of the new lamp as a business getter. The fragility of the filament has been so well overcome that less than 1½ per cent. are now broken in shipment. While the current consumption is less for the same number of lamps as compared with the old style, the customers are better pleased, and with lower cost larger installations are made and the hours of use are increased, resulting in no curtailment of the station's income. Some users are known to have increased the hours of use of the lamps from an average of three hours a day to nine hours. Mr. Osborn and Mr. Loring answered many questions concerning the lamps. Care must be taken not to injure the light distribution by improper reflectors.

Meeting Gas and Gasoline Competition.

A discussion of the best ways to meet gas and gasoline competition was taken up on Thursday morning, led by Gus Lundgren and M. A. Harrison of Nevada. Mr. Lundgren had found the tungsten lamp one of the best weapons for meeting this competition. He believes in backing up arguments with demonstrations. In his office Mr. Lundgren arranged two adjoining booths, where the quality of gas and gasoline lamps could be compared with the tungsten; consumers were thus easily convinced. Mr. Harrison said that good service is the first necessity for meeting competition. Lamps should be taken out as soon as they begin to get black, and the voltage should be well regulated. He started a day service in the small city of Nevada, and it is beginning to pay, as it is a means of getting new customers. All prices can be met with the tungsten lamp. Electric power once installed has no trouble competing with gas engines.

Austin Burt said that demonstrations are necessary to meet competition. The working of meters should be explained to customers, and when complaints are made the meters should be tested in the presence of the consumer. Gas companies should confine their efforts to fuel and the electric companies to light and power. The electric companies, he said, should stay out of the cooking field where gas is economically available for that purpose. The motor business is the central-station company's advertisement.

F. K. Shuff of Ames said that for the same cost of operation two tungsten lamps could be used in place of one gas lamp, with a marked improvement in light. Messrs. Ferris, Carson, Lake and others offered suggestions.

Motor Characteristics.

Prof. A. H. Ford, of the State University of Iowa, read a paper on "Electric Motor Characteristics." He combined standard characteristics with the results of tests made by him and presented them in a form of real value to the central stations. It is necessary to know these characteristics in order effectively to solicit power business.

Freight Rates.

The freight question in the state of Iowa is a perplexing one, and efforts are being made for relief from apparent discrimination. On this subject Thomas Crawford presented the report of the committee on freight rates, and E. G. Wylie of Des Moines read a paper on "The Freight Question." Mr. Crawford said that about a year ago Des Moines filed a complaint with the Interstate Commerce Commission, complaining with reference to the excessive rate charged on generators, motors, switchboard instruments, meters and transformers from eastern points to Des Moines, claiming that the rates were too high as compared with the through rate to St. Paul and Minneapolis, also in regard to the proportional rate from the Mississippi River to Des Moines being in excess of the local rate from Rock Island to Des Moines. The hearing in this case was held a few weeks ago in Des Moines, the case consuming the better part of two days. After briefs have been prepared, the oral arguments will be held in Washington about this time, and the decision which the Interstate Commerce Commission will render in this case is important, inasmuch as the decision will decide to a great extent what relief the other cities in Iowa may hope for.

Mr. Wylie cited opinions of the United States Court, Interstate Commerce Commission and the state commission and criticized the rate-determining theories of railroads. He said the three great classifications are not consistent, and an effort should be made for a national uniform classification.

New-business Methods.

The closing session of the convention was given over to a discussion of new-business methods. L. D. Mathes of Dubuque, J. F. Porter of Davenport, A. L. Dodd of Charles City and J. P. Walters of Toledo were the speakers.

Publicity is the foundation of business, and publicity means advertising, said Mr. Mathes. Every company can afford to advertise to some extent. The columns of the press, bulletins and circulars or letters may be employed. The solicitor puts on the finishing touches. First of all, provide a reliable and satisfactory service, then make a price that can compete from a financial point with other agencies. Some companies get the business by admitting that the cost of electric service is a little higher than gas, but by good quality and numerous advantages prove that it is the cheapest after all. Every company can make an effort along the line of a display room, which is very effective. Be liberal in demonstration and guarantee of new devices. The tungsten lamp will get the man who has clung to gas, refusing to recognize quality in preference to cost. The adoption of the golden rule policy by the electric lighting fraternity will work out to the benefit of all.

J. F. Porter of Davenport said that local conditions must govern new-business efforts. Adequate plant, proper facilities and reasonable rates coupled with effective advertising will get business. The central station should be able to get the load of all factories requiring up to 300 horsepower to operate their plants. The many new devices being brought out should increase the load. Advertising is preferable to solicitors in dull times, as a saving can be effected. It is necessary to have a thorough understanding of rates to talk business effectively.

A. L. Dodd of Charles City gave the history of the improvement of an inefficient plant. By all means the central-station company should have an office downtown with a good display of lighting and heating devices. The speaker's little town is using 85 flatirons, 25 fans and 30 motors. Collect bills every month. Don't let them run several months and then scare the customer with the amount.

Just before the date of the convention, J. P. Walters reported that officials of the company in Toledo had remarked that unless a new prospect gives evidence of 7 per cent dividends, they didn't want the business. Companies should make a good charge for house wiring, and in this way make up for the expense of a long wire leading to installations in remote territory.

Regulation of voltage, according to Thomas Ferris, is an important factor in keeping satisfied customers. When the voltage is allowed to rise for considerable periods the consumer naturally thinks the company has insufficient power as soon as the brilliance fades away with the fall to normal or below. This brings complaints. Ordinarily too many transformers are used with consequent increased core losses. A 30-light transformer will take care of five or six ordinary residences.

O. E. Brownell of Lake City said that some companies were profiting by the use of a portable vacuum cleaning outfit. One manager said that his outfit earned $17 in a few days the first week it was in service. The outfit had a single-phase motor of 10 amperes.

EXECUTIVE SESSION.

With the executive session on Thursday afternoon the convention came to an end. The next convention will be held in Cedar Rapids beginning the third Wednesday in April 1909. The following named officers were elected for the ensuing year:

President—L. D. Mathes, general manager Union Electric Company, Dubuque.

Vice president—O. F. Brownell, superintendent Lake City Electric Company, Lake City.

Secretary—W. N. Keiser, engineer Des Moines Edison Light Company, Des Moines.

Treasurer—W. O. Mall, manager Belle Plaine Electric Light Company, Belle Plaine.

Executive Committee—The officers and Thomas Sloss of Cedar Rapids, F. L. White, manager Traer Electric Company, Traer, and J. F. Porter, president Tri-City Railway and Light Company, Davenport.

L. D. Mathes, the new president, is one of the most active and efficient workers in the association. He is a man of high personal character and wide business and technical training. He is 36 years of age, and for the last five years has been general manager of the Union Electric Company of Dubuque. Mr. Mathes was born in Memphis, Tenn., and was educated at the University of Tennessee. He has had extensive practical electrical experience, gained by working up through the various positions in electric light and railway operation and through connection with manufacturing companies. The association, as in the past, will benefit by his marked skill and wise counsel.

W. N. Keiser, the secretary, stands high in the esteem of the association. Because of his efficient work last year he was re-elected. Mr. Keiser is engineer for the Des Moines Edison Light Company and fills his responsible position with ability, although young in years. He went to Des Moines for the General Electric Company in 1901 to do underground and central-station work, and two years later took his present position. He is a native of Logansport, Ind., and a graduate of the electrical course at Purdue. During the Spanish-American war he was a member of the Fourteenth Signal Corps under Fitzhue Lee of the seventh army corps.

Iowa Street and Interurban Railway Association.

The fifth annual convention of the Iowa Street and Interurban Railway Association was held in Des Moines, Iowa, on April 23d and 24th. The sessions were held in the Savery Hotel, where the Iowa Electrical Association held its convention on the 22d and 23d. By this arrangement both associations had the benefit of the large exhibit made by the supply men in a large hall on the same floor with the meeting rooms.

The convention was called to order by the president, F. J. Hanlon, vice-president of the Mason City and Clear Lake Railway Company of Mason City. Mayor A. J. Mathes of Des Moines delivered a short but cordial address of welcome and a pleasing response followed by C. E. Walters of Toledo.

In the annual address President Hanlon thanked the members for their hearty support during his term, and he recommended a membership in the association as one of the most valuable assets of any electric railway company. He said that the papers on the programme merited the closest attention and careful discussion. Of particular interest is the proposed classification of operating expenses recently issued by the Interstate Commerce Commission. Closely allied with this subject is the matter of depreciation.

The report of the secretary and treasurer and the disposal of routine business was followed by a paper on "Reinforced Concrete in Electric Railway Construction," by N. M. Stark of Des Moines.

Following Mr. Stark's paper, W. A. Williamson was given permission to show a new automatic register for street cars, made by the Brooks Automatic Register Company of Providence.

The subject of "Depreciation" was presented in a paper written by Daniel Royse of Chicago. Among other things, Mr. Royse said: "In considering what present provision for future demands it is desirable or necessary to make, railways should be classified according to the length of time their franchise grants run. Depreciation applies to all railways, but plans for the amortization or retirement of the capital need be made only by those companies having short-term franchises. Depreciation is that deterioration of the physical property which is not made good by current repairs. For example, a car, though kept in the best of repair, eventually will have to be taken out of service and replaced. If the term of service be 20 years, it is evident that the car each year has depreciated in value to the extent of five per cent. of the difference between its original cost and its value as scrap. Assuming a scrap value of 20 per cent. of the original cost, there will be a depreciation of four per cent. per annum on the car. If no provision has been made for this current depreciation, when the time comes for replacing the car [illegible] earnings. The resolution also made it incumbent on the companies, in the interest of public sentiment and fairness, that regular reports be made public.

Arthur W. Gross of the Omaha and Council Bluffs Street Railway Company presented a paper in which he showed the best methods of handling claims against electric railways.

The morning session of Friday was given over to the subject of "Handling Fares on Interurban Railways." P. P. Crafts of Clinton read an excellent paper on the subject, and in the long discussion which followed the conclusion was reached that no absolutely perfect system has yet been discovered to protect the company from loss or theft of fares.

There was a general discussion of the subject "Advertising by Electric Railways." All were agreed that it was good policy to patronize the newspapers freely. The space in the papers should be used in such a way as to impress the public that the company wishes to be fair in its dealings and courts co-operation.

C. L. Wright of Des Moines presented a valuable paper on "Interstate Commerce Commission—Statistics and Accounts." The new forms of accounting as recently proposed are considered too elaborate for most of the electric railways, and the association took action requesting each member to write to the Interstate Commerce Commission and protest against the tentative classification which raises the number of main accounts from the original 59 to 116, with sundry sub-accounts. The members thanked Mr. Wright for the able manner in which he presented the subject, which they agreed was of too much importance to be discussed offhand.

The association approved the plan offered by the secretary of the Des Moines Commercial Club to hold the 1910 convention in Des Moines jointly with the electric-light association in connection with an electrical show. The commercial interest of the city will build a large exhibition hall for the purpose, and its use will be offered the association free of cost.

At the executive session the association adopted the report of the nominating committee which named the following gentlemen as officers for the ensuing year:

President—P. P. Crafts, general manager Iowa and Illinois Railway Company, Clinton.

Vice-president—R. A. Leussler, general manager Omaha and Council Bluffs Street Railway Company.

Secretary and treasurer—L. D. Mathes, general manager Union Electric Company, Dubuque.

P. P. Crafts, the new president, is one of the leading electrical and street-railway men of Iowa. He is 36 years of age and is a native of Maine. He first entered the electrical field with the Stone & Webster interests in the East, remaining four years. For three years he had charge of the electrical department of the Brookline Gas Light Company. Later he spent a year in connection with electric-light and street-railway properties in Minnesota, and then went to the Saginaw Valley Traction Company in Michigan, remaining two years. For the last four years Mr. Crafts has been general manager of the Iowa and Illinois Railway Company at Clinton. His graceful attentions to the visitors to Clinton at the time of the Iowa electrical conventions of 1907 will not be forgotten easily.

Exhibits and Exhibitors at Des Moines.

An interesting line of asbestos products was displayed by the Keasley & Mattison Company of Omaha, Neb.

George Loring of the National Electric Lamp Association, Cleveland, was kept busy greeting his many friends.

W. P. Cosper of Chicago, general western agent for the Lord Electric Company, showed a line of interesting railway specialties.

The Green Fuel Economizer Company showed a small model which demonstrated the advantages and operation of the economizer.

Erwin Dryer of the Allis-Chalmers Company, Milwaukee, was present. The exhibit consisted of a large assortment of trade literature.

J. L. Woodress of St. Louis was present in the interest of the Century Electric Company, manufacturer of single-phase motors and fans.

A novel and practical device for protecting linemen was exhibited by H. E. Marshall of the Linemen Protector Company of Detroit, Mich.

The Northwestern Appliances Company of Minneapolis had a number of attractive new articles in its exhibit of electrical supplies and machinery, [illegible] hibit.

[illegible]

[illegible] descent Lamp Company. Especially attractive was [illegible] lamps. Secretary and Treasurer Theo. Mueller and Mr. C. R. Wood were in attendance at the exhibit.

A large [illegible] made by the Western Electric Company. Special attention was attracted by the Beck flaming arc lamp, [illegible] of railway appliances. Visitors were entertained by H. W. Arnold, D. C. Guest, G. H. Macklin and M. R. Lash.

W. F. Brann, 1721 East Thirty-third Street, Des Moines, is the inventor of a recently patented device for replacing derailed cars. He showed a wooden model of the origianl, which is made of steel and weighs 70 pounds. The device has been tried and meets the approval of the Des Moines City Railway Company.

The Bryan-Marsh Company's exhibit was devoted to a display of high-efficiency lamps. A four-lamp cluster of tungsten lamps was shown to demonstrate that the new lamp can be used in a horizontal position. Sam Furst and J. L. Barnard, the latter manager of the northern office at Minneapolis, took care of the company's interests.

The National Lead Company had on exhibition various articles made of Phœnix babbitt metal. A large swinging bell made of pure Phœnix babbitt was on exhibition to demonstrate the clearness of the tone. All who visited the booth were given a souvenir "ring." This bell was used to announce the opening of the various convention sessions.

Some of the more popular articles from the large line of the Simplex Electric Heating Company of Cambridge, Mass., were exhibited, making a very pretty display. Household irons and dining-room sets were exhibited along with the baby bath warmer, heating pads, water-cup heaters, etc. The company was represented by E. R. Jacobs of the Chicago office.

An attractive display was made by the American Steel and Wire Company, in charge of B. H. Ryder of Chicago and George Quigley of Kansas City. There was shown a line of rail bonds that may be applied by compressors and a full line of pin terminals and twin terminal bonds. Much attention was attracted by the automatic hydraulic screw compressor for bonds.

The Electric Appliance Company of Chicago had a large exhibit of high-grade supplies, the principal articles of interest being Sangamo watt-meters, American Cooking and Heating appliances, tungsten lamps, porcelain sign letters and Wagner instruments. F. J. Alderson of Chicago, J. K. Alline of Ft. Dodge and Mr. Collins of Warren, Ohio, were present to interest callers.

The W. R. Garton Company of Chicago was represented at the convention by President Ray P. Lee and E. Lewis, Iowa salesman. This company had one of the largest exhibits. Lima porcelain insulators for high voltage were shown, including the underhug type for 150,000 volts and the 66,000-volt pin insulators. Demonstrations were given with Heany fireproof wire and indestructible magnet wire.

The Illinois Electric Company of Chicago exhibited a line of general supplies and accessories, including Paiste material, Woolley enclosed fuses and CC non-gap arresters, Peerless incandescent lamps, Arrow-E switches, Duncan and Westinghouse meters, Gifford lightning arresters and the American Electric Heating Company's devices. J. A. Duncan of Chicago and Iowa Salesman Morehouse were present.

Among the most attractive and interesting exhibits was that of the Duncan Electric Manufacturing Company. Meters of the house type as well as those calculated for switchboard service were shown, several of them being in operation, attracting decided attention. The display was in charge of Adrian Tobias, sales manager. Mr. Tobias made many friends for his company while at the convention.

The Fort Wayne Electric Works had a large exhibit of motors, meters, arc lamps, etc., in charge of W. S. Goll of the Chicago office and F. S. Wiemeyer of the Des Moines office. A new meter calibrator attracted the attention of central-station men. A large line of fan motors was shown. The new type self-contained direct-current arc lamp, in which the resistance is enclosed within

the lamp body, was an attractive feature of the exhibit.

A. W. Zahm, formerly of Mason City and Fort Dodge and a former president of the Iowa Electrical Association, represented the Northwestern Electrical Equipment Company of St. Paul. In the same booth C. W. Loose took care of the interests of the Fostoria Incandescent Lamp Company. He had an attractive exhibit of high-efficiency lamps, including the tungsten. Some Holophane goods were also shown.

The Electric Service Supplies Company was represented by the Porter & Berg department, Chicago. The large exhibit included rail bonds, Keystone overhead line material, Victor porcelain insulators, Garton-Daniels arresters, Crouse-Hinds electric headlights, etc. The Keystone combination sander and whistle valve attracted the attention of the railway men. C. C. Ewing and E. R. Mason of Chicago were in charge of the exhibit.

Visitors at the booth of the Westinghouse Electric and Manufacturing Company were entertained by W. R. Pinckard of Chicago, A. M. Miller, H. C. Caughlan and A. N. Brown. The exhibit contained some of the company's products of especial interest to central-station men. There was an elaborate display of portable instruments, switchboard instruments, fan motors and electric sadirons. The metallic-flame direct-current series arc lamp attracted wide attention. There was also a good display of Westinghouse tungsten lamps.

A feature of the exhibit of the Federal Electric Company of Chicago was the tungsten fixtures designed to replace the gas "arc." Three 60-watt lamps and one 100-watt lamp in the cluster give a much better light than the gas arc and is its equal as to economy or in any other respect. F. H. Welling was in charge of the exhibit and he also showed a line of standard lighting fixtures, various kinds of electric signs, dim-a-lites, couch brackets and other devices which interested the lighting men.

Much attention was attracted to the exhibit of the Pacific Electric Heating Company of Ontario, Cal. Henry F. Holland, Chicago representative, was in charge and called attention particularly to the new flatiron with which three degrees of heat can be maintained by a convenient arrangement. These irons also have an attached stand on which they rest when not in actual use. A practical device shown was the curling-tongs heater, a small heater which can be screwed into the nearest lamp socket. The company is finding much favor for its electric toaster, which operates from a lamp socket and can be used on the dining table.

A motor-driven coffee mill, meat chopper and bone grinder was exhibited by the Hobart Electric Manufacturing Company of Troy, Ohio. The outfit presents an attractive load for central stations. The coffee mill has a novel device which prevents stones, screws or nails from entering the grinding burrs, thus eliminating all strain or danger to the motor and insuring long life to the mill. Hobart direct-current or Emerson alternating-current motors are used, ranging in size from one-quarter to two horsepower. J. E. Williams, sales manager for Iowa and Nebraska, was in charge of the exhibit.

The H. W. Johns-Manville Company of Milwaukee was represented by George A. Saylor, manager electrical department; William B. Roberts, Iowa representative, and J. W. Eviston, special boiler compound expert. The company had a full exhibit of its standard Noark fuses, service boxes, overhead line material, strain insulators, sockets, etc., of molded mica insulation, electrotherms, fire extinguishers, etc. "Linolite," the new system of lighting for show windows, showcases and all kinds of decorative lighting, was shown; also Victor combination meters for direct-current work, giving a direct reading of volts, amperes, kilowatts and horsepower on the same dial simultaneously; [illegible] wood for electrical purposes taking the place of slate and marble for panel and switchboard construction, and Magic boiler compound.

The General Electric Company's exhibit was in charge of its Iowa representative, J. D. A. Cross. Other representatives of the company in attendance were A. P. Jenks, S. F. Dibble, F. T. Ben- [illegible] Callahan of Chicago, and George C. Osborn of Harrison, N. J. The com- [illegible] devices was exhibited. The electric irons in various weights from [illegible] to fit standard mantel grate openings. Especially [illegible] multiple tungsten lamps fitted with suitable re- [illegible] multiple magnetite luminous arc lamp exhibited in [illegible]

A Thompson high-torque test meter was also included in the exhibit.

Near the entrance to the hall the Ohio Brass Company had a large exhibit in charge of A. L. Havens, district sales agent. A full line of standard overhead construction material was shown, and a number of specialties, including genuine bell-metal bearings, high-tension insulators, Armstrong oilers and several new overhead devices, prominent among which was the company's new section insulator, which embraces its well-known form of wood break strain insulator. Among the claims for this section insulator are: The trolley wires cannot pull loose, no strain upon the runner piece and runner piece unmovable. Samples of compressed terminal and several types of soldered bonds were exhibited, all of the company's one-piece type. An active demonstration of a model set of Tomlinson automatic car couplers was, however, the greatest drawing card and maintained an interested crowd of railway representatives.

Westinghouse Horizontal Double-acting Gas Engine.

The particular type of large gas engine here illustrated may be considered as the result of about 10 years' actual development of various sizes and types at East Pittsburg. During this period, the development of large Corliss engines has gone on simultaneously until the steam turbine practically forced the abandonment of Corliss engine construction. The gas engine has, however, held its field, owing to inherent efficiency of the gas-power system, and the long experience of the builders in steam-engine practice, has been put to excellent use and embodied in the heavy-duty reciprocating gas engine. During these 10 years the manufacturer reports that 1,054 engines have been entered on the order books, aggregating 140,000 brake horsepower nearly, or a little over 140 horsepower per unit. The plants equipped number 648, over one-third of which (225) are above 100 horsepower. Moreover, more than 90 per cent. of this total is either in operation, erecting, or in process of shipment. At this date there were also stock orders booked sufficient to bring the total business recorded by this company up to over 162,000 brake horsepower.

There are now in operation 25-cycle, single-phase interurban railways, 60-cycle central stations, 25-cycle and 40-cycle industrial plants, all operating in parallel electrically. There are also many direct-current plants. For the above, both horizontal and vertical types have been installed. Among the industries may be mentioned the blast-furnace plants at Bessemer and Gary, cement mills at Iola, Kan., oil refineries at Philadelphia, gas compressors for long-distance transmission in the natural-gas field, and many others.

While the largest number of engines are running on natural gas, the largest plants use some form of manufactured gas, such as blast-furnace, producer or coke-oven. By-product coke-oven gas promises an excellent field for development, although little has been done as yet. Manufactured gas, coal or mixed, is widely used in the smaller plants, and in a few special installations, such as the high-pressure, fire-pumping station at Philadelphia, where the cost of fuel gas is not important, owing to the comparatively short periods of operation.

Within the last year material progress has been made in the application of producer gas to all classes of service, and it is probably true that the future of gas power rests with the corresponding development of the producer. A number of successful types are now in operation, using both bituminous and non-bituminous fuels, it is said. These include both the suction and the pressure types, the former for plants up to a few hundred horsepower in capacity, and the latter for the larger plants. The largest producer plant, about 3,000 brake horsepower, operates the works of the Winchester Repeating Arms Company, New Haven, Conn. This plant runs on bituminous gas with the intermittent-type producers.

In the adoption of the four-stroke cycle, the builders have proceeded in the belief that an engine of maximum simplicity and efficiency would result. The four-stroke cycle engine is self-contained. It does its own pump work and provides a sufficient length of time for the induction of mixture to reduce fluid velocities and resulting friction to a reasonable amount, and avoids entirely auxiliary pumping apparatus, the sole function of which is to overcome this friction of ports and passages within the allotted time. The tandem cylinder arrangement is standard for all sizes of engines, whether single or double crank. The former gives two power strokes per revolution, the latter four power strokes per revolution with cranks at 90 degrees. This tandem arrangement, with flywheels of reasonable size, easily yields a turning moment sufficiently uniform for all tandem work.

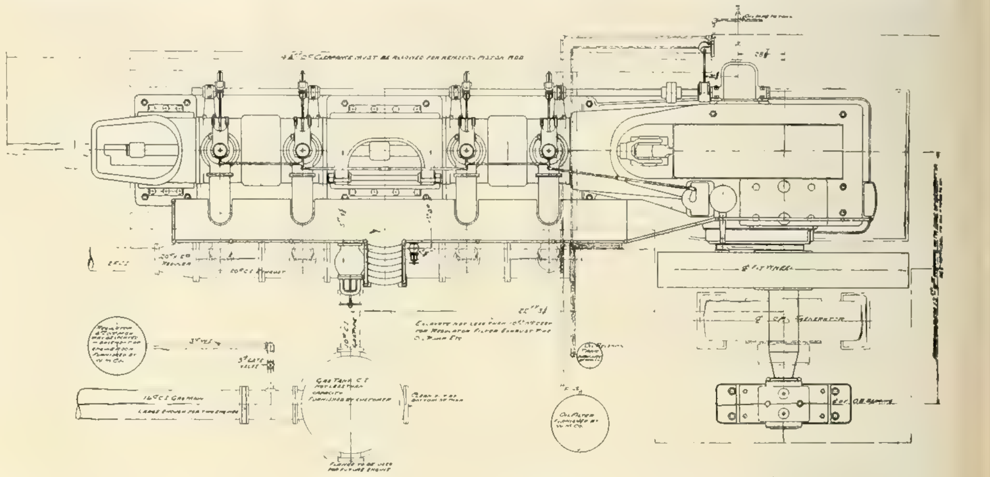
As all Westinghouse horizontal engines are of the side-crank construction, the alignment of but two bearings is necessary. The smaller shafts are solid forgings; the larger are bored hollow. Cranks, counterweights and crank pins are cast in one piece, with the pin at the bottom of the mold, to insure homogeneous metal. This design of crank is made necessary because of the relatively short stroke and large shaft diameter required.

Instead of a single governor valve controlling all inlets from a single point, the governing is accomplished directly at each inlet, the inlet valve performing the function of mixing and governing. Thus gas and air are mixed only at the point of entry to the cylinder, and in exact quantity required by the load—a condition of sensitive governing. The inlet valve has two distinct motions, one due to the eccentric and the other to the rotation of a loose internal sleeve controlled by the governor and provided with ports registering with corresponding ports in the surrounding valve cage. The essential function of this rotating sleeve is that of a purely throttling governor which opens or closes the respective ports according to the load. Hence the mixture itself remains unchanged at any load.

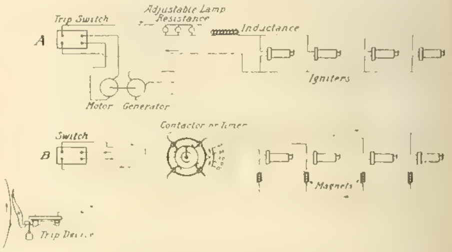
By means of an oil-pressure relay system the regulator is entirely relieved of the actual work of moving the heavy valves. The regulator and relay are driven direct from the engine shaft and connected by means of reach rods to the various inlet valves. The regulator itself is of a purely centrifugal type, but European design, the Hartung or the Jahns. Each involves straight-line motion for the governing weights and is fitted with an oil dash-pot to prevent hunting. By driving the regulator directly from the main shaft, the effect of variable torque in a lay-shaft drive, is avoided. Oil pressure for the relay is supplied at about 60 pounds pressure by a small pump (either of the rotary or the piston type) driven from the engine lay shaft.

In the event of a possible disablement of the governor, a safety device interposes and shuts down the engine by cutting off the ignition.

Make-and-break ignition has been adopted to



PLAN OF 500-HORSEPOWER SINGLE-CRANK TANDEM WESTINGHOUSE GAS ENGINE.

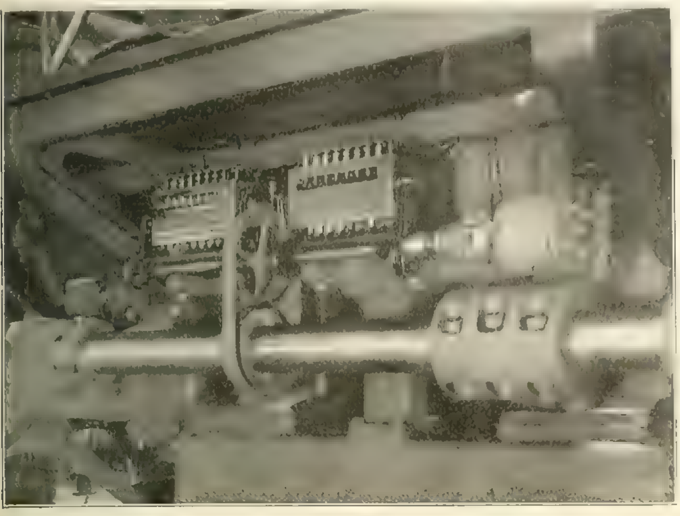


(A) Mechanical Igniters.
(B). Magnetic Igniters.

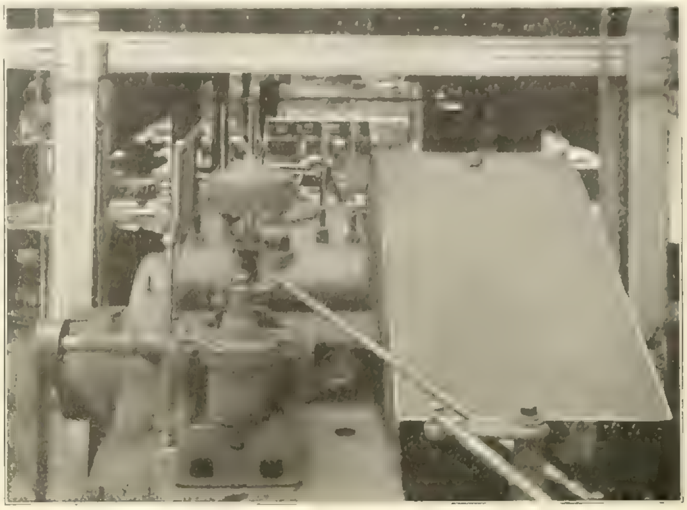
DIAGRAM OF IGNITERS AND SAFETY STOP DEVICE.

the exclusion of all other systems after much experimenting, as the most practical for average conditions. Jump-spark ignition proved satisfactory on rich gas, but showed erratic results with the high compressions used in blast-furnace-gas practice. Platinum points, formerly used, are now entirely done away with, and cast-iron or a special bronze is employed for the moving contact, working against a fixed steel terminal. High voltages and low current furnished by a small motor-generator gives the desired security of action and long life. In the event of a serious ground, an igniter immediately insulates itself by the blowing of a fuse, one of which is inserted in each independent circuit.

An important point is the provision of two or more igniters for each combustion chamber; in the larger sizes there are three igniters located at



View Showing Contactor for Magnetic Igniters and Sight-feed Forced Lubricators.



View of Governor, Showing [illegible]

DETAILS OF WESTINGHOUSE HORIZONTAL GAS ENGINE.

corners of an equilateral triangle. The results of using more than one igniter are more rapid and perfect combustion and an increase in electromotive power of nearly four per cent. for the second igniter.

Recognizing engine lubrication as a vital necessity, the builders have relieved the operator entirely of the work by automatic lubrication. For the cylinders, force-feed lubricators are employed. Most important, the oil is accurately timed so as to reach the piston just at the close of the power stroke when covering the oil ports. Engine oil is served by a gravity system, including pump, filter and elevated reservoir, with individual sight-feeds, all controlled by a single valve, so that individual adjustments, once set, need not be changed.

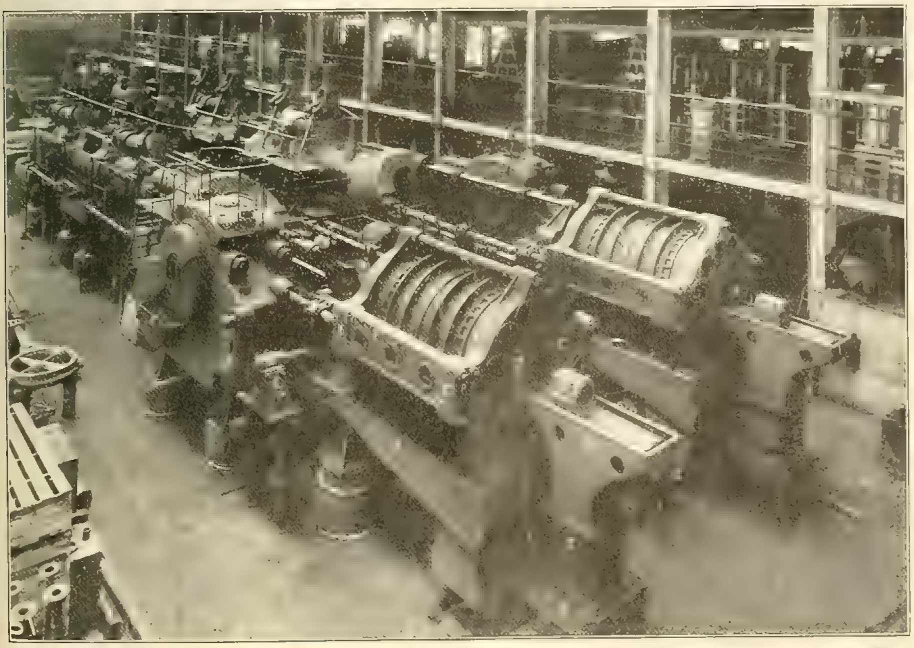
Particular attention has been given to reducing the quantity of cooling water required for the engine. For this purpose a series system has been employed to some extent. A water pressure of 25 pounds is all that is required for supplying all parts.

As in smaller sizes, the horizontal engines are started by compressed air and automatically through individual cams and poppet valves, located along [illegible] With ignition on, the engine starts itself after [illegible] cylinder picks up its ignition (after one or two [illegible] by the combustion pressure. On the other hand, the air continues until combustion has started in all four chambers until shut off at the throttle. Then the air valves drop out of engagement by their own weight.

[illegible] ways subject to considerable variation, it is necessary to provide an automatic regulator in the supply line to maintain at the inlet valves the proper mixture. This mixture is ordinarily set by the [illegible] air and gas-supply pipes leading to each inlet. The main gas regulator employed on Westinghouse engines consists simply of a butterfly disk valve inserted in the supply line, the position of which is controlled by a small gasometer connecting with the main on the engine side. Thus the movement of the gasometer and the butterfly follows instantly upon the varying demand for gas by the engine.

Contrary to the general impression, it is asserted that parallel operation at all but excessive frequencies has ceased to constitute a difficulty. A sufficient factor of safety in amplitude of cyclical variation is provided in Westinghouse engines to provide for the contingency arising in case of displacement of one complete set of igniters; i. e., with the engine operating on "three legs." The governing system employed controls the mixture directly at the inlet to each cylinder, and at a distant point, and a speed regulation as low as 2½ per cent. (no load to full load) may be obtained.

The rating of these gas engines is placed at the conservative figure of 10 per cent. below the maximum load the engine will sustain for a considerable period. Owing to the high efficiency of the four-[illegible] 10,000 British thermal units per brake horsepower-hour. And this efficiency is largely independent of [illegible]



GENERAL VIEW OF 3,000-HORSEPOWER GAS-ENGINE BLOWING UNIT FOR STEEL WORKS AT GARY, IND.

Omaha Electrical Show.

[illegible] Omaha Auditorium on May 4th, to continue one [illegible] ceeded in securing a large number of excellent exhibits, and every indication points to the success of the show. It is no small undertaking to run an electrical show in a city the size of Omaha, and especially the first show of the kind, but the members of the Nebraska Electrical Trades Association have taken hold of this show with great energy and enthusiasm, and that means half the battle in every case.

The Auditorium, which is located near the heart of the city, will be beautifully illuminated and decorated by means of an elaborate lighting scheme. The exhibition space has practically all been taken with the exception of a few booths, and will be filled undoubtedly before the opening day of the show.

All of the local electrical houses in Omaha and Council Bluffs, of course, are represented in this show and among the more prominent electrical manufacturers the following may be mentioned:

General Electric Company, Schenectady, N. Y.
Crouse-Hinds Company, Syracuse, N. Y.
Central Telephone and Electric Company, St. Louis.
Fort Wayne Electric Works, Fort Wayne, Ind.
Adams-Bagnall Electric Company, Cleveland, Ohio.
Benjamin Electric Manufacturing Company, Chicago and New York.
Buckeye Electric Company, Cleveland, Ohio.
Economical Electric Lamp Company, New York.
Independent Arm and Pin Company, Chicago.
Nungesser Electric Battery Company, Cleveland.
Blake Signal and Manufacturing Company, Boston, Mass.
The Batteries Supply Company, Newark, N. J.
Crescent Insulated Wire and Cable Company, Trenton, N. J.
The Duplex Metals Company, New York.
The Federal Electric Company, Chicago.
Mathias Klein & Sons, Chicago.
National Carbon Company, Cleveland.
Sprague Electric Company, New York.
Westinghouse Electric and Manufacturing Company, Pittsburg.
John A. Roebling's Sons Company, Trenton, N. J.
H. W. Johns-Manville Company, New York.
Nernst Lamp Company, Pittsburg.
A. L. Ide & Sons, Springfield, Ill.

Emancipated Mules of Reno.

A few weeks ago electric locomotives were installed to haul ore on the 700-foot level of the Sutro tunnel on the Comstock Lode at Reno, Nev. Until that time the ore was hauled by mules, and the interesting statement is made that 12 of the mules taken from the mine last month saw daylight for the first time in over 30 years. The Sutro tunnel was opened in 1877, when a large number of mules were taken underground. Some have since died, but the surviving 12 old veterans, now relieved by the electric locomotive, will be pastured out for the rest of their lives.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker.

Part V.

The Test Room.

Organization.—The "test room" of the central-station company is the general headquarters for shop and testing work connected with the company's meters. In small companies the term and the place itself may comprehend all the available facilities for every part of the work in the history of the installed meters, from the receipt and installation of the meter, through every detail of its service life, to its final dissolution into "meter parts" for the repair of other meters. In larger companies, in which specialization becomes advantageous, we begin to have an organization of the "Meter Department," with separate test rooms, stock rooms, machine shop, etc. In this organization the test room becomes a place exclusively for testing and repair work. Here are located the men, apparatus and equipments for the calibration and general maintenance of the company's meters, including all work on meters removed from their places of installation for any cause. The place is also employed as a headquarters for tests at consumers' installations.

In some companies the workshops are utilized for every kind of electrical testing, experimental and repair work that may come up in connection with the plant as a whole. This work may include much that is outside the immediate scope of the Meter Department, such as the testing and repairing of transformers, motors and storage batteries, and of arc and incandescent lamps, including photometric work and life tests of the last-mentioned; the analysis of fuels and oils; and the making of engine and boiler tests at the company's central stations, and tests of the efficiency of the electric machinery at its stations and sub-stations and at consumers' installations. Finally, and in conjunction with the foregoing work, the test room has the care and calibration of the instruments used in testing work.

In what follows will be given notes of the author's observations on the functions and equipment of the test room in certain central-station companies, under the heads, "The Laboratory," "Special Equipment and Methods" and "The Repair Shop." However, no pretension to the giving of an exhaustive account is made.

The Laboratory.

Functions and General Equipment.—The functions of the laboratory are to make meter and other tests, and keep the testing apparatus in calibration. Its equipment consists of various pieces of physical and electrical apparatus, including so-called "secondary standards" in the form of laboratory, switchboard and portable instruments—a larger or smaller number, according to the size or degree of organization of the company—and in some of the larger companies a number of original or "primary" standards. Several of the instruments of each of these types are briefly described herewith.

Many companies having a set of primary standards make a practice of using them to check their secondary standards every week. Companies not possessing primary standards of their own generally utilize their secondary standards for checking their equipment of portable instruments, relying upon an occasional recalibration of the former by an outside standardizing bureau. The United States Bureau of Standards, Washington, D. C., or the Electrical Testing Laboratories, New York city, are equipped for recalibrating the primary and secondary standards of central-station companies.

Secondary Standards.—The equipment of laboratory instruments naturally includes not only the apparatus required for meter calibrating work at the test room and for the periodic checking of the entire equipment of portable and switchboard instruments belonging to the company, but for the work of testing meters in service at consumers' [illegible]

[illegible] instruments of different ranges and [illegible] should be provided [illegible] the reading of [illegible] light and heavy loads. Meters have been incorrectly read- [illegible]

[illegible]

indicating instruments of inappropriate range which were themselves in error, for example, on the low part of the scale. This subject is discussed practically on pages 593-595 of Mr. H. Miller's article, "Metering Commercial Electric Currents," in the Electric Journal for October, 1907.

Apart from the switchboard instruments connected to the meter-testing and battery-charging circuits, the equipment of indicating instruments may include high-grade portable direct-current ammeters, or (preferably) milli-voltmeters with shunts; direct-current voltmeters, such as the Weston laboratory standard, having three scales reading to 3, 15 and 150 volts, respectively, with multipliers for doubling or quadrupling the range on the 150-volt scale (additional multipliers of 10 and 20 are also convenient); alternating-current voltmeters, of which a suitable form is the Weston laboratory standard having two scales, zero to 150 volts and zero to 300 volts, with a thermometer and adjustable resistance fitted into the case of the instrument; and, lastly, alternating-current wattmeters, such as a selection from the line of Weston standard instruments, varying from two-ampere to 200-ampere capacity and provided with multipliers of 2 and 4 for enabling the wattmeters to be used on 220-volt and 500-volt circuits. A wattmeter of 25-ampere capacity at potentials of 75, 150, 300 and 600 volts is especially useful.

Self-contained ammeters are not ordinarily advisable for meter-testing work, owing to the difficulty of reading small currents accurately on instruments of sufficient capacity to test meters of 25-ampere capacity and over, and to the temperature error that comes in when the instrument remains too long in the load circuit.

Whether an ammeter or a shunt with a milli-voltmeter is employed, it should be connected in circuit so as not to measure the current in the potential circuit of the meter.

The use of a milli-voltmeter (calibrated in amperes) and shunt instead of a self-contained ammeter, in measuring load current, is preferred by many companies. The facility of making connections with a separate shunt commends this method alike for measuring large currents in the test room and for measuring currents of all strengths in testing on consumers' premises.

Fig. 7 is a diagram of the connections of a three-scale (1.5, 15 and 150-ampere) milli-voltmeter

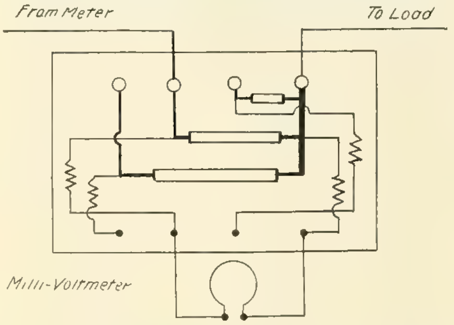


FIG. 7. DIAGRAM OF CONNECTIONS OF THREE-SCALE MILLI-VOLTMETER AND SHUNT FOR TESTING ON CUSTOMERS' PREMISES.

and shunt for meter testing on the consumers' premises. The shunt consists of three low-resistance strips, of appropriate carrying capacity and low temperature coefficient, mounted in a ventilated wooden box, and connected to the heavy "load binding posts" (the top row in the figure), by means of which the shunt is cut in on one side of the service wiring, between meter and load, as shown. The shunt may be placed in any location directly accessible to the service wiring, thereby avoiding the necessity of providing and connecting up heavy test leads, and leaving the milli-voltmeter, which is connected to the shunt by light wires, to be placed in the most convenient location for reading.

In another form of this current-measuring apparatus, especially adapted to meter testing, the "multiplying power" of the shunt is 1.5, 15 and 75; i. e., the set has three ranges, zero to 1.5, to 15 and to 75, respectively. The milli-voltmeter has only two scales, however, zero to 15 and zero to 75, the former answering for the lowest range also (zero to 1.5) by assigning each scale division on that scale a value of one-tenth its stated value.

The function of the milli-voltmeter is to measure the current passing through one or another of the low-resistance strips, or "shunts," which it does by measuring the fall of potential in the shunt. Ordinarily, therefore, the milli-voltmeter will be connected directly to the load binding posts. But in the form of shunt illustrated, separate binding posts (the bottom row in the diagram) are provided for the milli-voltmeter connections, these binding posts being wired to the ends of the shunts through the small resistance coils shown (contained in the shunt box), by means of which the final calibration of the milli-voltmeter is effected. Additional shunts may be provided, enabling the same milli-voltmeters to be used for measuring larger currents than the above; e. g., 300, 500, 600, 1,000 and 1,200 amperes.

The following precautions should be observed in handling the milli-voltmeter and shunt:

Under no conditions should any other milli-voltmeter leads than the ones furnished with the instrument be used, or the lengths of these leads be changed.

Before changing connections, or load, in circuit with the load binding posts, the milli-voltmeter should be disconnected by removing the wire from the binding post not marked + on the shunt, and placing it under any of the other milli-voltmeter binding posts. In this way, a short-circuit or overload through the shunt will be prevented from impressing an abnormal voltage on the instrument, thereby bending the needle or burning out its coils, or burning out the calibrating coil in the shunt box. A momentary heavy current which would not injure the shunt itself might completely wreck the instrument.

The milli-voltmeter leads should be covered with good soft-rubber tubing, and should be kept clear of the ground when the instrument is connected to a live shunt, in order to avoid liability of reverse readings due to leakage.

In using the milli-voltmeter and shunt on three-wire systems with grounded neutral, the shunt should be cut in on the neutral, if possible, and not on either of the outside mains, in order to avoid liability of short-circuit by accidental grounding of an instrument lead connected to the shunt. In many consumers' installations, however, it is not practicable to connect the shunt in this way, as the meter is cut in in one of the outside wires, and the neutral carried through without break in the service wiring.

[*To be continued.*]

Induction Motors in a Brewery.

In following out its plan for enlarging and improving the power equipment for its large plant, the Pabst Brewing Company, Milwaukee, recently placed contracts for a line of 25-cycle Allis-Chalmers induction motors, of standard and special design, ranging in capacity from five to 50 horsepower. These motors, which are three-phase, 440-volt machines, are to be driven from the three Allis-Chalmers engine and generator units installed some months ago in a central station to replace a number of smaller isolated power plants in various parts of the brewery. The electrical generating equipment has a capacity of 1,100 kilowatts. The power station for this establishment has been made a notable show plant, and the addition of induction-motor drive is but one more step toward an ideal equipment for brewery service.

A Large Order for Air Brakes.

The Chicago Railways Company, which owns all of the North Side and West Side street railways in the city of Chicago, has just awarded a contract to the National Brake and Electric Company, Milwaukee, Wis., to furnish all of the air-brake apparatus for the 1,200 new cars, which, in accordance with the traction ordinance, it will purchase and place in service within the next three years. The Chicago Railways Company expects to put about 550 new cars into service this summer, orders for 400 cars having already been placed with the car builders.

This contract, it is believed, covers a larger number of air brakes than has ever before been contracted for by any electric-railway company.

The Franklin Institute.

In the Journal of the Franklin Institute of the State of Pennsylvania for April there is a report of an interesting lecture, with portraits and illustrations, on "The Franklin Institute; Its Services and Deserts," by Dr. Persifor Frazer. The lecture was delivered on February 14, 1908, on the occasion of a reception to mark the reorganization of the society following its receipt of the Benjamin Franklin legacy. Franklin Institute, devoted to science and the mechanic arts, was founded in 1824. Many distinguished men have been connected with it, and it has an honorable history. The present president is Walton Clark, and Dr. William H. Wahl is secretary.

H. H. Hyatt, the promoter of an interurban line between Oklahoma City and El Reno, has left for St. Louis to purchase rails and material for the line and says that the work will begin at once.

The New Incandescent Lamps.[1]

By Francis W. Willcox.

Tantalum Lamp.

The tantalum lamp was the first metal-filament lamp to dispute the supremacy of the ordinary carbon lamp. With the excellent efficiency of two watts per candle the lamp was a material improvement over the ordinary carbon lamp, which requires 3.5 watts per candle for the same life as the tantalum (on direct current), giving a saving with the tantalum lamp of over 30 per cent. for the same illumination, or, as the tantalum lamp is not made less than 20 candlepower, a saving of about 30 per cent. over the ordinary 16-candlepower lamp. This material gain in economy has given the lamp a good start in commercial lighting, and over 1,200,000 of the lamps have been sold in this country. The lamp would have had a wider use but for certain limiting conditions.

In the first place, the tantalum lamp reached its development a little late, coming as it did at the time of the introduction of the Gem or metallized filament, which gave an efficiency of about 2.5 watts per candle at a cost of but 25 per cent. more than the ordinary carbon lamp, where the tantalum lamp cost three times as much as the carbon lamp.

Secondly, the reduced life on alternating current (about half of that on direct current at ordinary frequencies, 60 cycles or less) practically limited the lamp to direct-current service, and this seriously restricted its field of application on central-station service, in which alternating current is used for the most part. (Out of 4,000 central stations in this country less than 300 by number have direct-current service; about 40 per cent. by quantity of lamps.)

Further, the relatively high cost of the lamp (about three times that of the carbon lamp) made it impossible for central stations to supply free renewals of the lamp as is customary for carbon lamps. This naturally restricts its use among central-station consumers, many of whom hesitate to adopt a lamp they have to pay for when they can get free lamps, even though a clear saving of 20 to 30 per cent. in current and 25 per cent. increased illumination can be shown. This has necessitated a great deal of advertising and soliciting work to introduce the lamp.

In spite of these limiting conditions the tantalum lamp has been quite extensively employed in this country since its introduction a year and a half ago. Most of the lamps have been the 50-watt (25 candlepower) and 40-watt (20 candlepower) sizes. An 80-watt size is also made, which is used as an incandescent unit with the No. 2 size Holophanes. The 40-watt and 80-watt are also supplied in the Meridian bulbs.

The lamps have taken best in central-station service where the central station does not supply free renewals of carbon lamps, and customers being accustomed to buying their lamps will more readily purchase and try the tantalum. There are, however, relatively few of the direct-current central stations which charge for renewals of carbon lamps.

The early difficulties in the manufacture of tantalum lamps have now been entirely overcome, and the present lamps are giving excellent life and very satisfactory service.

The average life on direct-current service runs well beyond the guaranteed figure of 700 hours, with many lamps lasting for 1,200 hours and more. The life on alternating-current service, as is well known, is below the direct-current life. The alternating-current life varies with the frequency.

The 40-watt tantalum lamp is naturally the most popular size, since the lamp saves 10 watts (one kilowatt-hour for every 100 hours of service) over the ordinary 50-watt carbon lamp, and thus saves its added cost in 400 to 500 hours of service rates.

Considering its economy, brilliant quality of light and present excellent life performance on direct current the lamp should have a wider use.

What effect the introduction of the tungsten will have on the tantalum only time can tell. At present, appearances are that it will help to extend the use of the tantalum lamp in the smaller sizes. The tantalum lamp will form a good adjunct to the tungsten, as it is a more hardy lamp, cheaper and more adaptable to the ordinary socket installations. It will, probably, therefore, share in the increased demand for high-efficiency lamps created by the tungsten lamp and be used as a supplement to the tungsten in locations where it would not be desirable or practical to employ the latter.

A large part of the tantalum lamp installations has been on isolated plants. Its most successful service has been given on such plants in relieving overloaded apparatus and giving additional illumination without any increase of plant.

A successful example of its use in central-station work is to be found at Muncie, Ind., a city of 30,000 inhabitants. Provided with an abundant supply of natural gas distributed by five or more separate companies and with a widespread use of indi-

[illegible] watts connected yields an annual income of $144 per kilowatt connected. The use of the tantalum lamp in conjunction with an aggressive campaign for business has assisted to increase the connected incandescent lighting demand 23 per cent. for the last year in face of most severe competition.

In the lighting of office buildings in the larger cities, such as New York and Boston, the tantalum lamp has proved of marked value. Many such buildings have overloaded lighting plants or need increased lighting capacity, but do not wish to make additions to plant, as aside from the expense involved it is not possible or practicable in many cases to obtain the additional space required.

Furthermore, the modern office building and hotel must today provide a liberal and high-grade illumination and the tantalum lamp gives the distinctly brilliant and attractive quality of light required.

Tungsten Lamp.

The filament of tungsten lamps is not a wire of metal like copper or iron wire. Tungsten is too brittle to be drawn, and although the metal has been known for considerably over a century, it is only in the last few years that it has been possible to build a wire of it—a feat which has given us the tungsten lamp.

In order to make a filament of tungsten, the fine particles of the metal powder (its general form) are made into a paste with some binding material and this paste squirted through a die, which die must be made from a diamond as the only material suitable. The filament so obtained is dried, the binding material removed by suitable processes and the particles of tungsten welded together into a continuous wire.

Metallic conductivity is generally high, and to obtain the necessary resistance with tungsten for 100 to 125-volt lamps, long and very thin filaments are required. As such filaments are somewhat delicate and soften when burning, it is necessary to provide special methods of supporting the filament. The General Electric Company supports its filaments in the lamps with a special and clever form of anchor which permits burning the lamps in any position.

Although the filament of the tungsten lamp is fragile, this difficulty can be and is being overcome by special methods of packing and greater care in handling the lamps. We have the evidence of the Welsbach mantle to the point that fragility is not a very serious difficulty. The early carbon filaments were as delicate and fragile as those of tungsten are today, and nobody would have then believed that a carbon filament would be made as durable as we know it to be today.

Our company in the last few months has shipped over 75,000 tungsten lamps to all parts of the country with positive and direct information from most of the packages as to breakage. The results show an average of not exceeding 1½ per cent. breakage, which compares favorably with breakage on ordinary lamps.

A point of value occurs here. It is found that tungsten filaments while burning cannot readily be broken; so if customers will keep lamps lighted while cleaning lamp, globe or fixture, lamp breakage will be minimized.

The positive temperature coefficient of tungsten (and tantalum) lamps causes them to suffer much smaller changes of candlepower and life for any change in voltage than occurs with the carbon-filament lamp, all of which makes these new lamps better able to stand the fluctuations of service conditions than the old.

As is well known, the multiple tungsten lamps are now being made in this country in 40-watt, 60-watt and 100-watt sizes, and so far over 200,000 of such American-made lamps have been made and sold. The probable supply of such lamps for the ensuing 12 months will be from 3,000,000 to 5,000,000 lamps. This will be enough to enable the central stations of the country to displace some gas arcs and take on additional business.

The tungsten lamp is used to the best advantage with the bowl form of Holophane reflector, particularly with the frosted type, which gives a very soft and agreeable lighting effect. From such a unit combination it is possible to obtain an illumination of four foot-candles per watt per square foot upon a plane 10 to 12 feet below the lamps, which is fourfold better than the average result from ordinary lamps and shades.

It must be realized that the tungsten lamp is a radically different proposition in many respects. It is not a lamp to replace ordinary lamps everywhere, as it is too large a candlepower and too brilliant. It requires to be used in a somewhat more special way—above the line of vision, or, in any event,

[illegible] costs with lamps placed well above the view. En- [illegible] illuminated to a full and satisfactory brilliancy. [illegible] new era of daylight illumination.

[illegible] attractive quality of light of the brilliant resplendency of sunlight, reproducing the daylight and [illegible] illumination.

[illegible]

Improvements in lamps heretofore have indicated progress, but the tungsten lamp means a revolution in the lighting industry. Its effect will be more far-reaching than even that of the Welsbach mantle. Can there be any central-station manager indifferent or antagonistic to the adoption of the tungsten lamp? If so, let him consider how he would like to be denied its use while a competing company were to employ it. What would have happened to gas lighting had there been no Welsbach light? It is not whether electric companies want the tungsten lamp, but what would become of them if they could not and did not get it? Many companies are too prone to consider only the possible effect on business in hand (generally under 25 per cent. of the entire lighting employed) and not look to the possibilities for new business to be reaped from the 75 per cent. or more lighting done by other illuminants.

Now the tungsten lamp can and should be employed primarily to secure new business. Let every central station take the tungsten lamp and go after the fellows they have never been able to wean away from gas or oil, or who have gone back to gas or oil. Let your old customers know you have the tungsten lamp and that they get them at a price, but push them with the unsecured fellows and see the result. It is not necessary to do anything more than put the lamps in; they will talk for themselves far more eloquently than anyone else can for them, and you can count on holding the business. The lamps will never be ordered out.

In other words, if you will try the "pay-after-you-have-tried-them" plan (instead of the "pay-as-you-enter," the new street-car programme), you will find that you can introduce as many lamps as you can obtain from the manufacturers and hold business permanently with them. The central-station supply policy on lamps should therefore aim to make the stock of lamps obtainable available chiefly for developing new business. To this end a price should be made on the lamps which will not cause the old customers to take them up too rapidly, but will leave most of the lamps available for use in securing new customers.

Experience in electric-lighting service has shown that it has been a desirable policy for central stations to have as complete control and direction over the lamps used on their circuits as it is possible to obtain. Complete control has been obtained by the free-renewal policy, which policy has quite generally prevailed with central-station companies in this country. While the same principles considered desirable with the carbon lamps apply, the writer believes, to the new lamps, the relatively higher price of the new makes it impossible to supply them on the free-renewal basis, and it is necessary for central stations to make a charge to cover at least the additional cost of such lamps.

Along this line of policy, therefore, it might be desirable to supply the lamps at a lower figure than they could be purchased by customers in the open market, but at a conservative figure, erring rather on the side of a safe cost than too low a price, in view of the relative limited output of such lamps and the desirability of utilizing them chiefly for obtaining new business instead of creating too great demand from present installations. The relative greater fragility of the tungsten lamps and the danger of breakage are deemed by some sufficient cause for charging the full list price for the lamps on the assumption that central stations must, for business policy reasons, guarantee every individual lamp's performance—something that the manufacturer cannot, of course, attempt to do.

Several companies have adopted the plan of furnishing the lamps with direct charge to the customer by making a monthly maintenance charge per lamp therefor, after the plan that has been followed for years by gas companies with gas "arcs" and also with the Nernst lamps.

A fair monthly charge for the 100-watt tungsten lamp for an average use of two to four hours per day would be 25 cents per lamp per month, and in many cases it might be desirable to have the supply and maintenance of these lamps undertaken by a separate company controlled by the lighting company, so that the collection of the charges for main-

1. This is the greater part of a paper read before the Iowa Electrical Association at Des Moines on April 22, 1908. The part omitted relates principally to the Gem lamp. The author is assistant to the manager of the Lamp Sales Department of the General Electric Company at Harrison, N. J.

TABLE I.—COST OF LIGHTING BY TUNGSTEN LAMP FOR 1,000 HOURS OF SERVICE.

Saving in Cost of Current at Various Kilowatt-hour Rates

Rates in Cts. per K W Hour	With 32-C. P. 40-Watt Tungsten. Over 32 C. P. Carbon 3.6 W. P. C.	Over 32 C. P. Carbon 3.1 W. P. C.	With 48-C. P. 60-Watt Tungsten. Over 50 C. P. Carbon 3.6 W. P. C.	Over 50 C. P. Carbon 3.1 W. P. C.	Over 50 C. P. 125-Watt Gem.	With 80-C. P. 100-Watt Tungsten. Over 5 16-C.P. Carbon 3.5 W. P. C.	Over 5 16-C.P. Carbon 3.1 W. P. C.	Over 75 C. P. 187-Watt Gem.
1	0.74	0.59	1.21	0.95	0.65	1.80	1.50	0.87
2	1.48	1.18	2.43	1.90	1.30	3.60	3.00	1.75
3	2.22	1.78	3.64	2.85	1.95	5.40	4.50	2.62
4	2.97	2.37	4.86	3.80	2.60	7.20	6.00	3.50
5	3.71	2.96	6.07	4.75	3.25	9.00	7.50	4.37
6	4.45	3.55	7.29	5.70	3.90	10.80	9.00	5.25
7	5.20	4.14	8.50	6.65	4.55	12.60	10.50	6.12
8	5.93	4.74	9.72	7.60	5.20	14.40	12.00	7.00
10	7.42	5.92	12.15	9.50	6.50	18.00	15.00	8.75
11	8.16	6.51	13.36	10.45	7.15	19.80	16.50	9.62
12	8.91	7.10	14.58	11.40	7.80	21.60	18.00	10.50

tenance would not be involved with the central-station company's account for current.

In view of the fact that the relative price of the 40-watt and 60-watt lamps is higher in proportion to their candlepower and income than the 100-watt tungsten, it might be justifiable to charge the same price, say $1.50 each for the three lamps, offering the customer the option of any size desired, and as the customer would rather obtain the most for his money, this might tend to create a demand for the larger and higher wattage lamp, which would be desirable from the central-station viewpoint, which is to induce customers to increase the amount of light for the same wattage rather than decrease his consumption by using lower wattage lamps.

Table I. shows the saving secured for equal candlepower by the tungsten lamp. It shows the rates at which any one of these new tungsten lamps will pay their full cost or additional cost over equivalent candlepower of carbon filament in a given term of service, 1,000 hours. It will be noted that the 100-watt tungsten will pay its full cost in this time at a rate of one cent per kilowatt-hour and its additional cost at any rate over one-half cent per kilowatt-hour. The 40-watt lamp pays its full cost at any rate over 2½ cents per kilowatt-hour. For ordinary central-station rates, therefore, these lamps will justify their full cost and save their full cost several times over for equal illumination.

A word here as to the suggestion that the tungsten lamp be used at a lower efficiency to secure a materially longer life and thereby permit reduced costs or free renewals thereon. The necessary life for the 100-watt tungsten lamp to reduce the cost to that of the present carbon-lamp costs, runs 3,000 hours, and for the 40-watt lamp, 7,500 hours. It should be unnecessary to point out that such lives are wholly impracticable. The ordinary use of lamps of two to three hours a day means a year's service with 1,000 hours' life, and this is about the limit of practical lamp life on which to consider renewal costs, etc.

Any longer life than a year introduces a continually increasing hazard of mechanical breakage under ordinary conditions of service from handling, cleaning, etc. In any event, the special character of the tungsten lamp and its fragility render it easily possible for consumers either maliciously or carelessly to increase the breakage on the lamps to such an extent as to heavily increase the renewal cost to central stations attempting to supply such lamps on free-renewal basis.

It would seem from these considerations that it is wholly impracticable to attempt free renewals through the plan of increasing the life.

The life of the tungsten lamp operated or handled with reasonable care is so good at regular rated efficiency of 1¼ watts per candle that it is unnecessary to vary the rating thereon, as such variations tend to reduce the brilliancy and candlepower of the lamp and mar one of its chief advantages and attractions.

Table II. gives some data on the various new lamps, including the tungsten, and will repay careful study. In table III. is shown the cost to a consumer of a candle-hour of light at various rates per kilowatt-hour, including cost of power and lamp renewals.

The tungsten street series lamp is of equal, if not greater, value than the tungsten multiple lamp in providing profitable business for central-station companies. These lamps, as is well known, are listed in 32, 40 and 60 candlepower, and the amperes range from 4 to 7.5 amperes at an efficiency of 1¼ watts per candle. One of the eastern central-station companies has obtained in service test a life of 1,350 hours on these lamps. On the basis of 4,000 hours' service per year this would only call for three renewals. A substantial saving per lamp can therefore be shown for the tungsten lamp over the carbon. It is to be expected, therefore, that the tungsten lamp will promptly replace all other forms of electric lamps for street lighting. A recent installation of these lamps at Adel, Iowa, has given the following comparison of saving to be secured:

This company installed a constant-current transformer of 8.8 kilowatts and 5.5 amperes complete with switchboard panel, with a circuit of 82 40-candlepower tungsten lamps supplied therefrom. These replace a lighting installation of 82 32-candlepower multiple carbon lamps. The saving this customer makes the first year in energy will pay for the installation of the new apparatus and still show a net saving of over $115. The second year the saving will be over $413. This saving is obtained on the basis of three cents per kilowatt-hour and three renewals of lamps per year.

TABLE III.—COST PER CANDLE TO CONSUMER FOR VARIOUS LAMPS.

Rates per Kw.-Hour in Cents.	Total Cost of Lamps and Power per 100 Candle-hours. 32-C. P. 100-Watt Carbon.	40-C. P. 100-Watt Gem.	20-C. P. 40-Watt Tantalum.	80-C. P. 100-Watt Tungsten.
1	.51	.43	.567	.416
2	.85	.70	.784	.552
3	1.19	.97	1.001	.688
4	1.53	1.24	1.218	.824
5	1.87	1.51	1.435	.96
6	2.21	1.78	1.652	1.096
7	2.55	2.05	1.869	1.232
8	2.89	2.32	2.086	1.368
9	3.23	2.59	2.303	1.504
10	3.57	2.86	2.520	1.64
11	3.91	3.13	2.731	1.776
12	4.25	3.40	2.954	1.912
13	4.59	3.67	3.171	2.05
14	4.93	3.94	3.388	2.184
15	5.27	4.21	3.605	2.32

The more interesting point is the comparison of street-lighting costs of tungsten lamps in competition with gas. The 40-candlepower tungsten lamp with its practically constantly maintained candlepower during life will match the regular Welsbach street lamp, which, while it claims an initial candlepower of 60, declines so rapidly in candlepower that its average candlepower is no greater than the 40-candlepower tungsten lamp. The gas mantle, using 3½ cubic feet of gas per hour, will burn 14,000 feet during a year's service of 4,000 hours, amounting to $14 at $1 per thousand, or $10.50 at 75 cents per thousand feet. Assuming the renewals of mantles in use, repair and attention to lamps as fixed to three cents per lamp per night (the figures used in recent Buffalo contract), the total cost per lamp will be $24.95, with gas at $1 per thousand, or $21.45 with gas at 75 cents per thousand. Assuming four renewals per year as a conservative figure for the tungsten lamp at a price of $1.27½ each, we have about $5 for the lamp-renewal cost for the tungsten. Deducting this from the renewal cost of the gas mantles of $10.50 leaves an excess of $5.50 for the gas mantles for the year. Adding this excess to the cost for gas at $1 per thousand, $14, we have a total of $19.50 per lamp as the figure to be paid for power.

The 40-candlepower tungsten lamp consumes 50 watts, or, on the basis of 4,000 hours' service, 200 kilowatt-hours, so that dividing $19.50 by 200 kilowatt-hours we have a rate of nearly 10 cents per kilowatt-hour, which could be charged to meet the cost of gas. This rate, of course, is most remunerative for this class of service. Central stations could afford to make a materially lower rate than this and thus be able to effectually compete against Welsbach lamps for street lighting. Incandescent lamps for street lighting possess many advantages, as the small units of light distributed at frequent intervals secure a uniformity of distribution that insures much better and more agreeable illumination than can be obtained with large units of light spaced at considerable distances apart.

From this review of the lamp situation we can declare that central-station companies have great cause for rejoicing over the new developments which have given them a lighting device of such efficiency and simplicity and low cost as will enable them to effectually compete on the basis of cost against gas and other illuminants. Electric lighting has held its own in spite of a serious handicap in cost, and now that it is able to compete on equal terms the limit of its use is only measured by the capacity of the central-station company to supply the service.

TABLE II. [illegible] DATA [illegible] COSTS OF LAMPS AND SERVICE.

	16-C. P. [illegible]	16-C. P. [illegible] Carbon.	[illegible] P. 100-Watt Carbon.	20-C. P. [illegible] Gem.	40-C. P. 100-Watt Gem.	20-C. P. 40-Watt Tantalum.	32-C. P. 40-Watt Tungsten.	48-C. P. 60-Watt Tungsten.	80-C. P. 100-Watt Tungsten.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]	40	[illegible]	100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	500	[illegible]	[illegible]	[illegible]	800
[illegible]	[illegible]	[illegible]	[illegible]	21.25c	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	0.85c	[illegible]	[illegible]	[illegible]	3.0c	2.11c
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1.00	[illegible]	40c	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1.07	46.4c	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14,720	23,680	[illegible]	60,000
[illegible]	[illegible]	3.8c	[illegible]	[illegible]	[illegible]	2.17c	1.36c	[illegible]	1.36c
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.35c	0.50c	[illegible]	0.28c
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Vitrification of Clays.

By G. A. Ernest.

This brief article is intended for the information of inspectors of conduit and terra cotta. As a preliminary, vitrification may be defined as the process of melting a sufficient quantity of the clay body to cause a fusion of the whole body into a homogeneous mass, which, upon cooling, will present a flinty surface, showing a slight luster, without laminations, which cannot be scratched with steel.

In order fully to understand the process of clay vitrification it is necessary to have a slight knowledge of the composition of clay and how the clay is affected by heat.

Composition of Clay.—Clay is a mixture of numerous earthy compounds, of which a constant constituent is a hydrated silicate of alumina, of the formula Al_2O_3, $2SiO_2$, $2H_2O$. This substance is highly refractory, resisting fusion to a high degree of temperature. With this complex compound is always mixed a number of "fluxing impurities" in the form of oxides with a much lower heat resistance.

The ultimate analysis of clay might be expressed as follows:

Pure Clay—Kaolinite, Al_2O_3, $2SiO_2$ $2H_2O$.

Fluxing Impurities—

Silica .... SiO_2
Alumina .... Al_2O_3
Ferric oxide .... Fe_2O_3
Lime .... CaO
Magnesia .... MgO
Potash .... K_2O
Soda .... Na_2O
Titanic oxide .... TiO_2
Sulphur trioxide .... SO_3
Carbon dioxide .... CO_2
Water .... H_2O

Heat Effects on Mixed Clay.—When the clay mass is heated in a kiln the following indefinitely marked stages of burning result:

1. The free water, mechanically mixed in the clay, is driven off at low temperatures.

2. The water of crystallization, a constituent part of the clay particles, is driven off.

3. Certain organic oxides are driven off, such as the oxide of iron, carbon and sulphur.

4. The softening of the clay mass at high temperatures follows in the following order and with the following results in the cooled clay mass:

(a) *Incipient Vitrification.*—In this stage the clay has softened sufficiently to make the grains stick together, and enough to prevent the recognition of any, except the larger ones. The particles have not, however, softened sufficiently to close up all the pores of the mass nor to allow of a recrystallization. The broken mass of the clay shows a dull surface with laminations more or less distinctly evident in the mass, with many isolated particles showing no heat effect. If the burning is arrested at this stage the resultant mass will be slightly softer than steel; will absorb water quite readily and will disintegrate under the continued absorption of alkaline and acid liquids.

(b) *Complete Vitrification.* Under a continued and gradual increase of temperature the clay granules undergo an additional softening, sufficient to close up all the pores and render the mass imper-

vious. Clays burned to this condition show a flinty, crystalline, broken surface with a rather smooth fracture, having a slight luster and showing no laminations. The substance will not be scratched with steel.

(c) *Viscosity.*—After the vitrification period is passed a sufficient rise in the temperature is accompanied by both swelling and softening of the clay until it leaves its original form and flows in a viscous mass. Upon cooling, the substance so thoroughly crystallizes as to leave a dark, glassy mass.

Complete vitrification is essential to a perfect conduit, and the stages of incipient vitrification and viscosity should be avoided.

Chemical Process of Vitrification.—It is apparent that proper vitrification of clay depends primarily upon two factors:

(1) The chemical structure of the clay.

(2) The physical effects of the heat.

Both may be informally summed up as follows:

Kaolinite, the purest form of clay known, is not found in any quantity as clay. In laboratory tests it is found to resist fusion to considerably above 3,000° F. When it does fuse the whole mass melts at once, not going through any intermediate stages of vitrification but becoming at once viscous.

When the kaolinite is mixed with a small quantity of these fluxes to make up the clay the expected and usual result is as follows:

At a temperature considerably below 2,000° F. the fluxes melt and so surround the particles of kaolinite as to fill up all porous spaces. If the clay mass is heated no higher, the result is such as is described above under "Incipient Vitrification." If, however, the temperature is now increased, the kaolinite particles yield their fusion point to meet that of the fluxes, the kaolinite particles soften to such an extent that they allow of a recrystallization, but still not so far as to flow and deform the clay mass. In cooling, the whole mass of kaolinite and fluxes crystallize together into a homogeneous, flinty mass, harder than steel. The result is as described above under "Complete Vitrification."

If the clay is composed of a large quantity of the fluxes with a smaller portion of kaolinite, the fluxes so overcome the refractory character of the kaolinite that the clay mass will very rapidly pass through the stages of fusion, often so rapidly that the stage of viscosity will be reached without any warning. Clays of this composition cannot properly be called fire-clays.

In order to overcome such an excess of fluxes, some manufacturers resort to the addition of particles of a highly refractory nature, such as sand, grog or shale. This practice does not, however, allow the clay mass to approach any nearer complete vitrification, but does decrease the chances of the clay mass losing its form if slightly overheated.

VITRIFICATION TESTS.

The following are summarized tests gathered from text-books and practiced by testing engineers:

Tests on the Whole Unbroken Piece.—1. Place the piece to be tested [illegible] tested sharply with a piece of metal. If the sound is sharp and metallic it indicates complete vitrification. If the sound is flat, as if the piece were cracked, it indicates lack of complete vitrification. This test is comparative and should be first tried between two known pieces. After the difference in tone is once established there will be little mistaking future tests.

2. If the piece has an unglazed surface most of the following tests can be applied to the whole piece. If the piece is glazed the piece must have a broken edge for the following tests. It should be understood that there is absolutely no relation between glaze and vitrification; either may exist without the other. Color is never an indication of vitrification.

Tests on Portions Broken from Whole Pieces (Visual Tests).—1. The broken edge of a completely vitrified product is homogeneous, flinty and has a slight luster. Any evidence of lamination is sure indication of insufficient fusion.

2. The fractured surface of a completely vitrified product shows an abrupt break, with a comparatively smooth surface. A sharp, shelly fracture will be noted at the broken edge. There will be but slight evidence of granulation.

Tests on Portions Broken from Whole Pieces (Scratch Test).—1. Scratch the broken edge with a knife blade or other tool steel.

(a) Complete vitrification is manifested by a dark metallic line, unaccompanied by flying dust when scratched.

(b) A metallic line with some dust flying indicates poor vitrification.

(c) When the scratch is evident and dust or particles fly from the scratched surface, vitrification is not indicated.

Absorption Test.—Dry the piece perfectly. Weigh it. Immerse it in distilled water for 24 hours at a temperature of from 60 to 80° F. Dry the surface with a damp cloth. Weigh it again. If the piece has absorbed five per cent. of its weight in moisture, incomplete vitrification is indicated.

The Milwaukee Northern Electric Railway Company expects to open its line to Sheboygan, Wis., probably in June. All grading through the swamps between Port Washington and Sheboygan has been completed and all right-of-way has been secured. Over six miles of track is laid.

Some Recent Motor-driven Pumps and Blowers.

[illegible] motors are of approximately the same diameters [illegible] two pumps shown in the illustration is less than five feet.

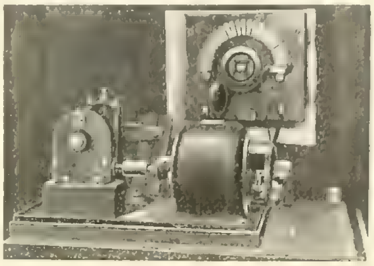
In addition to its compactness, the circular form of motor is easily provided with covers in cases where the presence of dust or moisture makes this protection advisable.

Motor drive for pumps is in all cases advantageous, owing to the possibility of entirely automatic control. A tank switch, operated by the rise and fall of the liquid, or a pressure switch in the case of compressors, closes and opens the circuit automatically, operating an automatic self-starter, which controls the pump motor.

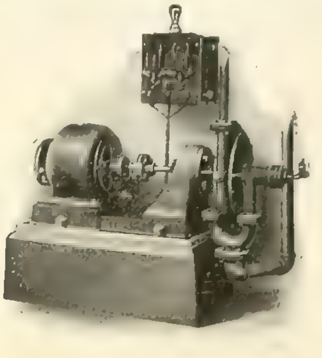
In the case of blowers, speed control is another important consideration. In some cases this is also made automatic by means of a thermostatic device, to regulate temperature by the volume of air blown past a heater. It is due to the ease of control of the electric motor that fans and blowers have come into general use for heating as well as for cooling.

Noiseless running is another point which may be mentioned in favor of motor drive for pumps. This is particularly important in hotels, shops, restaurants, etc., where the noise of reciprocating parts is a source of annoyance to patrons and tenants, and thereby a loss of patronage to the proprietor.

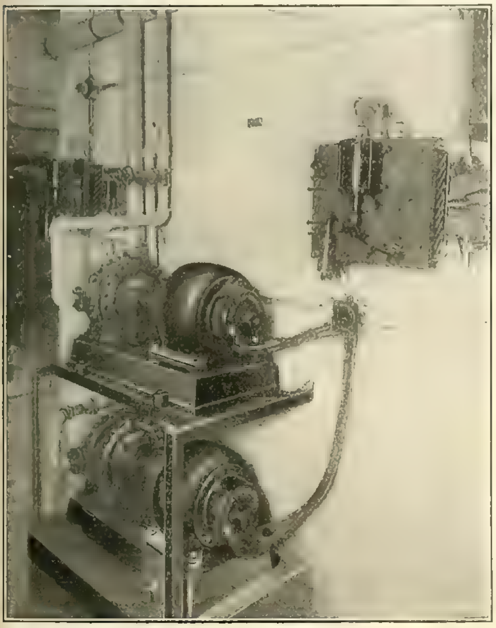
The accompanying illustrations show several rotary pumps and similar machines driven by motors made by the Crocker-Wheeler Company, Ampere, N. J.



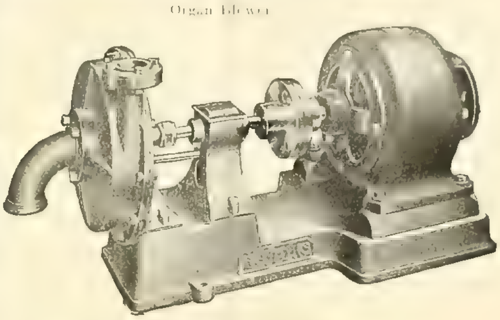
Organ Blower.



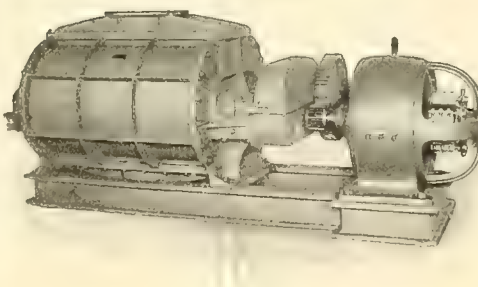
Centrifugal Pump.



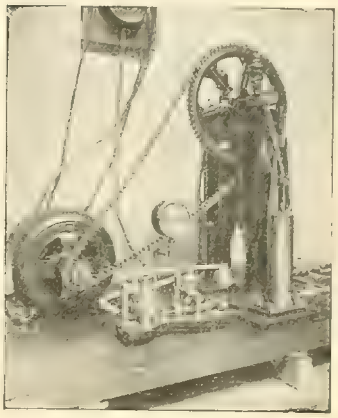
Two Two-stage Tacony Turbine Pumps.



Brooks Varnish Pump.



Piqua Blower.



Brown Automobile or Beer Pump.

SOME RECENT MOTOR-DRIVEN PUMPS AND BLOWERS.

"Wireless" Apparatus Exempt from Suez Canal Tolls.

The United States ambassador in Paris sends the following translation of a letter from the president of the Suez Canal Company announcing certain modifications in the regulations concerning the navigation of the canal: "At its meeting of March 2, 1908, the administrative council of the Suez Canal Company decided in future to include the spaces intended to hold the apparatus of wireless telegraphy and the electric projector of the vessels among the spaces deducted from the gross tonnage as being useful for the maneuver of the vessel, and under reserve of the observation of the maximum total of five per cent. of the gross tonnage."

Electric Heat for Bookbinders' Tools.

Electric heat in the bookbindery presents decided advantages over gas. Being absolutely clean, it prevents spoilage, and, being more efficient, reliable and convenient, it enables the workman to devote more attention to his work and to get better results. One of the most successful of the electrical devices now manufactured for the bookbinder is the Hadaway hand-tool heater. It consists of an electrically heated plate, surrounded by a platform of heavy wire fabric. It is large enough to heat a number of tools at a time, and the platform

HEATING BOOKBINDERS' TOOLS BY ELECTRICITY

provides a suitable support for the handles of the tools being heated, and a convenient place to cool off the tools that have been used. This method of heating the tools is said to be more expedient and satisfactory than individual heating and does away with the flexible cords or small gas pipes that would otherwise be required. It permits greater freedom to the workman and enables him to maintain always the exact temperature required. The simplicity of the device is shown by the accompanying illustration. This heater is manufactured by the Hadaway Electrical Heating and Engineering Company and sold by the Westinghouse Electric and Manufacturing Company.

Rubber Industry on the Upper Amazon.

As a result of personal visits to various districts and camps within the sphere of his consulate, which embraces trans-Andean Peru, Consul Charles C. Eberhardt of Iquitos, furnishes a report covering the manner of securing the right to work rubber tracts, the manner in which the same are worked, and how the product is collected and prepared. He says that in spite of the assertions of many of the rubber gatherers, that there is no cause for alarm at the increasing number of trees dying in proportion to the number of new ones springing up, and the further admitted fact that many of the trees which have worked for 20 and 30 years are still productive, there is no denying the fact that in Peru at least the number of rubber-producing trees is steadily growing less. Systematic planting and cultivation would be of inestimable benefit to the country and the individual, he says.

GENERAL TELEPHONE NEWS

F. H. Murray succeeds C. C. Summers as manager of the telephone exchange at Charles City, Iowa. Mr. Summers will go to Mason City, Iowa.

A new regulation of telephone rates is being enforced in Kasson, Minn. A non-subscriber will hereafter pay 15 cents for toll service and 10 cents for a local call.

The Napoleon Telephone Company of Napoleon, N. D., has been granted a franchise for the extension of its toll line from Napoleon via Burnstad to Wishek. G. A. Bryant and O. F. Bryant, directors.

The Phœnix Telephone Company of Winona, Minn., has made an application for a permanent injunction against the city of Rushford, Minn., to restrain granting a franchise for building a second telephone system in that place.

J. Gordon Steele & Co. of Minneapolis have been selected to make a thorough investigation as to the financial condition of the Northwestern Telephone Company for the purpose of determining satisfactory telephone rates for Minneapolis.

The Chicago Telephone Company has opened a new exchange on the North Side, known as "Lincoln." It is on Larrabee Street near Wisconsin Street and covers an adjacent territory formerly [illegible] stations.

The total revenue of the American Telephone and Telegraph Company's associated operating com- [illegible] and not including the long-distance lines, for Jan- [illegible] pared with $17,496,900 for the corresponding months [illegible]

CORRESPONDENCE

Continental Europe.

Paris, April 14.—Some interesting experiments in the way of wireless telephony have been carried out lately by Dr. Lee De Forest, who has been in Paris for some time. He is engaged in making experiments for the French government with his apparatus, and these are carried on with the Eiffel Tower as a base, being witnessed on several occasions by French officers who represented the army and navy, besides the officers who are directly connected with the tower plant. In the first trials the telephone messages were sent to the radio-telegraph station of Villejuif, which lies in the suburbs of Paris at about seven miles distance. But in the succeeding experiments Dr. De Forest was able to cover a much longer distance and could send messages as far as the government station of Melun, which is 36 miles distant. During the tests he used only a short mast wire such as is employed on shipboard so as to demonstrate the use of the system in the navy, where it will be especially useful. In the other tests which are to follow he will use the long antenna of the Eiffel Tower.

Mr. Berjonneau, a French inventor who has been working in the line of image transmission, succeeded in transmitting photographs with his new apparatus from Paris to the suburbs. His instrument works on the principle of a halftone plate rolled around a revolving cylinder, and the points of the image produce a series of electric contacts by a metal point which runs over them. A similar cylinder mounted at the receiving end produces a photographic impression by means of an electromagnetic shutter, the latter being operated by the current impulses. He recently set up the transmitter at Paris and the receiver at the suburb of Enghien and transmitted a portrait in about four minutes. The reproduction at Enghien was very good and resembled a photograph. On this occasion he used a single telegraph line which was grounded in the usual way. It seems that this is the first time that a single line with ground return has been used in this way, as the experiments made by others in the same field took place with a double line. Mr. Berjonneau is also making experiments in order to operate his system by electric waves at a distance, and says that this can be done readily, although it may require a somewhat longer time to make the transmission in this way.

Application has been made to the Swiss government for the concession for a narrow-gauge electric railroad, the Oberland-Gothard line, which will start from Meringen and have its terminal point at Göschenen. It will cover a total distance of 28 miles, and the maximum grade will be 4.6 per cent., which is less than the grades of the Montreux-Oberland Railroad. The longest tunnel on the present line will be 4½ miles long. The cost of the project is figured at $2,400,000.

In France the company which operates the large coal mines of Ronchamps has commenced building an electric plant on the premises which is designed to furnish 30,000 horsepower for the different services of the mines, and at the same time it will supply a large amount of current for the surrounding district in which there are many industries. The plant will use the coal on the spot and is thus in a position to furnish current at low rates. The operations will cover the districts of Doubs and Vosges and the territory around the city of Belfort lying near the eastern frontier. A. DE C.

Great Britain.

London, April 18.—The first section of the Midland Railway Company's experimental single-phase railway between Morecambe and Heysham, on the northwest coast of England, was opened for public traffic this week. Rapid progress has been made with this work, and although work upon the London, Brighton and South Coast Railway Company's experimental single-phase line near London was commenced first, the Midland company secures the honor of opening the first single-phase electric railway in Great Britain.

The British Thomson-Houston Company has supplied a 1,500-kilowatt Curtis turbine for exhaust-steam purposes in the Tyne district. I believe this is the first turbine of this class to be used for exhaust-steam purposes, at any rate in Great Britain.

The London County Council is gradually overcoming the prejudices of the Borough Councils to the use of the overhead-trolley system. After some negotiations, the consent of the Fulham Borough Council has been obtained to 4½ miles of track upon this route, which includes running the trams across one of the Thames bridges.

Professor Darwin, F. R. S., will deliver his presidential address to the British Association in Dublin on September 2d.

What is claimed to be the first completely electrically operated coal mine in the world has just been started in the north of England.

The first action in the high courts against a tramway company for alleged nuisance caused by the noise from the tram cars, and the alleged bad condition of the track generally, is being taken by a number of local authorities in the west of London against the London United Tramways Company, Ltd. It is no new experience for this company to find itself "up against" the local authorities through whose districts its lines run, for ever since its commencement the company has been a sort of target for the local authorities and has generally had to buy them out, so to speak, in the shape of contributions to street widenings and the like.

A large electric cantilever crane has recently been erected at the Mersey freight house of the Lancashire and Yorkshire Railway Company. The total weight of the crane, which, by the way, has cost $50,000, is 150 tons. It runs on 14 wheels on a track 500 yards long and 10-foot gauge. It has a clearance height of about 30 feet, a cross-traverse of 172 feet and can pick up a load and deposit it at any point within an area of about 31,000 square yards. For lifting and longitudinal traveling there are two 90-horsepower motors and for cross traveling a 25-horsepower motor. The lifting speed is 90 feet per minute, longitudinal traveling 400 feet per minute, and cross traveling 600 feet per minute. It is supplied with power from the railway company's power house by means of overhead conductors. G.

New England.

Boston, April 25.—A test was made on Thursday of the electrical apparatus for moving the gates of the lock in the Charles River dam between Boston and Cambridge, and proved successful. Only a few changes will be necessary to insure the smooth working of the gate. The motive power is supplied by two 50-horsepower Westinghouse motors of the railway type, placed at the shore end of the gate chamber.

According to press dispatches from Washington, the administration is looking into the matter of trolley-line ownerships by the New York, New Haven and Hartford Railroad Company, which has been the occasion of so much discussion in Massachusetts in and out of the Legislature, with a view to taking legal action that will compel the railroad company to dispose of its electric-railway holdings. The national Department of Justice and Attorney-general Bonaparte are said to have reports bearing on the subject from District-attorney French of Boston.

The Gas and Electric Light Commission of Massachusetts has authorized the Lowell Electric Light Company to issue $93,000 additional capital stock; par, $100; issue price, $150. B.

New York.

New York City, April 25.—The New York Central Railroad's application to the Public Service Commission to issue $4,000,000 3½ per cent. and $20,000,000 four per cent. bonds was granted Tuesday. The improvements to be made during the year are: Motive-power facilities, $747,530; signal improvements, $462,849; eastern division, $324,732; Mohawk division, $269,174; western division, $1,395,213; Rome, Watertown and Ogdensburg division, $54,734; Pennsylvania division, $50,000; River division, $282,833; electric division, $18,769; miscellaneous, $9,175; Electric Zone construction, $3,432,500; additional facilities needed for motive power and car repairs, $1,299,500.

Forty-four persons were killed on the electric and steam roads in this city in March, according to a table issued by the Public Service Commission.

By means of the Marconi wireless-telegraph system, and through the courtesy of the Lozier company, which had a wireless station in its headquarters at Briarcliff Manor, on the course, the New York Times was able to give in Times Square Friday morning a complete account of the incidents of the Briarcliff automobile race within a few minutes after the occurrences were chronicled. All night long wireless-telegraph experts had been busy arranging the apparatus and getting in tune with the Lozier station at Briarcliff Manor, with wireless and telephone connections to various other points on the course. It was interesting to note with what great regularity the wireless system worked and how quickly the news was received after the occurrence of any particular event on the course. A remarkable circumstance was the very small amount of disturbance from other stations in the neighborhood. Occasionally when the tower machine was not in tune with Briarcliff there could be heard distinctly signals from as far south as Cape Henry, Va.; Glace Bay, Sagaponack, L. I.; Manhattan Beach, Wellfleet and Fire Island. Owing to the great length of the course and the rolling country it was only by means of the information gathered by the wireless service that bulletins could be sent from one part of the course to another and to the Times Building. It was considered a remarkable feat that within a minute and a half after the first car started over the line the news was being posted on the bulletin board of the Times.

The Public Service Commission has finally approved the mortgaging of practically all the property of the Interborough Rapid Transit Company and the issuance by that concern of $30,000,000 in bonds to secure a temporary issue of $25,000,000 of notes, the proceeds of which are to be used

chiefly for refunding purposes. Chairman Willcox confirmed the recent announcement that J. P. Morgan & Co. were to underwrite the note issue, basing his statement on information he had received from the company's counsel.

The bill providing for amendment to the Elsberg rapid transit law, which would permit construction of subways in New York city by private capital, was passed in the Assembly on Tuesday. The bill provides two methods to facilitate the building of subways. The first method involves the construction of subways by private corporations under franchises for a period of not more than 50 years, when the city at its own discretion may take over the system at a price not to exceed the actual cost of construction and equipment. The other method contemplates the construction of subways by the city and their lease to private corporations for a period of not more than 35 years, when the city may take them over by paying the cost of the equipment put in by the lessee corporation. W.

Southeastern States.

Charlotte, N. C., April 25.—Col. C. P. E. Burgwyn and a party of associates are negotiating for the construction of an electric railway about six miles in length, to be built from a point five miles south from Richmond, Va., to Fulton, a suburb of the city.

J. M. Spotts of Staunton, Va., has purchased practically the entire interest in the local Blue Ridge Light and Power Company, including the street-car system of the town, in which improvements may be made.

The Georgia Railway and Electric Company of Atlanta is actively pushing the construction of a new electric railway to Peachtree Creek, where, after a bridge is built, the line will be continued. The cost of the 3½-mile extension of the trolley line to Peachtree Creek will cost about $100,000.

The Macon (Ga.) Railway and Light Company is making improvements on its lines, and, in addition, will install a 3,000-horsepower turbine engine in its power house.

The Georgia Railroad Commission has an interesting economic problem under consideration, growing out of the competition of the electric railway with the steam railway, in the application of the Central Railroad for the right to issue commuters' tickets at a special rate, in order to make the Central's suburban traffic pay. The steam road sets forth that, on account of electric competition, its income from suburban traffic has greatly decreased.

J. B. McCrary & Co. of Atlanta have secured a contract from the town of Sparta, Ga., to install an electric-light plant, in connection with a waterworks system, the work to be completed by October, 1908. D. H. L.

Indiana.

Indianapolis, April 25.—The Indianapolis, Frankfort, Delphi and Chicago Traction Company has filed articles of incorporation. It is capitalized at $100,000. The object of the company is to construct and operate an interurban railway from Frankfort to the city of Hammond, by way of Delphi, Monticello, Rensselaer and other intermediate points. The company's principal office will be in Frankfort. The corporation will succeed the Frankfort, Delphi and Northern Traction Company, incorporated last year, and will improve the water power at Monticello to furnish and distribute electricity for light and power purposes.

According to the plea made by a number of representatives of the traction lines operating in the state of Indiana, made before the Indiana State Tax Board last week, the business of the traction companies has been less profitable during the last year than during the preceding year. While these representatives admit that the companies carried as many if not more passengers and a greater amount of freight, the earnings per mile were not as great, since the cost of maintenance and material, supplies, etc., has been much greater.

The Bedford Power Company has been incorporated to construct a dam in White River, near Bedford, and erect a power plant for the generation, transmission and distribution of electricity by wire to the towns and cities within a radius of many miles, and especially to furnish power to the Bedford Cement Company at Bedford.

The Central Indiana Lighting Company of Columbus, having secured a new franchise, declares that all the promises made by the officials will be fulfilled this year. The improvements to be made include the construction of a new power plant for the street-car line and electric-lighting system. The electric-light service will be extended and the company will prepare to furnish steam heat to local consumers.

Charles F. Street, president of Street, Wykes & Co. of New York, has purchased the Crawfordsville Water and Light Company's property for $76,000. The sale was made by the order of court at a suit brought by the Knickerbocker Trust Company of New York, which held a mortgage covering the property. S. C. Rowland, who has been receiver of the plant, will continue in charge [illegible] in Anderson.

E. E. Witherby, general manager of the Richmond Light, Heat and Power Company, has renewed his offer to the City Council to purchase the municipal lighting plant, agreeing to pay dollar for dollar, or every cent the plant has cost the city to date. Mr. Witherby asserted in open council that the municipal plant is a big loser, that it had never been a success and that it never would be. He alleged that the report for the past year showed that over $30,000 of the taxpayers' money had been spent unnecessarily by the city during 1907, just for the pleasure of owning a municipal plant. S. S.

Pacific Slope.

San Francisco, April 23.—The United Railroads of San Francisco has closed a contract with the General Electric Company for the largest generating unit which has been ordered for use on the Pacific Coast this year. It is a 5,000-kilowatt unit, consisting of a three-phase generator direct connected to a Curtis steam turbine. Current will be generated at 13,200 volts, which is the standard voltage on the United Railroads system. The new equipment will be installed with the greatest speed in the North Beach power station of the United Railroads.

The first official statement of the loss in gross earnings sustained by the United Railroads Company during the strike of last year has been made by President Calhoun. He gives the gross earnings for 1907 as $4,745,116, as compared with $5,955,786 in 1906, a decrease of $1,210,670. This latter sum is therefore the loss in gross receipts caused by the strike. In 1906 there was a loss of receipts for several weeks following the April disaster.

Chief Engineer Downing of the Pacific Gas and Electric Company has inspected the company's plants in the Nevada City district. The plant on Deer Creek, Cal., is practically ready for operations, and when the water is turned on it will generate about 8,000 horsepower. The current will be transmitted to the valley and bay towns.

S. J. Lisberger, engineer of electrical distribution for the California Gas and Electric Corporation, has been in San Jose looking over the section of the city in which all wires are to be placed underground.

The two-story brick building to be erected by Grace G. Heydenfelt on the south side of Folsom Street, between Third and Fourth streets, San Francisco, has been leased to the American Electrical Novelty and Manufacturing Company for a period of five years.

The Stanislaus Electric Power Company is commencing the erection of steel towers, near Midway and through the hills of Alameda County, for its transmission lines. I. B. Parsons has been securing the rights-of-way for the power lines through this part of the county.

The Board of Public Works of Oakland, Cal., has asked for an appropriation of $600 for two more electrically driven pumps to be installed on the shores of Lake Merritt to furnish salt water for street-sprinkling purposes.

The City Council of Santa Cruz, Cal., has decided to consider calling a $200,000 bond election for sewers, bridges, wharf and an electric-light plant.

At a recent meeting of the board of directors of the Hawaiian Electric Company of Honolulu, T. H., it was decided to double the capacity of the present plant. A Westinghouse-Parsons turbo-generator set has already been ordered.

The trustees of Placerville, Cal., have engaged J. W. White to make a preliminary estimate for the proposed electric plant. A.

PERSONAL.

Mr. Isham Randolph, consulting engineer, has moved his offices to suite 748 First National Bank Building, Chicago, Ill.

Mr. C. H. Williams, formerly manager of the La Crosse Gas and Electric Company of La Crosse, Wis., has accepted a similar position with the Northern Colorado Power Company, at Denver, Colo. He will manage 18 power plants.

Mr. A. A. Cohill of S. Pearson & Son, contractors, London and New York, was a visitor in Chicago this week. Mr. Cohill was construction engineer for Pearsons on the eastern section of the Pennsylvania tunnel under the East River in New York.

According to the daily newspapers, Prof. William Kent, dean of the College of Applied Science, Syracuse University, will not be retained on the faculty of that institution after the close of the college year. It is alleged that while Chancellor Day was away at conference Dean Kent reported to the Department of Public Safety of the city that some of the college buildings were unsafe. The department found that the buildings were safe. It is [illegible]

Mr. Charles E. Sharpe has tendered his resignation [illegible] reside in Rock Island, associated with other enter- [illegible] tric Association.

ELECTRIC LIGHTING.

The [illegible] Light Company has been incorporated.

The Pender (Neb.) Light and Milling Company has been incorporated with a capital of $15,000.

The Citizens' Light and Power Company has purchased the plant of the Taylor Electric Light Company, Taylor, Tex.

The Grand River Light and Power Company of Fort Gibson, Okla., has been incorporated with a capital stock of $15,000.

The city of Farmington, Mo., has had plans prepared for an electric-light plant. Machinery amounting to $20,000 in value will be needed.

The Council of Ladysmith, B. C., is introducing a by-law providing for the raising of $25,000 by the sale of debentures for the installation of an electric-lighting plant. Mayor Nicholson may be addressed.

The American Light and Traction Company has issued a statement covering the three months ended March 31, 1908, compared with the similar period in 1906. Total gross earnings were $659,093, and the expenses $12,000, leaving net $647,093. After accounting for the preferred and common dividends the surplus was $332,140. From this there was deducted for reserve $176,500.

The North American Company has effected the sale of one $1,000,000 lot of bonds, and has under way negotiations looking to the sale of $5,000,000 of another issue. Spencer, Trask & Co. have purchased $1,000,000 Milwaukee Light, Heat and Traction 30-year five per cent. bonds, which will be offered for subscription at 98. The larger issue now under consideration concerns the Union Electric Light and Power Company of St. Louis, another subsidiary of the North American Company. A New York banking house is negotiating for $5,000,000 bonds of this company.

ELECTRIC RAILWAYS.

The trouble between the Winnipeg Electric Street Railroad Company and its motormen and conductors is not yet settled. Several conferences between the men and the company have been held, but no decision has been arrived at. One of the chief demands of the men is that the union be recognized, and this the company is not willing to agree to. Wilford Phillips is general superintendent.

In a special message to the City Council of Chicago Mayor Busse urges the council to take up at once consideration of plans for the construction of subways in Chicago. The mayor says that the time has come when the city of Chicago, through its municipal government, should take up seriously the question of underground transportation with a view to procuring the actual construction of underground railways.

The Northwestern Elevated Railroad Company of Chicago announces that the eight-mile extension from Wilson Avenue, Chicago, to Evanston and beyond will be opened on May 15th. The route is over the Chicago, Milwaukee and St. Paul right-of-way. The track construction is said to have been completed, and only the electrical work remains to be done. A 10-cent fare will be charged from Evanston. Service will be afforded residents of Sheridan Park, Argyle Park, Edgewater, North Edgewater and Rogers Park.

Three-cent street-car fare on all lines operating within the city of Cleveland became a possibility on April 27th at the regular meeting of the city council when a "security grant" was passed under suspension of the rules to the Cleveland Railway Company, a new corporation which took over the consolidated properties of the old companies. At the conclusion of the council meeting that body, as a committee of the whole, met the officials of the Cleveland Railway Company, the Cleveland Electric Railway Company, the Forest City Railway Company and the Low Fare Railway Company in the Chamber of Commerce Hall, where the final papers were signed and passed leasing the property of the Cleveland Railway Company to the Municipal Traction Company, the holding or operating company, for 50 years. All existing franchises

were abandoned by the old companies. The new franchise is intended to protect both the interests of the public and the property of the Cleveland Railway Company.

A mortgage from the Peoria, Lincoln and Springfield Traction Company has been filed for record at Lincoln, Ill. It is to secure the issuance of bonds to the amount of $1,250,000 and is to the Central Trust Company of Chicago.

The Illinois Traction Company is building a loop in the city of Springfield, Ill., to connect the street-railway lines with the property leased by the company that it will convert into yards and a terminal station. The old barns of the street-railway company will be converted into a repair station for the company, and the repair work formerly done at Riverton will be made at the Springfield shops. The company will build additions to the shops and will make the matter of repairs to the rolling stock more conveniently.

POWER TRANSMISSION.

Hon. Adam Beck, chairman of the Ontario Hydro-electric Power Commission, says that the high-voltage transmission contemplated from Hamilton, Ont., will have an estimated capacity of 30,000 horsepower, but with 10,000 horsepower applied for by the city of Toronto, the line can be built and power delivered at the low price quoted to the various municipalities interested in the scheme. The estimated cost of the whole system of transmission lines to serve the western municipalities, as well as Toronto, is placed at $3,500,000.

PUBLICATIONS.

The Mechanical Appliance Company of Milwaukee calls attention to the Watson direct-connected ventilating fans in a small illustrated folder. Dimensions, speeds and capacities are given. The motors are adapted for 110, 220 and 500 volts.

The Bulletin of the Bureau of Labor, United States government, for January, 1908, contains articles on employers' liability in the United States and on foreign workmen's compensation acts. Lindley D. Clark is the author of the article on the legal liability of employers in the United States.

Standard and water-tight boxes for all electrical installation purposes are described in Bulletin No. 21 of the H. Krantz Manufacturing Company of 160-166 Seventh Street, Brooklyn, N. Y. Numerous illustrations supplement the descriptions. Prices are given in bold-face type. The pamphlet contains 52 pages.

"Vertical Gas Engines" is the title of a pamphlet distributed by the Bruce-Meriam-Abbott Company of Cleveland, Ohio. The engines described may be used for electric lighting, pumping and general power purposes. Engines of this type of from 12 to 200 horsepower are made, and their characteristic features are clearly illustrated and described.

The J. Lang Electric Company of 116-128 Lincoln Street, Chicago, issues a handsome general catalogue of electrical distributing apparatus. Switches, switchboards, panel boards, cabinets, plugs and receptacles, floor boxes, fuses and fuse boxes and similar appliances are described and illustrated in a pamphlet of 88 pages. Prices are given as well as dimensions, carrying capacity and other data.

The Holophane Company of 227-229 Fulton Street, New York, has just issued its No. 6 Bulletin, and calls attention to the fact that this bulletin especially announces sand-blasted and enameled reflectors and contains a valuable table showing the different types and sizes of lamps which can be used to advantage with the several styles and sizes of these reflectors. The publication is entitled "Holophane Reflectors for Gem, Meridian, Tantalum and Tungsten Lamps."

Several new and interesting bulletins have been issued by the General Electric Company, Schenectady, N. Y. Bulletin 4576 describes type F, form K-3, 4,500-volt oil-break switches. These switches are designed for panel installation and remote control. They have been especially designed with a view to combining every element of satisfactory operation with low price, and are said to meet the most severe requirements of exacting service on systems of 4,500 volts or less. The object of Bulletin No. 4578, on "Railway [illegible] compre-hensive manner the essentials of the various standard controllers that are manufactured for railway service, with special reference to the operating conditions for which each type is suited. Bulletin 4579 is devoted to the "Luminous Arc Headlight." This headlight is designed for interurban [illegible] and the lower electrode an iron tube filled with [illegible] the carbon arc, a very brilliant illumination is obtained. If the polarity of the electrode is reversed the light given is very much less and this is utilized for dimming the headlight when passing through the streets of cities. The "C. Q. Motor" is described in Bulletin 4584. This motor is for direct-current circuits and is made up to 20 horsepower in size, and for voltages of 115, 230 and 550. "Luminous Electric Radiators" are described in an attractive pamphlet. They consist of an ornamental cast-iron frame fitted with a polished copper reflector at the back and with three or more large cylindrical incandescent heating lamps. The source of heat is a small filament, which becomes incandescent immediately, emitting a powerful heat from the moment the current is turned on.

SOCIETIES AND SCHOOLS.

The annual convention of the Southwestern Electrical and Gas Association will be held at El Paso, Texas, on May 7th to 9th. Indications are that an unusually successful convention will be held in the quaint border city.

Engineering (including electrical engineering) courses, laboratory practice and research work will be given in the coming summer session of the University of Wisconsin, Madison, Wis., beginning June 22d and continuing six weeks. In addition to the engineering courses, the eighth annual session of the Artisans' School will be held during the same period. Here instruction of more elementary type will be given.

Commencement week at Purdue University will begin Saturday, June 6th, with a senior circus and band concert. The baccalaureate address will be made on Sunday by Bishop Anderson of Chicago. Monday is set apart for dramatic performances and Tuesday for alumni day. The final graduating exercises will take place on Wednesday, June 10th, the commencement address being delivered by Dr. Harvey W. Wiley of Washington, D. C.

MISCELLANEOUS.

Over $75,000 worth of oil was destroyed by fire at Tulsa, Okla., caused by lightning during a severe electrical storm.

The United States Civil Service Commission, Washington, D. C., announces an examination on May 13th, at the principal cities in the United States, to secure eligibles from which to make certification to fill a vacancy in the position of electrician, $1,000 per annum, Quartermaster's Department at Large, Columbus Barracks, Ohio, and vacancies requiring similar qualifications as they may occur in any branch of the service. The duties of the specific position to be filled require knowledge of and experience in house wiring, installation of electric-lighting fixtures, and construction of pole lines; ability to read and test wattmeters and to care for and make slight repairs to transformers and arc lamps.

The sandstone-brick industry has been developed to a high degree of commercial importance in European countries, while in this country it was hardly known 10 years ago. But there has been a remarkable growth here in the last five years, in which time about 200 plants have been installed for the manufacture of this kind of brick. The sand-lime brick is not a brick in the ordinary sense, but is really an artificial sandstone. In its manufacture the processes of nature for producing sandstone are copied as nearly as possible, with the exception that the operation is completed in a very short interval as compared to the ages it takes nature to do the work. A mixture is made of sand and lime, moistened and pressed and dried at a high steam pressure in large cylinders. It makes a strong and uniform brick, possessing great crushing strength, and is superior to most of the natural sandstone. These bricks may be given any shade of color desired and may also be glazed.

TRADE NEWS.

At a meeting of the City Council of Moosejaw, Sask., it was decided to return all the bids for the 500-kilowatt electrical unit and call for new tenders to be opened on May 17th.

The New York office of the Cutler-Hammer Manufacturing Company, maker of electric controlling devices, has been moved from 136 Liberty Street to the Hudson Terminal, 50 Church Street.

The New York office of the Western Electrician, in charge of Mr. Elmer E. Wood, has been removed from Room 809 to Room 1321 in the American Tract Society Building. The mailing address remains the same as before—150 Nassau Street.

The New York office of the General Electric Company has been moved from the Edison Building, 44 Broad Street, to the Cortlandt Building, 30 Church Street. The Cortlandt Building and the Fulton Building, twin buildings popularly known as the Hudson Terminal Buildings, are located on the northwest corner of Church and Cortlandt streets, one block west of Broadway and three blocks east of the Hudson River. Approximately 31,000 square feet, or the entire seventeenth floor of the Cortlandt Building, will be occupied by the General Electric Company. The buildings are admirably situated for office purposes, being in close proximity to the principal railroads and the river tunnels. There will also be a connection with the present subway under Broadway.

Mr. E. C. Austin, formerly of Toronto, but now of Arequipa, Peru, has written to friends in Canada asking them to look up some Canadian firm of engineering contractors who would undertake to build an electric railway in Arequipa. The promoters of the Peruvian company, he says, have heard of other Canadian undertakings in other parts of South America, and are anxious, if possible, to have their scheme considered by Canadian capitalists. At present there is a horse-car service in the city of Arequipa, but a company has been incorporated to have the system electrified. At the head of it is Senor C. Espejo y Ureto, president of the Credito Urbano de Arequipa, the largest bank in the place. The city has a population of about 45,000 and is the second city in Peru.

One of the signs of returning confidence in the business situation is the organization of the Canadian Crocker-Wheeler Company, Ltd., for the manufacture and sale in Canada of Crocker-Wheeler apparatus. The Crocker-Wheeler Company, Ampere, N. J., manufactures all types of direct-current and alternating-current motors and generators, power transformers, motor-generator sets, frequency changers, etc., some of the best-known lines being direct-current motors for special purposes, such as machine-tool and printing-press drive, and steel-mill work. Crocker-Wheeler alternating-current generators up to 2,000 kilowatts capacity have been in successful operation in Canada for some years. F. E. Lovell, president of the new company, is a member of the old-established lumbering firm of H. Lovell & Sons of Coaticocke, Que. Russell A. Stinson and F. John Bell, vice-president and secretary-treasurer, respectively, have been identified with the manufacturing, construction and sales ends of the electrical trade in Canada for the last 15 years and are particularly well known in Montreal, where the head office of the company has recently been opened in the Street Railway Chambers, Place d'Armes Hill.

BUSINESS.

To make it easy to obtain prices on Universal, Zero, Victor, Standard or Western desk or ceiling fans, the Western Electric Company of Chicago issues a return postal card with illustrative descriptive matter attached. It is declared that "the Western Electric Company offers you the best fan motors in every respect and the most complete line from which to choose."

The Mechanical Appliance Company of Milwaukee, Wis., announces that it has designed and developed and is now ready to furnish single-phase and polyphase alternating-current motors. These new lines, in conjunction with its previous direct-current line, distinguish it as one of the small number of electrical companies in this country manufacturing single-phase, polyphase and direct-current motors.

The last few weeks have developed a well-defined demand for the small self-contained direct-current engine-generator sets sold by Allis-Chalmers Company, Milwaukee, and comprising small Allis-Chalmers type "NI" generators connected to the type "E" American Blower engines, built by the American Blower Company of Detroit. These units are particularly suited for use as exciter sets in small isolated plants, steamship or steam-yacht lighting installations or wherever a small unit which will operate with minimum attention is necessary.

Signs of recovery from the industrial depression are unmistakable in the recent sales of new-machinery equipment to manufacturing plants in various parts of the country. This revival is general all along the line of commercial activity, for orders for steel are said to have increased 25 per cent. over a month ago. Railroad earnings are better for several of the larger systems, and building activities are much more active. Sales of Allis-Chalmers Corliss engines, mainly with electric generators and other equipments, made recently in several parts of the country, bear out this statement.

DATES AHEAD.

Omaha Electrical Show, Auditorium, Omaha, Neb., May 4th to 9th.

Nebraska Electrical Association (annual meeting), Omaha, Neb., May 6th and 7th.

Missouri Independent Telephone Association, Kansas City, May 6th and 7th.

Southwestern Electrical and Gas Association (annual meeting), El Paso, Tex., May 7th, 8th and 9th.

Grand Rapids Electrical Show, Grand Rapids, Mich., May 11th to 16th.

Indiana Independent Telephone Association (annual convention), Indianapolis, May 13th and 14th.

National Electric Light Association (annual convention), Auditorium Hotel, Chicago, May 19th to 22d

Oklahoma Electric Light, Railway and Gas Association (annual convention), Guthrie, Okla., May 25th, 26th and 27th.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

Michigan Electric Association (annual meeting), Grand Rapids, Mich., August [illegible]

[illegible]

[illegible] uary 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 21, 1908.

885,007. Telephone Transmitter. Alberta E. Beachum, Polkton, N. C. Application filed August 7, 1907.

This transmitter consists of a diaphragm and a microphone element comprising a vacuum tube connected to the diaphragm and extending parallel therefrom, the tube enclosing circuit terminals and a mass of carbon granules for bridging the terminals.

885,009. Induction Motor. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed November 29, 1905.

The rotor for an induction motor comprises a spider, radial fan-blades integral therewith, a slotted core mounted on the rim of the spider, conductors mounted in the slots of the core, and short-circuiting rings for the conductors mounted on the fan blades.

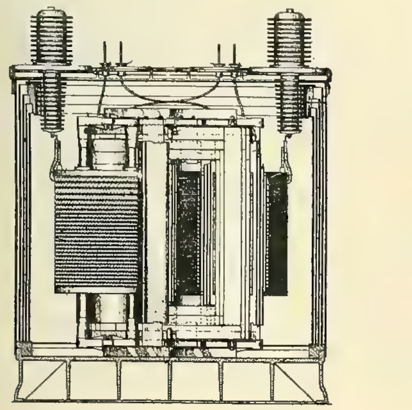
885,017. Canopy Attachment for Lighting Fixtures. George W. Cassidy, East Orange, N. J. Application filed June 19, 1907.

A canopy support and insulator consists of a sectional ring made of insulating material adapted to embrace the tubular covering of the fixture and provided with a tapering screw thread to engage the threaded opening of the canopy and to be thereby compressed and clamped upon the tubular covering.

885,031. Regulator for Dynamo-electric Machines. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 20, 1904.

In combination with a generator and an exciter therefor is a vibratory device for varying the resistance of the field circuit of the exciter and differential coils for operating the vibratory device, one of the coils being excited by current from the generator and the other coil being excited by current from the exciter.

885,034. Transformer. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 26, 1907.



NO. 885,034.—TRANSFORMER.

In a high-potential transformer the high-voltage conductors are insulated by surrounding them with insulated layers of conducting material, the layers being successively greater in area as they are successively spaced further from the high-voltage conductors so as to decrease and equalize the high-potential stresses over a large area of the insulation. (See cut.)

885,054. Gas Element for Converting the Energy of Combustible or Other Suitable Reducing Substances to Electric Current. Ernst W. Jungner, Kneippbaden, Norrköping, Sweden. Application filed May 15, 1907.

A galvanic gas element has an oxygen depolarizer, a generator comprising a reducing gas, nitrosyl-sulphuric acid dissolved in sulphuric acid and an electrolyte of sulphuric acid of high concentration.

885,055. Locomotive. Ernest C. Ketchum, Boston, Mass. Application filed July 3, 1907.

This locomotive carries a steam turbine and a condenser therefor, a dynamo driven thereby and propelling motors supplied with current by the dynamo.

885,061. Interlocking Relay. Thomas L. Lee, Westfield, N. J., assignor to the Hall Signal Company. Application filed June 6, 1907.

The relay has two magnets, contact fingers mounted on but insulated from their armatures, a locking arm mounted on each armature, and two detents, each of which is arranged to be engaged and actuated by one locking arm and to engage and lock the other locking arm to prevent contemporaneous operation of the armatures and their contact fingers.

885,063. Trolley Stand. William A. Loudon, Chicago, Ill., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 9, 1905.

A pedestal mounted on a car has a standard rotatable in the pedestal, a spring plunger in the standard, a trolley-pole hinged to the plunger and a link connecting the standard and pole.

885,072. Electric Igniter for Gas or Vapor Engines. Leon O. McPherson, Highland Park, Ill. Application filed March 25, 1907.

A pair of relatively movable contacts are arranged to extend into the cylinder. There is a timer adapted to automatically close the circuit and a magnet located outside of the cylinder and adapted when energized to relatively move the electrodes to break the circuit.

885,083. Electrolytic Apparatus. Brodde E. F. Rhodin, Sault Ste. Marie, Ontario, Canada. Application filed October 30, 1906.

A cell for electrolytic processes has a series of concentric retaining ridges arranged stepwise, each of the ridges being separate from the others.

885,106. System for Distribution. Lewis L. Tatum, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed April 16, 1906.

In a multiple-voltage system there is a balancer comprising two dynamo-electric machines having their armatures connected respectively to the main conductors, and a starting rheostat adapted to connect the armatures to each other and to the neutral or compensating conductor.

885,121. Puncture Telltale. Charles A. Winter, New York, N. Y. Application filed August 14, 1906.

In combination with a pneumatic wheel tire is an electric circuit and a circuit-closing device comprising a contact carried by the wheel, a part connected with the contact and engaged by the tire, a contact mounted on the wheel axle in the path of the wheel-carried contact, the tire when inflated acting on the part engaged thereby to keep the wheel-carried contact from touching the stationary contact, and a spring acting on the wheel-carried contact to move it when the tire is deflated to cause the closing of the circuit.

885,127. Electric Display Apparatus. Edmund L. Zalinski, New York, N. Y. Application filed October 6, 1904.

The apparatus consists of a series of electric lamps, reflectors disposed at different angles to the lamps and arranged at the sides thereof, and electromagnetic means for moving the reflectors to and fro in the plane of the lamps and approaching and receding therefrom.

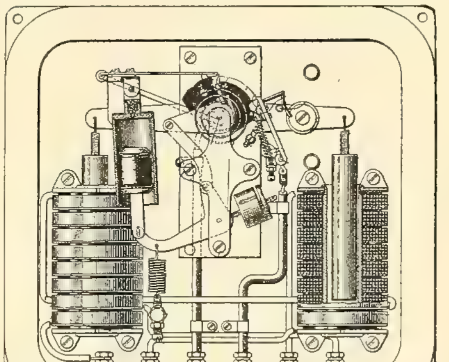
885,128. Motor Control. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 26, 1907.

A commutator motor has means for connecting it as a series motor for operation on direct current and as a repulsion motor for operation on alternating current; in the latter case the armature is short-circuited and the effective ampere turns of the inducing winding are increased relatively to the exciting winding.

885,134. Electric Gas-lighting Machine. David A. Barlow, Orange, Conn. Application filed February 21, 1907.

This is a device for lighting the burners on a gas stove. A stationary contact adjacent each burner is engaged by a movable contact operated by a reciprocating rod.

885,143. Automatic Synchronizer. Frank Conrad, Swissvale, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 2, 1907.



NO. 885,143.—AUTOMATIC SYNCHRONIZER.

Two sources of alternating current are connected to a part that reciprocates in response to the variations in the phase relations of the currents, and a switch comprising three co-operating members, one of which is operated directly by the reciprocating part, another is operatively connected to this part and the third engages the second member, except when the latter is moved to an extreme position. Means actuated by the reciprocating part cause engagement of the second and third members only when predetermined phase relations exist between the currents. (See cut.)

885,1[illegible]. [illegible] Charles A. [illegible], assignor [illegible] G. A. [illegible] Kohler, Chicago, Ill. Application filed October 24, 190[illegible].

[illegible] up and down position.

885,163. Armature Winding for High-speed Dynamo-electric Machines. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 2, 1905.

A winding [illegible] located in the armature slots has the [illegible] remote from the commutator, connected to commutator segments by means of comparatively high resistance conductors located in the armature slots and by comparatively low-resistance conductors located outside of the magnetizable portion of the armature core.

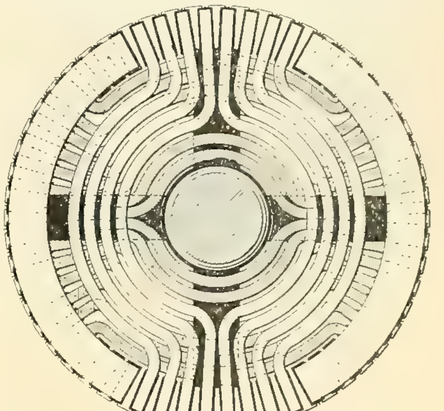
885,168. Automatic Signaling Device. Guy Milburn, Baltimore, Md., assignor of one-half to Willard G. Milburn, Baltimore, Md. Application filed May 11, 1906.

In a railway block-signaling system a source of energy is arranged in each block and normally disconnected from the rails, means under the control of an engine through a distant block are arranged for connecting the source of energy to the rail, and a signaling circuit on the train is arranged to be energized from such source of energy.

885,180. Telephone Trunking System. Edwin H. Rupe, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed November 15, 1906.

In combination with a cord circuit and ringing key is a relay, the actuation of which depends upon the character of the jack with which the cord is connected for governing the connection with the key.

885,184. Winding for Dynamo-electric Machines. Walter Schmidt, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed July 17, 1905.



NO. 885,184.—WINDING FOR DYNAMO.

A magnetizable core with a number of longitudinal slots has a winding therefor comprising two groups of coils of oblong cross-section, the ends of some of which are disposed edgewise and the ends of others of which are disposed sidewise in planes substantially parallel to the ends of the core. (See cut.)

885,186. Three-wire Central-energy Telephone System. Charles A. Simpson, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed February 26, 1906.

A third conductor isolated from the talking circuit contains a supervisory signal and means for disconnecting the signaling apparatus from the line and connecting the terminals with the talking circuit, and further means for opening the circuit of the supervisory signal.

885,245. Device for Separating Iron Particles from Chaff and the Like by Means of Magnets. Joseph Hagmüller, Allensbach, Germany. Application filed January 2, 1908.

A spoked flywheel has knives attached to the spokes, fittings provided with slots fixed to the spokes, scythe-like iron bars adjustably mounted in the slots, magnets fixed on the inner side of the bars, the magnets being bent away from and projecting beyond the knives.

885,246. Electric Fixture. Harry T. Hall, Greenville, Ohio. Application filed August 19, 1907.

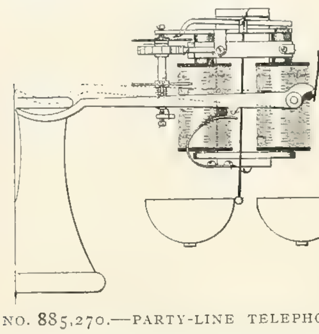
A reel for carrying a flexible conductor has an actuating spring, a case for the spring held in contact with the reel elastically, and a connection between the reel

and the spring case maintained by the elastic tendency of the spring case.

885,255. Magneto-electric Machine. Edward B. Jacobson, Pittsfield, Mass., assignor to the Pittsfield Spark Coil Company, Pittsfield, Mass. Application filed July 13, 1906.

This magneto, for ignition work, has an armature with primary and secondary windings and a rotatable shell.

885,270. Telephone System. Frank E. Mayberry, West Medford, and Newman H. Holland, Brookline, Mass., assignors to the Boston Telephone Selector Company, Boston, Mass. Application filed April 12, 1902.



NO. 885,270.—PARTY-LINE TELEPHONE.

In a party-line system means are arranged for connecting a source of direct current and a source of alternating current to the line conductors. Armatures in the field of the electromagnets are arranged, respectively, to respond to currents sent over the line of different direction, and a separate armature is responsive to alternating currents for signaling. (See cut.)

885,278. Commutator Wiper and Oiler. Daniel D. Neville, George H. Clay and John H. Clewer, Kansas City, Mo.; said Clewer assignor to C. M. Hanks, Kansas City, Mo. Application filed November 16, 1905.

A bifurcated bracket is secured to and insulated from the dynamo, a solenoid is adjustably mounted upon the bracket and provided with a magnetic plunger, a spring holds the plunger partly withdrawn from the solenoid. A substance for oiling and wiping the commutator is detachably secured at the lower end of the plunger.

885,280. Actuating Mechanism for Fare Registers. John F. Ohmer, Dayton, Ohio, assignor to the Ohmer Fare Register Company, Rochester, N. Y. Application filed June 13, 1907.

A series of banks of counters has an actuating member for each bank, a movable solenoid and a core having an extension adapted to be brought into operative relation with each of the individual actuating members, and means for energizing the solenoid to actuate the core and the core extension therewith to move the individual actuating member.

885,289. Alarm Gauge. Harry B. Presser, Memphis, Tenn. Application filed February 19, 1907.

A pressure gauge is provided with contacts closing an alarm circuit at limiting pressure values.

885,294. Battery-filling Machine. Charles T. Richmond, Cleveland, Ohio, assignor to the National Carbon Company, Trenton, N. J. Application filed September 14, 1905.

This is a machine for filling dry cells. A plunger forces the materials into the jar.

885,338. Arc Lamp. Johannes Härdén, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 12, 1903.

A solenoid and means actuated thereby are arranged for positively feeding the lower electrode when energized and releasing the upper electrode to feed by gravity, a switch controlling the energization of the solenoid, a series coil opening the switch and a shunt coil closing the switch.

885,345. Electric Switch. Benjamin Hughes, Montreal, and Herbert N. Young, Rockfield, Quebec, Canada. Application filed October 1, 1904.

In an electrically operable switch there is a polarized circuit-closing member, a magnet adapted to hold the member in position to break circuit, in combination with a second magnet adapted to move the circuit-closing means.

885,348. Telephone Hook Switch. Herbert L. Knight, Cleveland, Ohio, assignor to the Century Telephone Construction Company, Buffalo, N. Y. Application filed April 13, 1906.

In a [illegible] a number of upwardly extending, vertically positioned contact springs are carried by an insulating support. A vertically movable plunger is [illegible] the switch hook, and there is a laterally extending insulated member upon the plunger [illegible] of the contact springs into [illegible]

[illegible] Railway Signal and Telephone System. Frederick L. Odenbach, Cleveland, Ohio, as[illegible] John C. Poore, Cleve[illegible] Ohio. Application filed July 10, 1907.

[illegible]

[illegible] Trolley Pole. Jacob M. Olinger, Springfield, Ohio. Application filed [illegible]

[illegible]

arms at substantially a right angle to the length of the harp and provided with a guideway and a cutting edge adjacent to the guideway.

885,375. Coin Box and Registering Mechanism for Telephones. Frank D. Powell and Charles S. Ellis, Chicago, Ill., assignors to the American Coin Register Company. Application filed December 12, 1904.

An armature under electrical control from the central office carries two pins that project into the coin chute. A gravity pawl upon the actuator member is adapted to slide over the coin when the actuator is moved backward and to force the same from its arrested position upon the next advance movement of the coin actuator.

885,394. Apparatus for Converting Direct Current into Alternating Current. Frederick F. Strong, Boston, Mass. Application filed February 16, 1906.

A revolving commutator receives direct current through a pair of brushes. A series of collector rings is electrically and mechanically connected to the commutator. The brushes on these rings pass alternating current through a series of resistances to the outgoing line.

885,406. Pleasure Car and Track. William H. Vance, San Francisco, Cal. Application filed January 22, 1907.

An inclined circular track carries electrically operated and controlled vehicles.

885,417. Electrically Operated Punka and the Like. Harry H. Young, Colchester, England, assignor to himself and Bergtheil and Young, Limited, London, England. Application filed January 2, 1908.

An electric motor drives an oscillating punka frame through a friction pulley carried by the motor and a friction blade pivotally carried by the frame.

885,430. Thermo-electric Couple. William H. Bristol, New York, N. Y. Application filed December 27, 1907.

This couple has one element which consists of substantially pure graphite and the other of graphite containing clay.

885,446. Controller. Arthur T. Crocker, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 1, 1906.

The controller has a movable member capable of a number of operative positions, a solenoid having a core for actuating the member and means for automatically de-energizing the solenoid and again energizing it when the core reaches positions corresponding to the operative positions of the member.

885,476. Motor-controlling System. Arthur E. Hogrebe and Victor O. Strobel, Philadelphia, Pa., assignors to the Niles-Bement-Pond Company, Jersey City, N. J. Application filed January 14, 1907.

The motor field has means for supplying it through a single controlling device for one direction of rotation of the motor and through two controlling devices for the other direction of rotation. A main armature circuit includes a magnet, and an armature short-circuit also includes a magnet. A single switch is controlled by the two magnets and arranged to open and close the armature short-circuit.

885,484. Talking-machine Attachment. Bernard F. Keating, Hawthorn, Victoria, Australia. Application filed November 22, 1907.

The attachment has an electromagnet for energizing it by making a contact at a distance from the machine, a pivoted armature lever for the magnet, an intermediate lever adapted to move and pass the armature lever and have its return stopped by the latter, a motor controlling hand lever and a spring connection from the intermediate lever to the latter lever.

885,513. Electric Time Switch. Carl G. Nylander and Frank J. Regensburger, McKeesport, Pa., assignors to the National Electric Time Switch Company, McKeesport, Pa. Application filed October 31, 1905.

This switch is operated by a mechanism including an escapement wheel controlled by a clock.

885,519. Electric Signal. John Rebar, Smithdale, Pa. Application filed November 11, 1907.

A railway train signal system comprises a signal bell, a battery, a circuit from the battery to each car of the train, contacts carried on opposite sides of the couplers of the cars and circuit-closers on each car.

885,520. Device for Igniting the Charges of Internal-combustion Engines. Fritz Reichenbach, Charlottenburg, Germany. Application filed May 2, 1906.

A gas engine having water jackets has electrodes carried by the engine, a dynamo in circuit with the electrodes, a water motor to operate the dynamo, and means to convey the discharge of the motor through the water jackets of the engine.

885,523. Braiding-machine Stop-motion. Oliver A. Robbins, Charlotte, N. C. Application filed March 13, 1907.

In combination with a movable bobbin included in an electric circuit is an insulated support on the machine and a set of upright resilient contact devices positioned in groups on the support adjacent to the path of the bobbin and arranged to be engaged thereby.

885,545. Telegraph Sounder. James J. Thomas, Whiting, Iowa, and Albert G. Christopherson, Scribner, Neb. Application filed January 23, 1907.

A permanent magnet is supported upon uprights on the base. An electromagnet is supported by a pivoted lever adjacent to the permanent magnet and normally repelled by the latter. A breaking circuit includes the electromagnet.

885,562. Secondary Battery. William A. F. Alt, Brooklyn, N. Y., assignor to the American Battery Company, Cedarhurst, N. Y. Application filed April 1, 1907.

A method of assembling and insulating battery plates is described.

885,622. Process for Obtaining Pure Copper. Lucien Jumau, Paris, France. Application filed May 31, 1906.

The process consists in treating a solution containing salts of copper with a sulphite for producing a precipitate containing cuprous sulphite, treating this with an acid to reduce a portion thereof to metallic copper, forming the metallic copper into suitable anodes and subjecting them to an electrolytic refining process.

885,631. Housing for Electric-alarm Mechanism. James B. Mayberry, Houston, Texas. Application filed August 13, 1907.

A housing is made in halves and disposed upon opposite sides of the target rod. The alarm mechanism associated with the target is disposed within the housing.

885,678. Insulator for Heavy Currents. Louis Steinberger, New York, N. Y. Application filed January 26, 1906.

This insulator comprises a member of insulating material provided with a number of hoods and with spaces intermediate the hoods for the purpose of dead-ending cables, and a pair of distinct supports engaging the member of insulating material for distributing the weight thereof.

885,688. Relay. Archibald S. Cubitt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1907.

The relay has a current-carrying coil, a core movable in the magnetic field thereof, a frame serving as a path for the flux and as a magnetic shunt around the core, and bushings for varying the reluctance of the shunt path.

REISSUES.

12,782. Electric Heater. Moïse Landry, San Francisco, Cal. Application filed January 20, 1908. Original No. 873,317, dated December 10, 1907.

An electric heater consists of two boards hinged together, an asbestos covering on the inner surfaces of the boards and a high-resistance wire arranged to lie between the coverings when the boards are closed.

12,783. Automatic Train-stop. Hiram G. Sedgwick, Mill Valley, Cal., assignor to the American Train Stop Company, San Francisco, Cal. Application filed September 28, 1907. Original No. 864,866, dated September 3, 1907.

A brake magnet and circuit on the locomotive has means for opening and closing the circuit, the means embodying relatively movable contacts and a magnet and circuit. There are also means on the roadbed for closing this last-named circuit and means for automatically holding the brake-magnet circuit closed when once closed by the roadbed devices.

12,784. Process for Uniting Metal Pieces. Charles F. Jacobs, Chicago, Ill., assignor to the Jacobs Welding Company, Chicago, Ill. Application filed October 31, 1907. Original No. 825,541, dated July 10, 1906.

The process consists in bringing the pieces to be united near together but not in actual contact, introducing molten flux between the pieces, passing an electric current through the flux from one of the pieces to the other, and finally replacing the flux with molten metal.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 28, 1908:

451,101. Electric Arc Lamp. C. G. Young, New York, N. Y.
451,121. Electro-mechanical Gong Striking Machine. T. F. Gaynor, Louisville, Ky.
451,125. Electric Meter. F. K. Irving, New York, N. Y.
451,142. Electric Battery. J. T. Van Gestel, New York, N. Y.
451,154. Electric Railway. R. M. Hunter, Philadelphia, Pa.
451,155. Electrically Propelled Car. R. M. Hunter, Philadelphia, Pa.
451,157. Electric Signal for Railways. U. S. Jackson, Ossipee, N. H.
451,189. Electric Arc Lamp. J. H. R. Ward, New York, N. Y.
451,190. Electric Switch. LeRoy S. White, Waterbury, Conn.
451,212. Starting Device for Electric Motors. E. P. Sharp, Boston, Mass.
451,226. Electric Indicator. J. L. Ricketts, Philadelphia, Pa.
451,239. System for Electrically Supplying Hot Water for Consumption and Heating Purposes. M. W. Dewey, Syracuse, N. Y.
451,240. Method of and Apparatus for Electrically Supplying Hot Water for Consumption and Heating Purposes. M. W. Dewey, Syracuse, N. Y.
451,242. Armature for Electric Motors and Generators. P. Grant, Baltimore, Md.
451,250. Electric Arc Lamp. A. G. Waterhouse, Hartford, Conn.
451,267 and 451,268. Electric Switch. H. T. Clark, Bridgeport, Conn.
451,282. Advertising Bulletin and Train Annunciator. S. H. St. John and F. A. Jennings, Chicago, Ill.
451,308. Solenoid and Spool Magnet. H. S. Park, Chicago, Ill.
451,309. Electric Arc Lamp. R. Schefbauer, Paterson, N. J.
451,312. Regulator for Dynamo-electric Machines. F. Tischendoerfer, Brooklyn, N. Y.
451,320. Electric Motor. R. Eickemeyer, Yonkers, N. Y.
451,326. Tension and Cut-out Device for Electric Railways. B. Jennings, San Jose, Cal.
451,345. Method of Electric Welding. E. Thomson, Swampscott, Mass.
451,397. Electric Switch. H. A. Chase, Stoneham, Mass.
451,402. Electric Railway. R. M. Hunter, Philadelphia, Pa.
451,407. Method of Making Electrodes for Secondary Batteries. H. H. Lloyd, Camden, N. J.

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Public-service Electrical Utilities In and Near Kokomo, Indiana.

By C. A. Tupper.

As an illustration of what may be accomplished in building up an electric-railway, lighting and power distributing system, and at the same time strengthening the industrial position of an entire community, the management of the Kokomo, Marion and Western Traction Company furnishes one of the most striking and instructive examples to be met with anywhere in the country.

At the time ownership of the system was assumed by the interests now in control, less than four years ago, there was a small street-railway and electric-lighting plant, having no greater output than 500 kilowatts, a few miles of trackage wholly within the city of Kokomo, and circuits supplying several hundred arc and incandescent lamps. Today 22,000 incandescent and 395 arc lamps in and about Kokomo are supplied with electric current, and more than one-half of the company's customers have various electric household devices; factories in the vicinity take upward of 1,000 horsepower daily in current for operating motors; the street-railway system has been extended to a trackage of 10 miles, and a finely equipped interurban line of 28 miles in length extends from Kokomo, a city of about 18,000 inhabitants, to Marion, having a population of 26,000, through several large towns situated in a rich, closely tilled agricultural country. Further extensions are projected to Terre Haute and LaFayette on the West, distant, respectively, 130 and 79 miles from the eastern terminus of the road. Among the principal places on the line now in operation are Greentown and Swayzee, each of about 2,000 people; Sycamore, Sims, Herbst and Roseberg.

New Power Plant.

Among outward signs of progress, however, the most prominent is the development of the new power station (a plan of which is given on another page), which has recently been equipped with two Allis-Chalmers steam turbines and generators having an aggregate normal capacity of 2,000 kilowatts and delivering two-phase, 60-cycle current at a terminal pressure of 2,300 volts. The first of these machines, put in operation February 21, 1907, was found so satisfactory that a second unit of identical construction was ordered, the latter being placed on the line on December 7th of the same year.

The units will be described farther along in this article; but, in order to obtain a comprehensive view of the entire equipment and operation of the system, it will be well to begin with the unloading of fuel and follow the course taken in power development from the time it is first transformed in the furnaces until it has reached the end of its period of service.

Coal-handling System.

Coal, consisting of a comparatively low grade of Indiana screenings, is brought in on a spur from the Lake Erie and Western Railway and unloaded through a trestle extending the entire length of the firing room, so that it is heaped up in front of iron doors opening upon the several furnaces. From these piles it is shoveled directly into the furnaces, which are so arranged as to obtain a relatively high heat value from the fuel, with the exercise of good management.

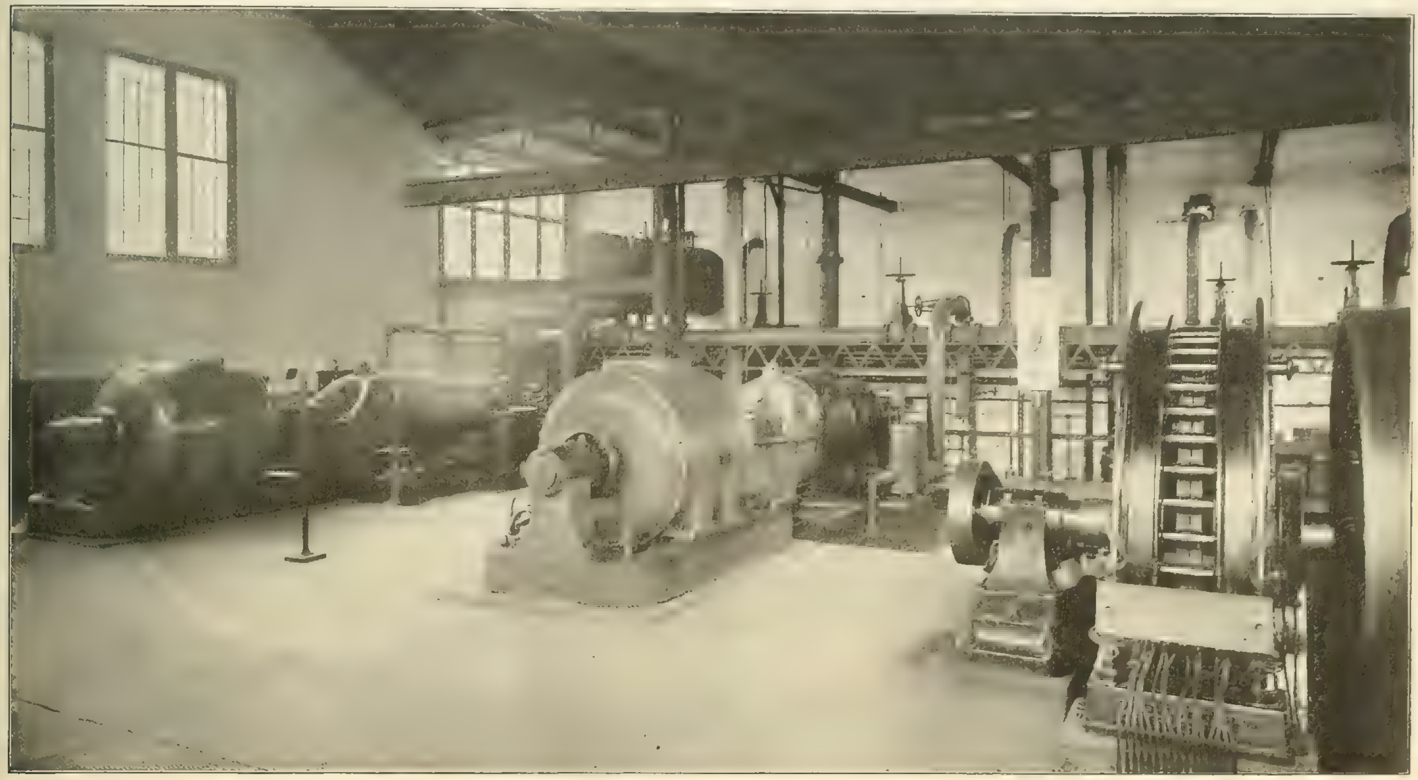
Removal of ashes is accomplished by an inexpensive device. Instead of the customary ash-pit with track and cars, there has been installed a tunnel and screw conveyor, through which the ashes are constantly transferred to a pit outside the building. There, by means of a bucket elevator and inclined conveyor, the material is discharged to storage bins at one side of the building and unloaded into cars, which take it to points along the line where it can be used as ballast.

Boilers and Stacks.

The boiler equipment, set on concrete foundations reaching to bed rock, consists of three batteries, two of which include four Stirling boilers, each having a capacity of 235 horsepower, and the third comprising one Atlas water-tube boiler with a capacity of 400 horsepower. Two of the Stirling boilers discharge into one stack six feet in diameter and 80 feet high, constructed entirely of steel, and the remaining two, with the Atlas boiler, into a stack six feet in diameter and 125 feet high, also of steel. The shorter of these stacks is equipped with an engine-driven Sturtevant blower, by means of which enough draft can be induced to give large temporary overload capacity to the two boilers with which it is connected. The boiler room has ventilators at the top and is very commodious, [illegible] capacity.

[illegible]

[illegible] located above the pump compartment [illegible] steam turbine room [illegible] which each turbine unit [illegible] pipe. Gate valves are placed between each battery of boilers and between each turbine inlet, these valves being of the Crane type with rising stems. There is also a 4½-inch auxiliary header. A proper arrangement of valves enables any part of the plant to be supplied from any boiler at will. All of the piping is made as short and direct as possible, and heat insulation is provided in the shape of heavy covering of the pattern furnished by the Johns-Manville Company. Long bends to provide for expansion have been used wherever necessary, and the system includes Cochrane steam separators.



INTERIOR OF GENERATOR ROOM OF POWER HOUSE OF KOKOMO, MARION AND WESTERN TRACTION COMPANY.

Feed-water Heater and Pumps.

The condensers and all of the other auxiliaries exhaust into a Cochrane heater (with Sorge water purifier), where a temperature of from 200° to 212° F.—never less than 200°—is constantly maintained. Water may be drawn from either the condenser suction or discharge pipes, from a deep well or from the city mains, and discharged into an elevated tank which feeds by gravity into the heater and from there by gravity into the boiler feed pumps; or the water may be by-passed directly to the boiler.

Two Worthington pumps are used for supplying the tank over the heater and two Dean pumps for boiler feed. Either one of these sets is, however, of sufficient capacity to take care of the water system of the entire plant. The Worthington pumps are now being displaced by a centrifugal pump with 2½-inch discharge, driven by an induction motor supplied with current directly from the main generator buses through a step-down transformer, but the steam pumps will be held in reserve.

Water Supply.

Water for condensation and boiler feed is taken from a creek about 350 feet distant through a 16-inch cast-iron pipe, and discharged back to the stream through 20-inch tile. The water is drawn from a concrete basin in the creek, 7 feet

square inside and extending 6 feet below the water mark, with walls extending to high-water mark and a gate on the down-stream side where the water enters. This gate can be readily closed down tight, when desired, and the water exhausted by pumps in the power plant, so as to facilitate cleaning the basin of sand and mud.

STEAM TURBINES

The turbine operating floor is 5½ feet above the boiler and pump room floor, 11 feet above the basement floor and 30 feet below the roof trusses, the foundation of each generating unit being kept entirely separate from the steel frame of the concrete flooring. Overhead is a 10-ton crane, hand operated.

POWER HOUSE OF KOKOMO, MARION AND WESTERN TRACTION COMPANY.

In this room are placed two horizontal steam turbines and generators, of 1,000-kilowatt capacity each, a 330-kilowatt engine-driven alternator operated in parallel with them, the exciter for these units, and sub-station apparatus, transformers, switchboard, etc., as later described.

Incorporated in the turbines are the various patented features controlled by the Allis-Chalmers Company among which may be mentioned channel-shaped shrouds protecting the ends of the blading from injury; machine-cut slots in the foundation rings insuring accurate spacing of the blades; a method of fastening the latter which prevents them from working loose, and improved balance pistons.

The turbines operate at 1,800 revolutions per minute, with a steam pressure of 140 pounds at the throttle, dry saturated, and a vacuum of 28 inches of mercury referred to 30-inch barometer at the exhaust nozzle. Large temporary overload capacity has been provided for in the design of these machines; high efficiency is maintained, and close regulation secured, even under unfavorable operating conditions. The turbines are frequently run six weeks at a time without taking the load off, and then only to make inspection.

The bedplate is divided into two parts, one carrying the low-pressure end of the turbine and the bearings of the generator and the other the high-pressure end of the turbine. The turbine is secured to the former, while the latter is provided with guides which permit the turbine to slide back and forth with differences of expansion caused by varying temperature, at the same time maintaining the alignment. This arrangement permits of the utilization of the entire space between the foundation piers and below the turbine, for the cond[illegible]ing apparatus.

The condensers for the steam turbines are of the jet type, each capable of giving the best service when its unit is operating at full rated load. Cycloidal air pumps, direct-connected to enclosed, self-oiling, high-speed engines, and duplex, double-acting circulating pumps are installed with this [illegible] condenser to take the [illegible] of the plant.

The speed of each turbine is regulated within [illegible] from the shaft through cut gears working in an oil bath. This [illegible] a balanced [illegible] for any possible accidental derangement of the main governing mechanism, there is an entirely separate safety or over-[illegible] gearing, and is so arranged that if the turbine should reach a predetermined speed above that for which the main governor is set, the safety governor will come into action and trip a valve, shutting off the steam and stopping the turbine.

The lubrication of the four bearings, two for the turbine and two for the generator, is effected by supplying an abundance of oil to the middle of each bearing by means of a small cycloidal pump driven from the turbine shaft, and allowing it to flow out at the ends. The oil is passed through a tubular cooler with water circulation, and pumped back to the bearings. The oil-cooling system is taken care of by two induction-motor-driven centrifugal pumps, and the gland water for the turbines is also supplied by two centrifugal pumps driven by direct-current motors, taking their power from the exciter circuits. No oil of any kind is used in the interior of the turbines, nor in the glands through which their shafts pass.

Between the turbine and its generator a special type of flexible coupling is used to provide for any slight inequality in the wear of the bearings, to permit axial adjustment of the turbine spindle, and to allow for differences in expansion. This coupling is so made that it can be readily disconnected for the removal of the turbine spindle or of the revolving field of the generator.

TURBINE-DRIVEN GENERATORS

The revolving-field alternators driven by these turbines are designed for high efficiency and safe operation at high peripheral speeds. The field core is built up of steel disks, each in one piece, giving high magnetic permeability and great strength. Coils are placed in radial slots, thereby avoiding side pressure on slot insulation and the complex stresses resulting from the centrifugal force, which, in these rotors, acts normal to the flat surface of the strip windings

The stator is completely enclosed, eliminating noise of operation. Coils were completely wound and insulated before being placed on the core, thus obviating the risk of defective ventilation. Stator windings are placed in open slots, rendering the coils readily removable.

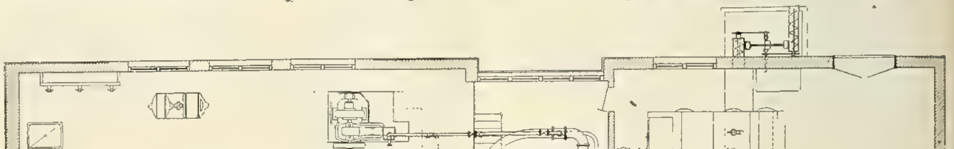
For the purpose of obtaining adequate ventilation and for muffling the noise produced by the circulation of air, the turbo-generators are enclosed in such a manner that the air is taken in at the sides through fans mounted on the rotor shaft which discharge it over the end connections of the armature coils into the bottom of the machine, whence it passes through the ventilating ducts of the core to an opening at the top.

Excitation of the two turbo-generators is accomplished by means of exciters of 35 kilowatts and 30 kilowatts, the former being driven by an induction motor and the latter by a steam engine. The engine-driven generating unit has a five-kilowatt belted exciter. Turbo-generator excitation at full load is 120 volts, 160 amperes. The exciters do not take care of the station lighting. Current for this is derived directly from the main bus-bars or from a storage battery.

STATION LOAD.

As above intimated, the character of the load put upon this station is railway, lighting and power combined. At present there is a normal consumption of current somewhat under the rated capacity of the turbines, so that one can be held constantly in reserve, and this drops to a minimum, during the early morning hours, of about 300 kilowatts.

A feature to be particularly commended is the thorough keeping of station records and the frequent checking of efficiencies of different parts of the plant. On the company's log sheet the daily load curve is plotted, thereby enabling it to be easily comprehended, for the 24 hours, at a glance. All costs and station performances are also recorded on the daily log. In addition to this, records are kept in the office of the outside distributing circuits, and two Wright demand meters are constantly used to check the loads on lighting and power transformers over the town.



PLAN OF POWER HOUSE OF KOKOMO, MARION AND WESTERN TRACTION COMPANY.

Alternating current is generated at two-phase, 2,300 volts, and transformed to three-phase, 11,000

volts for transmission over the line of the interurban railway. In the main station there are used for this purpose three 150-kilowatt, oil-filled, self-cooled transformers, Scott connected, and in the sub-station, 17 miles distant, there are three 150-kilowatt step-down transformers, delta-connected. These transformers have 1½-inch outlet pipes running directly through the floor, so that in case of fire oil can be emptied into barrels in the basement where the oil is stored.

Direct current for the city railway system and 10 miles of the interurban line is supplied through motor generator sets in the main station, delivering

ELECTRIC STREET LIGHTING IN KOKOMO, IND., SHOWING ARCHES.

power at an operating pressure of 600 volts; and the sub-station at Swayzee, 18 miles east of Kokomo, contains three rotary converters for the purpose of transforming the alternating to direct current. One of these, having a capacity of 200 kilowatts, is equipped with an induction starting motor, and two of 75 kilowatts each are started through a storage battery from the direct-current end.

DISTRIBUTION OF CURRENT.

Current from the main generator bus-bars passes to the outgoing lines through double-throw switches, ammeters, wattmeters and fuses, all such circuits being also put through integrating wattmeters. Cable of 300,000 circular mils area is used, with high-voltage rubber insulation. The wiring from the generators to the switchboard is open-work, fastened to the under side of the engine-room floor. The bus-bar system is in duplicate. Any machine or any feeder can be operated off of any set of buses. The switchboard rests on insulated stringers.

SWITCHBOARD.

Each of the panels for the turbo-generators has instruments mounted upon it as follows:

Two Westinghouse ammeters.
One Westinghouse power-factor indicator.
One Westinghouse voltmeter.
One Westinghouse indicating wattmeter.
One Westinghouse polyphase integrating wattmeter.
Two four-pole single-throw oil switches for main generator current.
One Cutler-Hammer rheostat located beneath the floor and driven by chain and sprocket.
One field knife switch with discharge rheostat, synchronizing plug and receptacle, and voltmeter plug and receptacle.

There is also a Westinghouse synchroscope on a swinging bracket at the end of the switchboard.

The exciter-switch panel for the turbine has—
Two direct-current Weston ammeters.
One direct-current Weston voltmeter.
Two Cutler-Hammer rheostats.
Two single-pole knife switches.
Four four-pole, double-throw Westinghouse oil switches.

The exciter panel for engine-driven unit consists of the following apparatus:
Two Stanley ammeters.
One Stanley voltmeter, so arranged as to switch it on to pressure tap showing voltage at center of distribution uptown.
Two double-pole knife switches.
Wirt rheostat.

[illegible]

One panel with Stanley instruments and switches controls four feeder circuits.

[illegible] Electric wattmeters.

One panel controls four street arc-light circuits on the Western Electric system.

The railway board consists of two panels, each controlling a 216-horsepower motor, and two panels [illegible] these motors in the power-plant sub-station. One panel contains the starting device and rheostat for these machines. There are also two feeder panels, one feeding the interurban line, and the other the city line. This railway board is equipped with Westinghouse apparatus, except for a few General Electric wattmeters and two Stanley phase indicators.

Two panels control a storage battery and a differential booster.

In the sub-station at Swayzee there is a switchboard consisting of nine panels—three alternating-current and three direct-current panels, for controlling the rotaries, one feeder panel and two storage-battery panels.

STORAGE BATTERIES.

In a separate building, located about 60 feet from the main generating station, is a battery installation supplied by the Electric Storage Battery Company, which has a capacity of 480 ampere-hours and consists of 288 Chloride accumulator cells. A smaller storage battery, consisting of the same number of cells, but having a capacity of 320 ampere-hours, is installed in the sub-station at Swayzee. The latter has glass cells and the former are of wood, with lead lining. The function of these batteries is to eliminate load fluctuations on the rotaries, so that their output will be constant. Regulating boosters are installed in conjunction with each battery, of such design as to automatically regulate the charge and discharge of the battery, causing it to discharge when the load is in excess of the average and charge at times when the load is less than the average.

OUTGOING LINES.

Alternating current passes from the switchboard bus-bars through the transformers, as above mentioned, and stick breakers are provided between the high-tension sides of the transformers and the outgoing lines, which are led through high-voltage bushings protected by round glass plates set in tile.

The lines are equipped with Westinghouse low-equivalent arresters and Westinghouse choke coils, to which ready access is had from the gallery. The lighting feeders have General Electric lightning arresters and choke coils manufactured at the station. On the direct-current railway system Garton lightning arresters are used, there being four of these to every mile.

EQUIPMENT OF RAILWAY SYSTEM.

The line of the interurban road is built with [illegible] entirely by the company. Seventy-pound A. S. C. E. [illegible] tracks. Rails are cross-bonded every half mile with No. 0000 copper wire.

[illegible] placed along 10 miles of the interurban system, chestnut poles on the remaining 18 miles and cedar [illegible] 500,000-circular-mil copper, feeding onto the interurban [illegible] feeder from the sub-station is stranded aluminum equivalent to 300,000-circular-mil copper. Spans are 100 feet in length.

[illegible]

The interurban cars operated on the road at an [illegible] equipped with four 50-horsepower motors, K-28 controllers and straight-air-brake equipments. There are six passenger cars of this type, with one freight car and one work car. Cars are run on one-hour headway, only three being ordinarily in service at the same time.

Direct telephone connection can be opened at any time between the cars and the train dispatcher's office by a pole-and-hook connection.

The city cars are 22 in number, each having two 40-horsepower motors and K-10 controller. Some of them are equipped with air brakes.

POWER-STATION BUILDING.

Everything connected with the physical equipment of the system has been very carefully looked after, and one of the best evidences of this is the power house itself, which is a well-planned, well-built fire-proof structure. All of the interior surfaces in the engine room which are not enameled are faced with Kokomo pressed sand brick of buff color and the remaining brickwork is of the ordinary kiln-run quality. Tile roofing covers the entire building.

The floors are of concrete, with smooth surface, the engine-room floor being supported on steel

BRIDGE WHERE KOKOMO-MARION ELECTRIC RAILWAY CROSSES STEAM RAILROAD.

beams, and under each of the turbine units there is an independent concrete foundation to a depth of 13 feet 6 inches, foundations for the exciters, condensers and other auxiliaries being correspondingly strong.

The steel trestle from which the coal cars are unloaded is 280 feet long, 140 feet of which is on the company's property. The steel work is built upon a concrete foundation, and the frame is most substantially constructed.

LIGHTING SYSTEM.

As previously intimated, the lighting system of the company has developed very rapidly. One feeder now goes out from the power station to the North Kokomo distribution system and another supplies South Kokomo, each being fed from a 2,200-volt, two-phase primary circuit; and, in addition, there are four series alternating-current arc circuits of 50 lights each, fed from transformers at 4,000 volts.

The towns of Swayzee and Greentown are both furnished with lighting current taken through transformers from the high-tension lines and stepped down to 220 volts.

Industrial Service.

A stone quarry, which was originally owned and operated by the company, in order to provide crushed rock for ballast, but has since passed into the possession of others, is located on the line of the interurban railway; and the larger part of the product of the plant—about 300 cubic yards per day—is transported by the company to the steam roads and out into various parts of the state for use in improving town and country roads. All of the machinery of this quarry used in crushing, elevating, etc., as well as of another quarry having similar capacity, is operated by motors run on alternating current taken from the power circuits.

Among other important customers taking power for motors are a brass works and spark-coil factory, two machine shops, a large flour mill, an automobile manufactory, bottling works, leather and harness establishment, glass factory, canners, planing mill, cooperage plant, mitten works, lumber yards, and nearly all of the smaller factories and shops in Kokomo, representing no less than 84 distinct industries. The use of small single motors and groups of two or three operated for various purposes is also growing throughout the city, so that electric drive has become one of the recognized features of the town.

To accomplish this result, which has been brought about within comparatively recent time, Mr. T. C. McReynolds, secretary-treasurer and manager, and Mr. Palmer, the company's engineer and lighting superintendent, have made a systematic study of local power requirements, and are prepared to give each prospective customer a detailed statement as to just what improvements can be effected in his particular case by the substitution of motor drives in place of power applied through shafting, belting, etc.

Furthermore, the central-station company is ready at all times to back up its assertions by satisfactory guarantees and to submit complete engineering plans involved by the proposed change. It is indeed a stubborn proprietor or manager who, seeing certain advantages of electrical operation set forth in black and white and guaranteed by a responsible concern, is not willing to listen to such overtures as the central-station people in this city are ready to make.

Household Lighting and Utilities.

The company's campaign has, however, not stopped at factories, shops, stores or industrial establishments, but has been carried into the homes of the city. Electric lighting is now become general, and more than one-half of the company's customers have electrical apparatus of one kind or other, including laundry irons, heaters and cooking utensils. If progress made along this line during the next few years is at all commensurate with present indications, it will mean a great increase in business, and the probability is that more will be done in this direction than the most sanguine would believe, for the results of such work multiply almost in geometric ratio.

Organization and Prospects.

Mr. G. J. Marott, who lives in Indianapolis, is president of the company; Mr. T. C. McReynolds is secretary, treasurer and manager; Mr. P. H. Palmer is engineer, and Mr. Matzoff superintendent of transportation. To each of these officials must be given credit for far more than the average enterprise and foresight, while all actively concerned in the operation of the system are to be praised for intelligent and earnest work.

Control of Motors by a "Practical Traveling Ground."

In response to a request for information in relation to what the newspaper describe as a "wire-less" system of control of electric motors, referred to in the Western Electrician of April 25th last, page 329, under the heading "Interesting if True," Dr. Frederick H. Millener writes from Omaha on April 26th as follows:

"[illegible] I have been experimenting under the supervision of Mr. W. R. McKeen, superintendent of motive power and machinery, Union Pacific Railroad, on a system of remote control, [illegible] a practical device whereby it is possible to have a selective control, and thus be able to cause a machine to move forward, reverse, stop, or run at different speeds, no matter what the motive power of the machine [illegible] car, either for the purpose of communication or [illegible] ground."

Distillation of Turpentine by Electricity.[1]

By F. T. Snyder.

Pine woods contain a series of volatile hydrocarbons having boiling points varying from 130° C. to 250° C. A mixture of these, including the groups which boil between 155° C. and 170° C., forms what is commercially known as turpentine. The principal constituent of this turpentine is pinene, with a boiling point of 155° to 156° C.

The process of obtaining turpentine from wood by distillation is an extractive one, in that the turpentine exists in the wood substantially in the form in which it is obtained, and is not a product of decomposition at the time of extraction. At 175° C., the pinene of the turpentine begins to break up into a mixture of lighter and heavier hydro-carbons, the decomposition being substantially complete at 270° C. It is therefore necessary to distill turpentine within relatively narrow temperature limits. If the wood from which the turpentine is distilled is not heated enough, part of the turpentine will be left in the wood. If it is heated too hot, part of the turpentine produced will be destroyed. Many of the products formed in breaking up turpentine have strong odors, and a small percentage materially affects the selling price of the turpentine produced, as the smell nauseates the painter using the turpentine. It requires a certain drop of temperature to cause the heat needed to flow from the exterior to the center of a turpentine retort, and this further reduces the narrow range of temperature available.

It has been known for many years that the fir wood of the North Pacific Coast contains a considerable quantity of turpentine, and efforts had been made to utilize it as a basis for the commercial production of turpentine. The principal difficulties encountered were those inherent in the close regulation of temperature necessary. Some years ago the obvious possibility of close temperature regulation obtainable with heat from electricity suggested the use of heat from electricity in the distillation of turpentine from this fir wood. At Vancouver, British Columbia, a considerable supply of waste fir wood was available, in the form of saw-mill refuse, and electricity from waterpower was available at a low cost. An experimental electric turpentine plant, with a capacity of one-sixteenth of a cord, was erected and tested, and subsequently reported upon by Dr. T. H. Bray of the Massachusetts Institute of Technology. As a result of Dr. Bray's report, a commercial plant, with a capacity of three cords per day, was erected, and has been in operation at Vancouver since July, 1907.

The wood supply for this plant is brought in by barge, from neighboring saw-mills, and landed at a dock adjoining the plant. On this dock the wood is filled into cans, which are wheeled into the plant, picked up by an overhead crane (Fig. 1), and dropped into a brick retort, forming one of a group which are placed together to reduce radiation. The top of the can forms a flange, which dips into a groove around the top of the retort, filled with tar, forming a gas seal when the can is in the retort. Electricity at 110 volts is carried through wrought-iron strips threaded through the brickwork on each side of each retort. The current supply for each retort is controlled by a switchboard of ordinary type, which also holds the direct-reading pyrometers, one of which registers the temperature at the outside of the can and one the temperature at the center of the can, showing the maximum and minimum temperature conditions in the can. The leads of these pyrometers end in flexible extensions on the top of the retorts which can be changed from can to can (Fig. 2).

The turpentine vapor is taken from the retort through a removable copper outlet pipe. This outlet pipe leads to a condenser (Fig. 3), which consists of an upright copper pipe, down which a spray of water is passed through the ascending turpentine vapor, and which terminates in a tank at the bottom. The tank serves as a separator for the condensed turpentine and water, the turpentine readily floating to the top of the water. The excess water from the spray is withdrawn from the bottom of the tank, and the turpentine taken off from the top of the tank into a storage system.

The brickwork of the retort, when a can newly filled with wood is put in it, is about 250° C. The cold can rapidly absorbs heat from this brickwork, the temperature of the brickwork being kept up by a current of 400 amperes, which is put through the resistance strips for about two hours. During this time the temperature at the outside of the can rises from 75° to 130° C., at which turpentine begins to come off, and at which time the center of the can is at 45° C. The current is then shut off, and the temperature of the can slowly rises by absorption of heat from the brickwork for two hours longer, when the temperature has reached 150° C. on the outside of the can and 205° C. in the center of the can, and the turpentine has been substantially all removed. In practice, it is found that from 90 to 95 per cent. of the turpentine in the wood, as determined by analysis, is removed during this interval. While the turpentine is coming off, the pitch in the wood melts and runs down to the bottom of the can and out through perforations, and is collected in the bottom of the retort, from which it is drawn off, at the end of the run, into the barrels in which it is shipped.

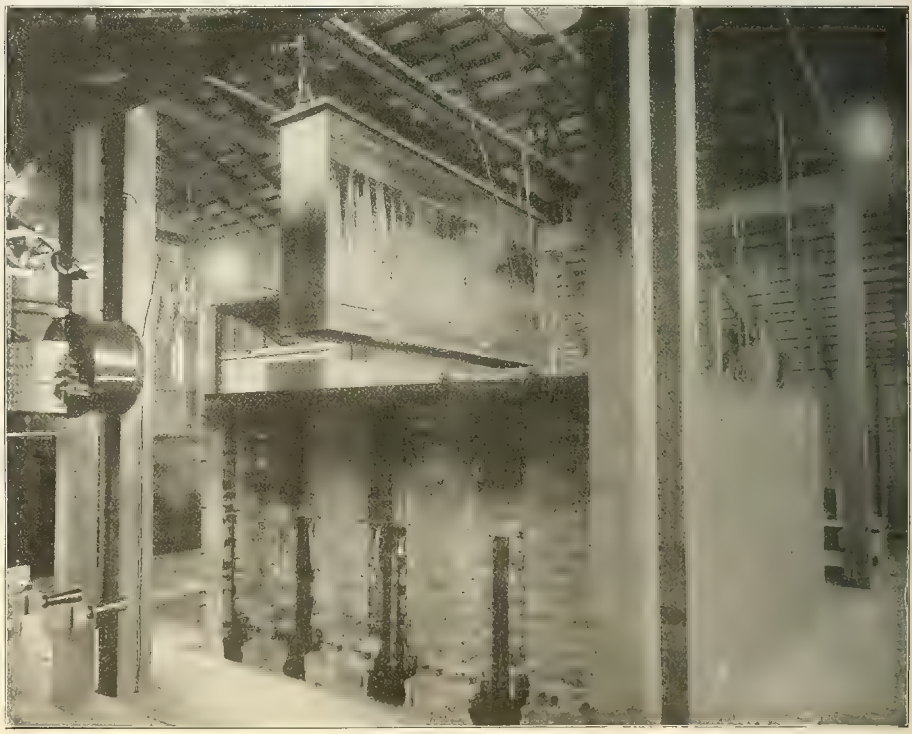


FIG. 1. DISTILLATION OF TURPENTINE BY ELECTRICITY.—RECEPTACLE CONTAINING WOOD BEING PLACED INTO RETORT.

It will be noted that the temperature of the interior of the can at the end of the turpentine run is hotter than the outside. This is due to the heat which is beginning to be liberated by the decomposition of the hydro-carbons in the wood. At this point the can is lifted by the overhead crane from the turpentine retort and put into the adjoining retort, a new can of raw wood taking its place in the turpentine retort. In its new position the original can of wood, from which the turpentine has been extracted, is connected up by another copper outlet pipe to the adjacent condenser. This change of retort and piping keeps the turpentine condenser and piping from being fouled by tar oil or tar products.

Due to the continued decomposition of the wood, the temperature steadily rises without further use of electricity, and the resulting decomposition gives a product known commercially as "tar oil" and which comes off as vapor and is condensed. The other product of this decomposition is wood tar,

[1] A paper read at the [illegible] meeting of the American [illegible] Society at Albany, N. Y., April [illegible]

which trickle down as the rosin did in the turpentine retort, and is collected in the bottom of the tar retort. It is found in practice that the tar tends to break up at the final temperature of the tar retort, and it is consequently drawn off continuously, during the tar run, into the barrels in which it is to be shipped.

At the end of three hours of the tar run, the temperature in the center of the can has risen to 375° C., and tar oil and tar stop coming off. The can is then lifted out and stood on a sand floor, which makes an air seal with the lower edges of the can and protects from combustion the contents of the can, which now consists of charcoal. When the can and its charcoal contents are cool, which

Fig. 2. View Showing Cans in Retort. Turpentine Vapor Passes Off through Outlet Pipes Shown.

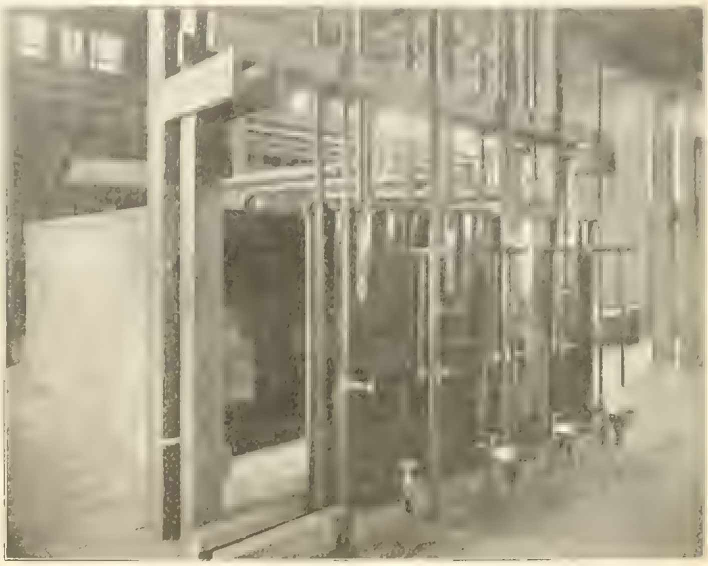


Fig. [illegible] View Showing Turpentine Condensers [illegible] Receptacles in Retort.

DISTILLATION OF TURPENTINE BY ELECTRICITY.

takes about three hours, the perforated bottom of the can is tripped and the can lifted, allowing the charcoal to fall out. This charcoal is then put in sacks, as required by the trade which consumes it.

Five products are produced from the wood—turpentine and rosin in the turpentine retort, tar oil and tar in the tar retort, and a residual product of charcoal. The amount and kinds of product derived from any supply of wood depend on the character of the wood. The following will indicate the results which are being secured from the British Columbia coast fir per 1,000 pounds of wood.

Turpentine	6.7	gallons
Rosin	168	pounds
Tar oil	5.1	gallons
Tar	68	pounds
Charcoal	323	pounds

It may be noted that this charcoal, being retort charcoal and cooled out of contact with air, is tough and suitable for special purposes. The amount of wood held by a can varies with the quality of the wood, but averages at Vancouver about 1,000 pounds. The electricity used per can is about 90 kilowatt-hours, and costs, at Vancouver, 18 cents per can of wood.

The plant is operated by one man on each shift, there being two 12-hour shifts per day. When the wood is large, an extra man is employed on the day shift to split it.

Recent Experiments with the Gyroscope in the United States.

By Montravill M. Wood.

No mechanical or scientific device offers more fascinating opportunity for study than the gyroscope, and public interest in the phenomena of forces exhibited by this study is particularly keen at the present time, due, no doubt, to British investigations, particularly those of Mr. Brennan, on the double-gyroscope monorail car.

Some four years ago the writer brought out as a scientific experiment a mahogany ball about six inches in diameter containing a gyroscope peculiarly poised. This ball would travel along a single track or suspended cable and remain balanced as long as the gyroscope mounted within was kept in motion.

In order to convert this piece of mechanism into the working parts of a monorail car it was only necessary to attach two wheels in tandem to the ball and adjust the gimbal of the gyroscope so that it was free to swing in any direction. When this was done a new principle was discovered—that of balancing a car on a single track with the use of only one gyroscope.

It is immaterial in which direction the car or gyroscope runs while the car is traveling in a straight line. But if the car is to turn a curve either to the right or left, the single "gyro" must revolve in opposite direction to that of the car. [illegible] chronism.

In order to thoroughly understand just why a [illegible] attached, perhaps a few remarks regarding its laws may not be out of place.

According to a familiar law of physics, any body once set spinning persists with all its power in revolving in one plane. Tops, hoops and all spinning wheels have made this law familiar to all. The gyroscope is smpiy a metal wheel poised within a gimbal. [illegible] tury ago, being most commonly used to illustrate the rotation of the earth around the sun. It is commonly sold as a toy. When mounted in a car two metal rings or gimbals are so placed that the wheel is free to turn in any direction while spinning.

To balance a ball and cause it to travel on a cord it is only necessary to cut a groove around the center of the ball in a plane with the gyro mounted inside. Now while the gyro is turning at a high rate of speed it has a tendency to remain in the plane in which it is turning unless some part of the gimbal or frame comes in contact with some other object; therefore if the groove in the ball is of considerable depth the ball will be held in the same plane as the cord on which it is traveling; but should the ball remain still it has a tend-

MR. WOOD AND HIS GYROSCOPES.

ency to twist itself around on the cord, and that, in turn, brings down either one end or the other of the shaft of the gyro, depending on the direction of rotation. As the gyro cannot swing in the ball, it cannot right itself; but if the gyro is mounted in a manner that allows it to swing it will then turn to the opposite side to which the ball is tipping, and when the shaft comes in contact with the side of the ball the frictional contact tends to roll the gyro around, shifting it to another plane, bringing the ball up to its original position.

When a single gyro is mounted in a car with both ends of its axis free to work upon a projecting segment attached to the side of the car, the projections not being in contact with the shaft until the car attempts to tip in either direction, there is established an almost human balancing device.

Many articles have been written on the law of [illegible] gyro has a tendency to right itself. Now the true [illegible] gimbal to turn in opposite direction to what it would turn were it free to act according to the law [illegible] will of course instantly shift the weight to the up- [illegible] force to hammer this side down than the weight [illegible] energy in the revolving disk or wheel

Imagine what a sensitive steering device this would make if applied to an automobile if the "auto" was constructed with two wheels in tandem. It is the writer's intention to make the first full-size practical demonstration with a gyro-auto car, and it will not be long before one will see autos running along like motor-cycles and coming to a stop without tilting to one side or the other.

Imagine what great speed could be maintained and how easily one could round a curve with a car so constructed. The writer's first car of this type will be equipped with steel flanges so as to run on one rail of existing steam or electric railways.

It would not be surprising to see a unicycle car

MODEL OF THE WOOD GYROS [illegible] RAIL CAR

for one passenger, the wheel being, say, seven feet in diameter and the rider placed inside of this wheel mounted on the shaft, steering his single-wheel car with a gyro running around him in opposite direction to that of the outer wheeel.

It is doubtless true that the monorail system will soon come to stay, but it will be used for express and mail before attempting to run passenger coaches, not on account of real danger but on account of the fear people will have while this system is new.

The writer has exhibited several types of cars to a few scientific people, and one of these cars was run on a cable placed in the office of the Western Electrician. The illustrations show experimental types equipped according to the writer's latest inventions.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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[illegible] of the [illegible] service of the [illegible] is demanded by residents [illegible] and other outlying districts on the South Side of Chicago which are served, or partially served, by this means of transportation. In Woodlawn a Business Men's Association, composed principally of Sixty-third Street merchants, has been formed recently, and it is not unlikely that one of its first acts will be to plead with the railroad company to abolish the smoke, cinder and noise nuisance of the steam locomotives of the Illinois Central Railroad within the city limits. Sooner or later the company will be compelled to heed these remonstrances. If it is wise, it will do so before the tide of resentment grows to an overwhelming flood.

MR. KNUDSEN, Denmark's versatile inventor, is reported to have declared in London a few days ago that he has invented a device by which linotype machines can be operated at a distance by Hertzian waves. He is said to have declared that "the time is not far distant when, with my invention, the London correspondents of the New York newspapers will be able to send their news straight to the printing press through the Marconi operator." Furthermore, the inventor asserts that he can send pictures also by "wireless," and a "special cable" to the New York Times is authority for the statement that on April 28th, at the Hotel Cecil in London, Knudsen transmitted recognizable pictures through a wall from one room to another without wires.

These be wonders indeed. But as radio-telegraphy itself is still rather erratic for long distances, and is displacing wires and cables very slowly, if at all, it will be well to await further developments before becoming overenthusiastic. The New York Times itself, which is the most "wirelessly" inclined of any newspaper on this side of the Atlantic, can hardly see the benefit of electric-wave linotype operation, even if perfected. It remarks, truthfully enough, that practically all newspaper "copy" has to be "edited" to some extent, and most of it to a large extent, before it can be used, and this work can best be done in the manuscript. Matter in type can, indeed, be corrected and revised to some extent, but it is difficult and expensive work that usually has to be done at an hour when time is most precious, and real editing can hardly be attempted then except for very serious reasons.

But if—there's certainly an if to it—the Danish inventor can operate linotype machines by "wireless," he can probably drive other machines as well, and that would be something worth while.

ONE OF MR. YERKES' legacies to Chicago was the Union Loop by the joint use of which the four elevated railways of Chicago enter and leave the central business district. For some time the capacity of this elevated loop structure, as at present operated, has been overtaxed by the growth of traffic. To get at least a temporary solution of the problem, the city recently employed Mr. George Weston, one of the Board of Supervising Engineers, to make a thorough investigation of the conditions, with recommendations looking toward relief from the congestion. Mr. Weston has completed his task, and has made a long report recommending through routing of trains, extension of station platforms and their rearrangement, universal transfers, and the development of stub terminals. These changes, he says, would add 43 per cent. at once to the capacity of the Loop.

Entering into the problem, also, is the question of consolidating the four companies under one ownership or management. Such a condition would unify the system and aid matters greatly. Several unsuccessful efforts have been made to effect consolidation, but it is now reported that a new project of this kind is under consideration, and this may result in something tangible.

In connection with the Loop stations the Loop Protective Association, through its engineer, Mr. C. K. Mohler, has worked out a plan for prismatic glass stairways, platforms and canopies as a means of offering less obstruction to light by the elevated stations than is the case at present.

Of greater interest is the fact that the impending subway problem has been taken up in earnest by the city government. Chicago needs subways as well as elevated and surface railways. The surface-railway tangle has been happily solved, and work on the rehabilitation is proceeding steadily. The elevated-railway service must be greatly improved, while the underground lines in the downtown district remain to be planned and built.

IRELAND has extensive tracts of peat bog, as everybody knows. The interesting proposal is made to utilize the large area of red bog in the center of that country, stretching east from the River Shannon, as fuel to produce electrical energy. The peat, twenty to thirty feet deep, varies in character from the moss of the surface to the lignite of the deepest strata. From this source of fuel it is calculated there are sufficient supplies adjacent to the proposed 12,000-kilowatt power house to generate electricity in the largest quantity likely to be needed for three hundred years. It is proposed to burn the peat in a gas producer, and drive gas engines coupled to electric generators of about 500 horsepower each. Part of the plan is to utilize ammonium sulphate and other by-products, "so that, quite apart from the supply of electrical energy, there would be a profit upon the transactions as regards the treatment of the peat alone." But a hard-headed committee of Parliament insisted that the capital should be forthcoming before the bill was passed—"an obviously impossible feat," as the chronicler tells us.

THE THIRTY-FIRST convention of the National Electric Light Association will be held in Chicago this year, at the Auditorium Hotel, and it promises to be a gathering of large size and great usefulness. The tentative programme was published in the Western Electrician of April 25th. The dates are from May 18th to May 22d, inclusive, and we wish to call the especial attention of our readers to the meeting while there is time to make good hotel reservations. Chicago is a large city, with many hotels, it is true; but this convention will be a very large one, probably a record-breaker for the electric-light industry. It is to be remembered, also, that Chicago has a large transient or hotel population. Therefore, while all who come, even at the last hour, will be provided with accommodations, it is very desirable that hotel reservations should be made well in advance so that desirable locations may be secured in the hotels nearest the meeting place. There is time now, if the matter is promptly attended to. Don't put it off, and then grumble because only less desirable accommodations are at the disposal of the hotel committee. This is emphatically a "do-it-now" proposition. If you expect to attend the convention—as all readers of the Western Electrician are urged to do—be sure to arrange with the hotel committee for reservations.

Elaborate preparations are under way for the convention—not alone in the programme of papers and discussions, but also for the exhibition and for the plan of entertainment. The very first feature on the programme is one of the most important of all. That is the reception to be held on Monday evening, May 18th, at the beautiful new banquet room in the Auditorium Annex. After the reception there will be dancing and a supper. One of the great advantages of the electric-light conventions is the opportunity for personal contact—the meeting with other men wrestling with the same problems and the chance to talk things over with them familiarly and face to face. It is still more pleasant to meet the ladies attending the convention. The Chicago convention has been particularly planned to give ample opportunity for these heart-to-heart talks, and at the very beginning is the reception of Monday night. Here everybody is expected to meet everybody, renewing old acquaintances and making new ones. The reception paves the way for all the subsequent events of convention week. Everybody attending the meeting should make it a point to arrive on or before Monday and to take part in the reception without fail. This will be making a proper start, add to the feeling of good fellowship and lend emphasis to the most important feature of the association's work—personal help to each member.

On another page will be found some interesting information in relation to the preparations for the convention.

Metallic-filament Lamp Discussion in London.

The discussion of the effect of metallic-filament lamps on the electric supply industry, writes the London correspondent of the Western Electrician under date of April 24th, was concluded at the Institution of Electrical Engineers last night. Generally speaking, it cannot be said that the debate reached a very high level, and opinions were sharply divided between those who thought the advent of this new lamp would be a blessing and those who thought the opposite, unless a new method of charging were introduced, which, incidentally, meant increasing the price to the consumer.

The general condemnation of the maximum-demand system of charging showed that this method is now being rapidly discarded all over the country, not because it was scientifically incorrect but because commercially it was impossible to bring it within the understanding of the average consumer.

One point of interest may be mentioned. Mr. W. M. Mordey, who is the president-elect of the Institution for the coming year, objected to the use of the term "metallic-filament" lamp and urged the expression "wire lamp" as being the more correct.

One speaker suggested a way out of the keen competition between gas and electricity in the shape of a compromise that one should do all the lighting and the other all the heating and power. The suggestion was hardly taken seriously; it certainly would not be by the gas interests.

Electrical Exports for March.

Electrical exports from the United States for the month of March, 1908, amounted to a total valuation of \$1,135,178, compared with \$1,510,824 for March, 1907. Both classes of goods, electrical appliances and electrical machinery, show a decline in the amount exported, as shown by the following figures: Electrical appliances—March, 1908, \$444,542; March, 1907, \$590,000. Electrical machinery—March, 1908, \$690,636; March, 1907, \$910,825.

The following-named countries were the principal destinations for electrical exports from the United States during March:

Electrical appliances—British North America, \$106,005; Brazil, \$86,881; United Kingdom, \$52,251; Mexico, \$33,359; Cuba, \$24,337; British Australasia, \$21,317; Japan, \$10,025; Argentina, \$19,147; Philippine Islands, \$14,277; Germany, \$9,265; France, \$7,078; Belgium, \$5,191; Central American States and British Honduras, \$4,748; British Africa, \$3,042.

Electrical machinery—Japan, \$105,225; Brazil, \$107,761; Mexico, \$76,465; France, \$53,649; United Kingdom, \$37,347; British Africa, \$36,039; British North America, \$32,840; Philippine Islands, \$20,644; Central American States and British Honduras, \$15,200; Chinese Empire, \$14,103; Argentina, \$12,227; British Australasia, \$12,064; British Indies, \$8,967; Cuba, \$7,453; Germany, \$7,026; Hongkong, \$1,430.

Technical Publicity Association.

The Technical Publicity Association, at its annual meeting on April 30th, elected the following-named officers: President, C. S. Redfield, advertising manager, Yale & Towne Manufacturing Company, New York; first vice-president, Rodman Gilder, publicity manager, Crocker-Wheeler Company, Ampere, N. J.; second vice-president, C. N. Manfred, manager advertising department, H. W. Johns-Manville Company, New York; secretary, H. H. Kress, publicity department, A. S. Cameron Steam Pump Works, New York; treasurer, H. M. Davis, advertising manager, Sprague Electric Company, New York; executive committee, F. H. Gale, in charge of advertising, General Electric Company, Schenectady, N. Y., and C. W. Beaver, special representative, Yale & Towne Manufacturing Company, New York. Twenty new members have joined the association since the last annual meeting.

La Salle Hotel Isolated Plant.

A large isolated plant for supplying electric light and power will be installed in the new 22-story La Salle Hotel, to be erected at the corner of Madison and La Salle streets, Chicago. The plant is to consist of three 350-kilowatt generators and one 200-kilowatt generator, direct-connected to four-valve steam engines. There will be a 15-panel switchboard and wiring for a total of 20,000 incandescent lamps. The Arthur Frantzen Company of Chicago has the contract to supply the complete electrical equipment.

The Coming Electric-light Convention in Chicago.

[illegible] indeed all electrical men who can possibly do so, [illegible] Chicago, chairman of the hotel committee. The hotel accommodations of Chicago are ample, of course, for all who come, but desirable locations in the hotels nearest the convention hall are going rapidly, and those who apply late will naturally get less desirable quarters. Hotel reservations should be made at once.

The advance programme of papers and discussions has already appeared in the Western Electrician. The revised programme will appear next week.

An excellent and carefully thought-out programme of entertainments has been arranged, and particular attention is paid to the welfare of the ladies, who will be warmly welcomed.

The first feature of the convention will be the opening of the exhibition of electrical appliances at the Auditorium on Monday evening, April 18th. This exhibition will undoubtedly be the finest and most handsomely arranged display ever seen at an electrical convention. Following the opening on Monday evening there will be an elaborate reception in the gold banquet room of the Auditorium Annex, followed by dancing. Music will be furnished by John Hand's orchestra of 14 pieces. Following are the names of the members of the reception committee, of which Mr. Samuel Insull is chairman:

Mr. Bion J. Arnold, Mr. and Mrs. Godfrey H. Atkin, Mr. and Mrs. Frank J. Baker, Mr. and Mrs. Enos M. Barton, Mr. and Mrs. Louis A. Ferguson, Mr. and Mrs. William A. Fox, Mr. and Mrs. Truman P. Gaylord, Mr. and Mrs. J. Henry Goehst, Mr. Walter S. Goll, Mr. and Mrs. Charles E. Gregory, Mr. and Mrs. H. Rae Hixson, Mr. and Mrs. Robert C. P. Holmes, Mr. and Mrs. Fred W. Insull, Mr. and Mrs. Samuel Insull, Mr. and Mrs. James W. Johnson, Mr. and Mrs. William E. Keily, Mr. and Mrs. Edward B. Kittle, Mr. and Mrs. Edward W. Lloyd, Mr. and Mrs. Willard W. Low, Mr. and Mrs. Ayres D. Lundy, Mr. and Mrs. Homer E. Niesz, Mr. and Mrs. Frank L. Perry, Mr. and Mrs. Frederick Sargent, Mr. and Mrs. Thomas I. Stacey, Mr. and Mrs. Bernard E. Sunny, Mr. and Mrs. Walter H. Whiteside, Mr. James R. Wiley, Mr. James Wolff.

There will be convention sessions on Tuesday morning and afternoon. On Tuesday afternoon the ladies will attend an illustrated lecture at 3 p. m. on "The Philosophy of the Cartoon," by Mr. John T. McCutcheon, the celebrated cartoonist. Mr. McCutcheon will draw pictures as well as talk, and he does both well. This lecture will be given in Fullerton Hall of the Art Institute, and afterward the visitors will inspect the various galleries in the Institute. Five o'clock tea will be served in the Rembrandt room.

On Tuesday evening both ladies and gentlemen will be the guests of the association at White City, one of Chicago's best-known amusement parks, where a lavish use is made of electric lights. Special trains will leave the old Congress Street station of the South Side elevated railroad at 8 to 8:15 p. m., and coupon tickets will be furnished which will admit the holders not only to the grounds but to the various shows inside without cost.

On Wednesday there will be morning and evening sessions of the convention. In the morning the ladies will assemble in the third-floor waiting room of Marshall Field & Co.'s retail store for a tour of inspection of that great establishment. The store is within walking distance of the Auditorium, but those who desire may take street cars at the Wabash Avenue side of the hotel which pass the Wabash Avenue entrance of Marshall Field's. Guides will be provided at the store, and after the inspection the ladies will be entertained at luncheon in the South Grill in the establishment, a large dining hall handsomely decorated in the Elizabethan style.

The feature of Wednesday afternoon is a visit to the Fisk Street power station of the Commonwealth Edison Company. This is the first and largest steam-turbine electric power house in the country. Its 10 steam-turbine units have a maximum capacity of delivering 150,000 horsepower in electrical energy. Here refreshments will be served in a large tent on the grounds west of the switch-house.

Morning and afternoon convention sessions will be held on Thursday. At 11 a. m. the ladies will leave in automobile touring cars for a visit to the South Shore Country Club, south of Jackson Park and facing Lake Michigan. This is a new and attractive club, with building in the Spanish style. In the grounds there is a nine-hole golf course, as well as tennis courts, croquet grounds and facilities for other outdoor amusements. All the privileges of the club will be extended to the visitors. An elaborate luncheon, supervised by the club's chef, will be served at half-past twelve. [illegible] are near the Auditorium. Indeed the Studebaker [illegible] Boulevard, near Michigan Avenue.

The entertainment programme which is outlined above was planned after careful consideration of many suggestions by the entertainment committee, [illegible] James W. Johnson, Ernest A. Edkins, Oliver R. Hogue, John J. Schayer and William H. Ott. The arrangement is excellent not only in the high class of the various events themselves, but from the fact that the programme is not overcrowded; there is time for rest and various private social engagements in between.

Arrangements have been made whereby the directors of the Glenview Golf Club have extended the privileges of the club to the golfing members of the association. Those desiring to play may obtain cards from Mr. Ferguson.

Those expecting to attend the convention are requested to register in advance. Address Miss Edith M. Myers, 55 Duane Street, New York city. The color scheme of the exhibition will be dark green and white containing a tinge of green. The lettering of signs will be in gold or aluminum. Walter Neumuller, 55 Duane Street, New York city, is secretary of the exhibition committtee, of which F. H. Gale of Schenectady is chairman.

Thursday, May 21st, is Commercial Day. It is said that "\$1,000,000 worth of ideas will be given away" on that day. In the aggregate and cumulative effect this may be no exaggeration. At the Council of Progress at Friday's overflow session several men of national repute, including Elbert Hubbard of the Philistine, will give short talks on commercial subjects. C. W. Lee of New York is chairman of the Commercial Day committee.

A special train will leave New York for Chicago via the Pennsylvania Railroad (foot of West Twenty-third Street) at 9:55 a. m. on Sunday, May 17th, arriving in Philadelphia at noon, Pittsburg at 7:30 p. m. and Chicago at 8:30 a. m., May 18th. George F. Porter, 29 West Thirty-ninth Street, New York city, is master of transportation.

A Michigan Avenue Show Room for Commonwealth Edison Company.

The Commonwealth Edison Company of Chicago has secured the corner stores on the ground floor of the Railway Exchange Building at the corner of Michigan and Jackson boulevards for a display room. The space will be used to exhibit all kinds of current-consuming devices and will be handsomely fitted up with artistic fixtures and the latest electrical appliances. As all Chicagoans know, it is at this corner that the North and South boulevard systems are connected with the West Side boulevards and parks. Probably more automobiles pass this point than any other in Chicago. The location is therefore a particularly choice one to display objects appealing to persons of taste, refinement and wealth, and the fact is attested by the number of high-class shops in the vicinity. The central-station company will endeavor to make its permanent display so beautiful, modern and interesting that it will be one of the show places of the city. The exhibit will probably not be thrown open for two months, for the designs for it have yet to be made.

Low Lighting Rates for La Fayette, Ind.

The city of La Fayette, Ind., has just closed a contract with the Merchants' Electric Light Association for lighting the streets, alleys and public buildings for a period of 10 years. For the last 20 years the city has been paying \$66 per lamp-year for 2,200 hours of lighting, with 6.6-ampere, direct-current, open arc lamps. Under the new contract, which goes into effect September 1, 1908, the company will furnish and light 300 metallic flame arc lamps 2,500 hours for \$37.98 per lamp per year, and extra lighting at one cent per lamp per hour. This will amount to a saving of about \$100,000 to the city in 10 years.

The engineering work, preparation of specifications and contracts, has been done by J. Walter Esterline, consulting engineer. After tests made at the photometric laboratories at Purdue University the Westinghouse four-ampere, metallic flame arc lamp has been selected by the Board of Works.

AMERICAN ELECTROCHEMICAL SOCIETY.

General Meeting in Albany, N. Y., April 30-May 2.

The American Electrochemical Society held its thirteenth general meeting on April 30th, May 1st and 2d, the headquarters being at the Hotel Ten Eyck in Albany. The sessions on the different days were held in Albany, Schenectady and Troy, respectively. Visits to industrial plants were made on the afternoons of May 1st and 2d, and an informal dinner was held at the Ten Eyck after the return from Schenectady on May 1st.

The attendance at the meeting was less than at the New York meeting of last October, there being 135 members and guests who registered.

At a business meeting held on Thursday afternoon, April 30th, it was announced that the next semi-annual session would be held about the middle of next October in New York city. The results of the election of officers for the ensuing year were announced, Mr. Edward G. Acheson of Niagara Falls being the president-elect. Prof. J. W. Richards of Lehigh was re-elected secretary.

A committee on electrical standards was appointed to co-operate with committees from the American Institute of Electrical Engineers, the American Physical Society and with the National Bureau of Standards in the work of fixing standard units.

Measurement of Resistances.

The session for the discussion of papers began on Thursday morning with a contribution by Mr. Howard L. Bronson of McGill University, Montreal, upon a method for the accurate measurement of resistances of the order of 100,000 megohms. This is an interesting application of the ionizing power of radium, it being found that a constant-standard high resistance can be made by placing a little radium bromide in an enclosed vessel, thereby rendering the gas conducting. Details of the method of utilizing this vessel in connection with an electrostatic quadrant electrometer were given.

In the discussion it was stated that the nature of the gas apparently had no effect upon the constancy of the testing vessel.

Absorption of Radio-active Emanations.

The second paper presented was by R. W. Boyle of Montreal, who has been studying radio-active emanations and their absorption by charcoal. It was found that the radiations from thorium hydroxide are absorbed by charcoals, just as ordinary gases are, and that cocoanut charcoal has the greatest absorptive power of those tried. The charcoals are placed between the source of radiations and a cell in which the ionization and rate of ionization can be measured. It was also found that the finer the grains of charcoal, the greater is the absorptive power, and that hot charcoal absorbs much less than cold charcoal.

Standard Cadmium Cell.

The next on the programme was a brief presentation of the results of some recent work done by Dr. F. A. Wolff at the National Bureau of Standards, in Washington, on the temperature coefficient of the Weston standard cadmium cell. Two hundred cells, some old and some new, were carried through temperature cycles from 0° to 40° C., and measurements made every 5°. Precautions were observed to maintain the proper and uniform temperatures throughout. It was found that there were many cells which showed considerable "hysteresis." Most of those showing marked hysteresis showed abnormal values at normal temperatures.

Dr. Wolff gave a new formula for the electromotive force of the Weston cell, which corresponds more nearly to the average curve of electromotive force of the cell than does the old formula. It was found by the careful measurements that the [illegible] maximum electromotive force at some point between 0° and 5° C.

[illegible] formula: E [illegible] 40 (t − 20) — [illegible]

[illegible]

In the discussion Dr. H. S. Carhart of the University of Michigan, who has done so much work on standard cells, said that the sizes of the crystals has such a marked effect that the cause of the [illegible] phate crystals were better than those prepared electrolytically. This is contrary to Dr. Wolff's [illegible]

[illegible] J. A. Wilkinson entitled "Mercury Cathodes in [illegible]

nitric acid, and the results go to show that there is no real difference in behavior.

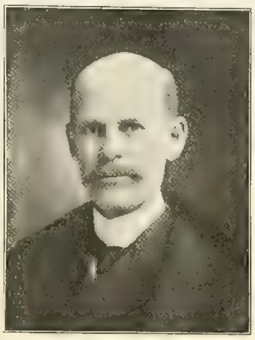
Early Work of Joseph Henry.

The morning session was closed by some interesting historical facts concerning the early work of Joseph Henry in the field of electromagnetism. Joseph Henry was an instructor in the Boys' Academy of Albany in 1826, and in that year and in those immediately following, he invented and explained the construction of the electromagnet, invented the first electromagnetic telegraph and showed the value of the series method of connecting cells for long-distance telegraphy. He also noted that electric currents could be induced electromagnetically. All of this work has been ascribed to other people.

Corrosion of Iron and Steel.

The afternoon session included a business meeting and the presentation of four papers, including the president's address.

The address of the retiring president, Prof. C. F. Burgess of the department of chemical engineering at the University of Wisconsin, was upon that subject which is probably of greatest interest to construction engineers, viz., the corrosion of iron and steel. The title of his address was "The Corrosion of Iron and Steel from the Electrochemical Standpoint." Professor Burgess stated that iron structures may depreciate, due to corrosion, from 1 to 20 per cent. per year, and notwithstanding this grave destruction there is a wide divergence of opinion as to the causes of and methods of protection from corrosion. Among the recent investigators who have published valuable contributions are W. R. Whitney, W. S. Walker and A. S. Cushman.



EDWARD G. ACHESON, NEWLY ELECTED PRESIDENT OF AMERICAN ELECTROCHEMICAL SOCIETY.

Two of the points particularly dwelt upon in Professor Burgess' paper are the effects of strain and the effects of heat upon corrodibility.

With reference to the influence of strain upon the potential set up by iron in an electrolyte, there has been much work done by Andrews in 1894, Hambuechen in 1900, T. W. Richards in 1906, and W. S. Walker in 1907. All of these except Hambuechen concluded that there was no potential increase noted, and some even found the reverse. The fact that Mr. Hambuechen's work was very carefully done so as to eliminate the effects of polarization, may account for his positive results showing a decided change of potential difference between strained and unstrained pieces of iron. His observations were, however, greater than could be accounted for by theory, and hence his work has been discredited.

Professor Burgess pointed out that Hambuechen's abnormal results might be accounted for by the fact that the pieces of iron under strain are not uniformly strained, and that as the difference of potential set up between a non-homogeneous electrode and an electrolyte is experimentally known to approach that of the constituent setting up the highest potential difference, the abnormally high results observed may be accounted for. Professor Burgess showed many samples and lantern slides in support of the more ready corrodibility of strained pieces of iron.

The greater corrodibility of iron when heated was investigated quite fully in an experimental boiler, and it was shown that electric currents were actually flowing between the hotter and the cooler parts of the interior of a boiler. It was further found that carbon dioxide is not objectionable in boiler water so far as setting up electric currents is concerned. Alkaline boiler compounds, such as sodium carbonate, reduce the corrosion.

[illegible] favorable comment. Dr. Carhart thought that not sufficient prominence had been given to the tem[illegible] equation in the theoretical considerations of the paper.

A second paper upon the subject of the corrosion of iron was presented in abstract by Mr. R. H. Gaines. The title of his paper is "The Electrochemical Corrosion of the Rochester Steel Conduit." Rapid and extensive corrosion is doing considerable damage, and there seemed to be no way to explain the cause except by local voltaic currents set up by variations in the physical and chemical composition of the steel. The paper is a long report upon the conditions found. In the discussion that followed, it was the opinion of those taking part that some good paint should be made to prevent such corrosion.

Uses of Aluminum.

Mr. E. Blough of Pittsburg showed some of the numerous forms into which the metal aluminum is now being worked and mentioned the various uses briefly.

Copper Anodes.

The last paper of the afternoon was by Mr. Paul Dushman of Toronto, entitled "Copper Anodes in Chloride Solutions," and dealt with the equilibrium ratio between the amounts of cupric and cuprous salts dissolved.

Electrochemistry of Light.

Dr. W. D. Bancroft of Cornell gave a lecture in the evening, which will be a forerunner of many more investigations upon the subject of photochemistry. The title, "The Electrochemistry of Light," was probably chosen because it was an attempt to correlate the causes of the chemical actions produced by light with electrolytic decomposition phenomena.

A number of experiments were performed to illustrate the relation. In the presence of suitable oxidizing or reducing agents which act as "depolarizers," many relatively unstable salts are split up by light energy, and chemical reactions then occur between the parts of the decomposed substance and the "depolarizing" agent. Dr. Bancroft's investigations are now along the line of reproducing the effects of light by electrolysis.

The first investigator along this line was Grothuss, who in 1818 formulated these laws:

(1) Only that light which is absorbed can produce chemical action.

(2) Light may be considered analogous to a linear electrolytic cell.

The exact relation between the light action and the electrolytic action was not made clear by Grothuss, and Dr. Bancroft could give no definite interpretation of this idea.

Among salts Dr. Bancroft experimented with were ferric sulphocyanate, ferric oxalate, mercuric oxalate, mercuric chloride, ferrous ferricyanide.

The study of photochemistry is one of great importance in many lines, particularly in those of photography, bleaching, and especially in the field of plant life.

In the discussion of the paper, Dr. Baekeland of Yonkers, N. Y., concurred with Dr. Bancroft in the importance of scientifically studying the field of photochemistry. Light affects not only unstable compounds, but very stable ones also. Hydrochloric-acid gas in the presence of moisture and oxygen, Dr. Baekeland found, would be partially broken up with the formation of a certain amount of chlorine gas. The process is reversible. The reversibility of light reactions is also of great importance. "Photo-retrogression" or reversed action occurs in photographic plates which have been exposed to light and have remained in the dark for long periods afterward. Heat, too, produces photo-retrogression in some instances.

Conservation of Natural Resources.

A paper by E. R. Taylor of Penn Yan, N. Y., was then given. This was a plea for co-operation in the fields of forest preservation, water storage, waterpower and navigation.

Dr. Steinmetz's Lecture.

The Friday morning session was held in the chemical lecture hall, Union College, Schenectady.

The first number on the programme was a lecture by Dr. Charles Proteus Steinmetz on the subject of "Kinetic Molecular Energy." The speaker announced that he would attempt to give a clearer conception of the principles of thermodynamics than one gets from a study of the subject by means of a consideration of the entropy factor. The idea is to derive the equations and laws of gases in which there are irregular motions of molecular and atomic masses, starting with the assumption of the molecular and atomic constitution of matter, and that the motion of these molecules and atoms occurs under the influence of intermolecular forces similar to the force of gravitation.

The conception of the three different states of matter was given as follows:

In a solid body the molecules have orbital motions about one another, which motions are relatively fixed or constrained to some particular locality in the body, so that the average distance between the molecules remains fixed.

In liquid masses the average distance between the molecules remains fixed, but the molecules move with much greater velocities than when in

the solid state, and, further, they are not constrained to certain definite orbital localities. They are free to have continuous travel, so long as the average distance between them remain fixed.

In the gaseous state the molecules have a still greater velocity, and the orbits of the particles are open or hyperbolic curves.

There is no need of the assumption that the molecules are constantly colliding with one another in order to transfer energy from one to another. The intermolecular forces transfer the energy. In a system consisting of but two individual particles there can be no transfer of energy from one to another, no matter how far apart they are. But in a system consisting of three or more particles there can be interchange of energy, and in a mass of gas which is assumed to consist of a very large number of molecules, there will be a constant interchange of energy depending upon chance relations. The mean energy of the molecules $\left(\frac{m v^2}{2}\right)$ is a constant for any given volume of gas.

Expansion of a gas is due to the insufficiency of the intermolecular forces to hold the particles to any given locality. Evaporation of a liquid or a solid is due to chance orbital motions which give to some of the particles a sufficient velocity to overcome the attractive forces that hold the majority together. In gases, particularly when near the state of condensation, there are molecules which give up, by chance, sufficient energy for small groups to collect and form polymerized gas which does not follow the laws of the ideal gas very closely.

If it be assumed that the temperature of a gas is proportional to the energy of its molecules, then the expression

$$t \sim \tfrac{1}{2}\, m\, v^2$$ represents this idea.

The expression

$p \sim n\, m\, v^2$ (n = no. of mols., m = mass of a mol. and v = velocity of a mol.) represents the gas pressure on the sides of a containing vessel.

It is seen that the temperature and the pressure are both proportional to $m\,v^2$, and hence the pressure is proportional to the temperature. Since the pressure of a gas is proportional to the number of molecules enclosed in a given space, if we double the number, or, which is the same thing, if we decrease the volume of a given quantity of gas by one-half, the pressure will be doubled. Consequently the pressure and volume of a gas are inversely proportional to one another. This is expressed as

$$p \sim \frac{1}{V}$$

From the above three formulæ we can derive directly the proportionality relation,

$$p \sim \frac{T}{\text{Vol.}}, \text{ or } p\, V = r\, T,$$

r being a constant.

Where polymerization occurs, near the point of condensation, for instance, the equation must be modified.

By similar simple lines of reasoning it can be shown that different kinds of gases must have the same number of molecules per unit volume, and that an expanding gas must give up temperature, pressure and energy.

In adiabatic gas expansion the law $p\,V^{5/3}$ = constant can be derived for monatomic gas molecules. In diatomic gas molecules the exponent becomes 1.44; in triatomic molecules it becomes 1.33, etc. Where the atoms in the molecule are not the same size, as in the case of steam, the actual ratio is found to be 1.286 instead of 1.33.

For a fuller discussion of the above considerations reference must be made to the completed article by Dr. Steinmetz, which will appear in the Transactions of the society.

Vaporization of Metals

Prof. J. W. Richards gave some empirical formulæ for the calculation of "the heat of vaporization of metals and other substances." The latent heat of vaporization for the molecular weight (in grams) = 23 T, where T is the absolute temperature of the boiling point at atmospheric pressure. (For constant-volume vaporization it is 21 T.) The total heat up to the temperature where all the material is volatilized is 33 T.

Patent Practice

The third paper presented was by Mr. A. B. Marvin of Schenectady, upon "Electrochemical Patents," and consisted of a brief statement of the growing importance of electrochemical patents and a plea for a larger and better Patent Office examining staff. A lively discussion was aroused, in which the weak Patent Office force and the United States patent laws received no sympathy. Among those who took part were Louis C. Regener of New York, Dr. C. P. Steinmetz and E. G. Acheson.

Testing of Iron During Annealing.

Mr. E. E. F. Creighton of Schenectady presented a brief abstract of a paper upon "The Electrical Testing of Iron During Annealing." The results [illegible] paratus.

[illegible]

The [illegible] Polytechnic Institute, Troy.

The [illegible] paper [illegible] was [illegible] Messrs. A. Hirsch and J. Ashton have done some work showing that iron and calcium will alloy to [illegible] tained in iron. These high percentage alloys were obtained by placing the iron oxide and the calcium in a steel cylinder and allowing the reaction to go on under pressure, the pressure being produced by calcium vapor. Calcium in iron makes it very brittle.

There is little likelihood of calcium being introduced into steel at atmospheric pressures, because of the extreme volatility of the calcium at the melting temperature of iron. The welding qualities of the calcium alloys are worthless. The alloys containing over four per cent. calcium will oxidize in the air. The temperature of rapid vaporization of calcium was determined to be in the neighborhood of 1,290° C.

In the discussion Dr. J. W. Richards inquired if the calcium-zinc alloys could be used to make iron-calcium alloys. While that had not been tried, it was thought by Professor Burgess to be impossible because the temperature would necessarily be too high for the calcium.

Dr. O. P. Watts, of the University of Wisconsin, outlined some of his work on the "Preparation of Calcium Alloys for Aluminothermic Work." These alloys, prepared by Dr. Watts and Mr. J. M. Breckenridge, consist of various combinations of calcium, magnesium, aluminum and silicon. The calcium content varied from 6 per cent. to 74 per cent. The object of making these alloys was to obtain a substitute for powdered aluminum, such as is used in the aluminothermic process. Alloys containing calcium and magnesium cause considerable splattering of the charge due to the vaporization of those metals. Alloys high in silicon cut down the intensity of the reaction. With fusible slags, the reactions progress much better.

The alloys were prepared by melting the elements in a covered Acheson graphite crucible, electric heating being employed. The alloys were made by adding the elements in the following order: Al, Si, Mg, Ca. Calcium chloride served as a useful flux to prevent volatilization. The calcium alloys are quite stable in dry air and do not disintegrate. They decompose water roughly in proportion to the calcium content. All the alloys described are readily pulverized.

In the discussion Dr. J. W. Richards asked if the use of these easily pulverized alloys had been considered for flashlight powders. Dr. Watts replied that it had. It was also brought out that the use of aluminum as a reducing agent for metallic oxides had been tried as early as 1858 by Tissier Bros., in France, and that Messrs. Greene and Wahl published in 1890 in the Journal of the Franklin Institute a method of producing carbon-free manganese by reducing manganese dioxide by aluminum.

Electrolytes and Electrolysis

Dr. Louis Kahlenberg of the Department of Chemistry of the University of Wisconsin, presented a paper upon "Conduction in Electrolytes." This was an interesting and valuable contribution.

Mr. Carl Hering of Philadelphia outlined some ways in which direct currents might be induced in electrolytes without electrodes, the point being to prove conclusively whether or not the idea is correct that the electrolyte merely transfers numerous electrostatic charges which are received from one electrode to the other electrode, instead of conducting the current electromagnetically as in a metallic conductor. The methods outlined are based on unipolar induction principles.

J. W. Turrentine's paper on "Reversed Electrolysis" dealt with the apparent contradictions to the usual electrolytic products found at the electrodes. Cases are known where hydrogen is given off at the anode and where chlorine and oxygen are produced at the cathode. These are due to secondary reactions near the electrode surfaces.

Dry Cells in Ignition Circuits.

Dr. J. W. Brown of Cleveland gave an instructive discussion on the "Use of Dry Cells in Ignition Circuits." By means of meters and rotating pointers from the ends of which sparks proceeded, he showed that an enormous waste of battery energy can occur when the apparatus used in connection with gas-engine ignition circuits is not properly designed. He stated that most of the spark coils and igniting devices now in use are extremely wasteful of energy, and that with a properly designed apparatus, the dry cell is the most economical and convenient device that can be used for supplying the spark. The ordinary meth- [illegible]

[illegible] with the iron and render the deposit hard and [illegible] per cent. sodium (as sulphate) the voltages required were 0.95 to 1.20 at 20° C. and 0.50 to 0.85 at 50° C. Good deposits were obtained from an electrolyte containing eight per cent. iron and four per cent. sodium as chlorides. Boiled solutions and solutions at 40° to 60° C. gave smooth deposits. Neutral chloride solutions produced finer grained and more flexible deposits than neutral sulphate solutions. Deposits from solutions containing no ammonium salt [illegible] those containing those salts.

Miscellaneous Topics

Prof. A. T. Lincoln of the University of Illinois gave a brief abstract of the continuation of his researches on "The Corrosion of Brasses and Bronzes." The electrolytes used were salt solutions, similar to sea water in composition. The corrosion of the brasses and bronzes increased with the copper content.

A paper by O. L. Kowalke of the University of Wisconsin dealt with the "Conversion of Iron Pyrites into a Magnetic Form." The principal point was that by roasting, and with only a slight loss of sulphur, the iron pyrites in zinc ores can be made sufficiently magnetic to be separated from the ore in a magnetic concentrator.

The paper of F. T. Snyder of Chicago on "Distillation of Turpentine by Electricity" is given in full elsewhere in this issue.

A number of papers were read by title.

Nebraska Electrical Association.

Omaha, Neb., May 5.—The annual convention of the Nebraska Electrical Association will be held on the stage of the Auditorium. The programme begins tomorrow morning with the reading of minutes, president's address, appointment of committees and general business. At the afternoon session there will be a paper on "Duties of the Electrical Inspector," by Waldemar Michaelsen of Omaha, and a paper on "Motor Problems from the Viewpoint of Small Central Stations," by V. W. Bergenthal of St. Louis. The question box will follow the discussion of the papers.

At Thursday morning's session there will be reports of officers and committees and election of officers, followed by a paper on "Electric Law," by Hon. W. R. Patrick of South Omaha. In the afternoon the following papers will be read: "How to Meet Gas and Gasoline Competition in Stores," by J. R. Cravath, Chicago; "Electric Rates," by Homery Honeywell of Lincoln; discussion by I. B. Zeiman, Omaha; question box.

Headquarters of the Nebraska Electrical Association will be the booth of the Western Electrician There are many electrical men here to attend the convention and to visit the Omaha electrical show, which is on at the Auditorium this week. A. K. M.

To Determine Cost of Municipal Lighting in Chicago.

Following the announcement in the Western Electrician last week of Mayor Busse's intention of finding out just how much the municipal street-lighting plants are worth and what it actually costs the city to own and operate them, the Council finance committee has authorized the mayor to employ such help as is necessary to look into the subject in a businesslike way. Some of the former city officials who were stanch municipal-ownership advocates argued that the city could do the street lighting cheaper than a private corporation, and they based their contentions on the figures of the municipal plants. But these figures thus far have shown little if anything more than the cost of the coal and other supplies used and the labor employed, and naturally were not convincing to business men accustomed to figuring closely in enterprises of this kind.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker.

Part VI.

The Test Room (*Continued*).

Secondary Laboratory Standards (Continued).—For direct-current voltmeters, portable instruments are also made having two scales of 150-volt and 300-volt range, respectively. The scale which can be read with the greater precision on the actual voltage should be used—for example, the lower scale in testing on 110-volt circuits—especially since these instruments are calibrated to give the maximum accuracy at the usual commercial voltages of 110 and 220 volts.

For the alternating-current voltmeters, multipliers are supplied to enable the instrument to measure higher potentials. In using the alternating-current voltmeter, care should be exercised in the use of the contact key to keep it down only as long as may be necessary to take a reading or a closely consecutive series of readings.

The wattmeter is a combination of voltmeter and ammeter, designed to take account of the power factor of the circuit. It therefore measures true watts, and not merely "volt-amperes." In using the wattmeter, care should be observed not to overload either the current or potential coils of the instrument. A low reading on an inductive load does not necessarily mean that the current or the potential is low; one or both may be so high as to work injury to the instrument, yet so far out of phase that the wattage is small.

In case of uncertainty as to the amount of current or voltage, an ammeter and a voltmeter may be used in conjunction with the wattmeter—not for the purpose of checking the readings of the latter, but to insure that its limits are not exceeded. Special care should be taken in the use of the multiplier, to connect it to the appropriate binding posts, as a mistake will inevitably cause the burning out of the wattmeter.

The potential coil of the wattmeter—like the voltmeter, when voltmeter and ammeter are used—should be connected to the mains on the service side of the meter under test. A deflection of the needle back of the zero indicates that the connections to the current and potential windings are in opposite directions with reference to each other; reversing the current leads to the instrument will correct the trouble.

A "precision wattmeter" for direct and alternating current, put out by the Westinghouse company as a primary standard, is shown in Fig. 8.

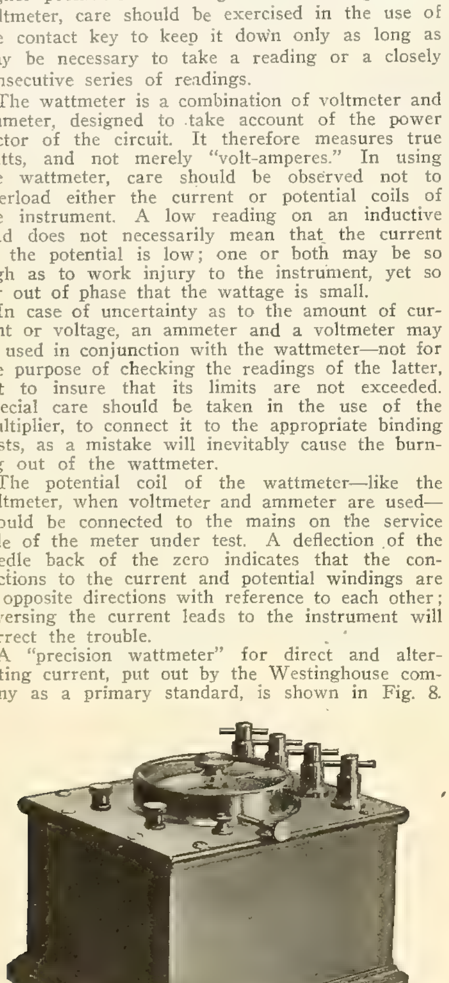


Fig. 8. A Precision Wattmeter.

This instrument, while not a primary or original standard in the sense in which that term is employed in the present work, is just as well adapted to the testing of the other secondary standards in use by a central-station company, including the laboratory standards that are ordinarily used for checking portable instruments. The wattmeter is put out by the Westinghouse company as a protection to the proper calibration of that company's meters, as it is found that ordinary "laboratory standard" indicating instruments are often incorrect.

The precision wattmeter is a high-priced instrument, but is put out under a follow-up card-index record system, so that the meter-manufacturing company knows at all times how the central-station company possessing one of these instruments is situated for the making of high-precision accuracy tests of installed meters in its test room, and for keeping secondary standards (such as test meters) [illegible]

The precision wattmeter is designed on the prin- [illegible] ball jewel. It is zero reading, the index pointer indicating zero when the deflecting pointer indicates the true

[illegible]

watts. Rough adjustment of the deflecting pointer is made by a knurled head. Fine adjustment is accurately made by a continuous worm. The scales are graduated on a silvered dial. The divisions are large and open, as the scales occupy the entire circumference of circles approximately five inches in diameter. The meters are calibrated in the company's standardizing laboratory, and a certificate is furnished with each, giving the various constants and the degree of accuracy of the constants. The company checks the calibration of these meters without cost to the purchaser, except transportation charges, for a period of five years from date of original purchase.

For an extensive illustrated discussion of this instrument, see Special Publication No. 7052 of the Westinghouse Electric and Manufacturing Company, a reprint of a paper entitled "The Maintenance and Calibration of Service Meters," by William Bradshaw.

A reliable stop-watch must not be omitted to be mentioned among the secondary standards. Several of these instruments, of good quality, should be provided, and they should be checked frequently, at different points on their dials, against a standard clock. The ordinary cheap stop-watch is not adapted to stand up under the work.

The following general precautions should be observed in handling portable instruments of direct-current and alternating-current type, in the laboratory and at consumers' installations:

Instruments laid out and connected up for a test should be placed on a secure, level surface, and not disturbed or moved until the test is completed. They should not be brought near motor or generator fields, or near any source of heat, such as a lamp bank. Magnetic fields are liable to destroy the calibration of direct-current instruments, as these contain permanent magnets. Both conditions are liable to affect the actual readings of both direct-current and alternating-current instruments—especially the latter, for the very reason that they contain no permanent magnets, and hence are very susceptible to stray fields.

"Twisted pairs" should always be used, when possible, for the current leads, to neutralize the field from the leads, that might otherwise affect the indications of the instrument very materially. Two or more instruments laid out for a test should be placed, when their scales are in line, at least one foot apart, as within that distance current in the windings of one instrument is liable to affect the readings of the other; if the instruments are set with their scales at right angles, however, they may be placed immediately adjacent. In order to reduce or eliminate the influence of external magnetic fields, many companies have equipped their portable instruments with heavy iron cases. The use of such "ironclad" instruments especially conduces to accurate results in testing at consumers' installations where strong and variable stray fields are liable to be present.

Care should be taken to avoid injuring the instruments—bending the pointers or burning out the coils—by connecting them to circuits carrying voltages or currents beyond their range. Alternating-current instruments should not be used on direct currents, or vice versa. Alternating-current instruments do not contain permanent magnets, and although they may be used on direct current, it is necessary in doing so to make reverse readings, and take the mean, which is slow and inconvenient, and also practically inaccurate under certain local conditions. On the other hand, direct-current instruments not only give incorrect indications on alternating-current circuits, but are liable to have their calibration permanently destroyed by connecting them to such circuits.

A convenient way to determine whether alternating or direct current is in the mains which are to supply the test circuit is to hold a *single-pole* telephone receiver near the globe of an incandescent lamp which is burning on the circuit, with the produced axis of the magnet threading through the loop of the filament at right angles to its general plane. An alternating current, by varying the field of the magnet, will cause a musical note to be heard in the receiver. In default of a single-pole telephone receiver, the alternating or direct character of the current may be determined with by an ordinary permanent magnet by presenting the latter toward the lamp. When this is done, a direct current will cause the filament to bend to one side or the other with a single steady movement, whereas an alternating-current will cause the filament to vibrate rapidly back and forth, so as to appear to broaden out.

Instruments that have had their pointers bent or that have become damaged in any way should be repaired and recalibrated at once, and not used in a defective condition. This applies particularly to the introduction of a "zero error," from a slight bending of the pointer, which the observer would have to add to or subtract from the actual reading.

The ends of wires or other live conductors should be kept from accidentally coming in contact with the metal case of a portable instrument, which is liable to burn the instrument out instantly if its winding happens to be grounded on the case, as it sometimes is. Good contact should be made between leads and binding posts, and the leads should be kept from dangling about, as contact with the ground or any other conductor may cause a short circuit, particularly in testing on central-station systems having grounded neutral.

In testing on motor circuits, the contact key of the voltmeter should be released before the motor is shut down, to avoid the back electromotive force of the motor, which might damage the instrument badly. Multipliers for use with either direct-current or alternating-current voltmeters should be clean and dry before connecting them into circuit. Moisture condensed on the surface of multipliers, due to bringing the instruments into a warm room from the cold outside air, may cause error in the voltmeter readings, or injure or even burn out the voltmeter. In testing at consumers' installations, in winter, multipliers should be wiped off, especially between the binding posts, and allowed to attain the temperature of the room before the voltmeter circuit is closed through them.

In making test connections care should be taken to connect the voltmeter to the mains on the line side of the meter.

Special precautions are required in using alternating-current instruments. The contact key of the alternating-current voltmeter should be used as a brake to check the motion of the needle, so as to avoid bending the needle or injuring the jewels by any violent movement of the needle. In general, alternating-current instruments must be handled more delicately than direct-current instruments, on account of their weaker control and heavier moving parts. The pointers should always be allowed to return to zero after using the instruments, as otherwise the springs, which are comparatively delicate, may take a permanent set, giving rise to a "zero error."

Alternating-current instruments are very susceptible to error from static charges on the glass or other parts. Such charger set up an electrostatic field which attracts the moving system and gives rise to error in the readings. For this reason the top of the instrument (glass or hard rubber) should never be wiped off just before taking a reading, as the friction is very liable to electrify it.

When the pointer of an indicating instrument will not return to zero, due to the presence of a static charge, the latter may be dissipated by breathing on the glass. To get rid of static troubles it is sometimes necessary to ground the meter or one of the mains—for example, when testing primary meters. A one-ampere fuse wire at least six inches long, enclosed in a piece of tape, should always be cut in on the ground wire, as in case the other side of the circuit is grounded a dead short-circuit would result.

An article entitled "Switchboard Instruments," by Frederick Lange, p. 1115 of the Electrical World for December 7, 1907, sets forth briefly but forcibly the need of the exercise of care and common sense in handling instruments and meters.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Voltage Regulation in Parallel Operation.

M. A. L., Peoria, Ill.: We have three 220-volt, 100-kilowatt, direct-current generators connected in multiple. Our voltage regulation is by hand and our load is quite variable, especially in the evening. I would like to know whether there is an automatic regulator made that could be used to advantage in our case.

Answer.

Automatic regulators are made, but their use is not advisable except in special cases. The situation here is not an exceptional one. The machines are evidently shunt dynamos. On a variable load these require too much attention. The common practice is to use compound-wound generators for such service. These give automatic regulation without the liability of getting out of order that is more or less characteristic of regulators.

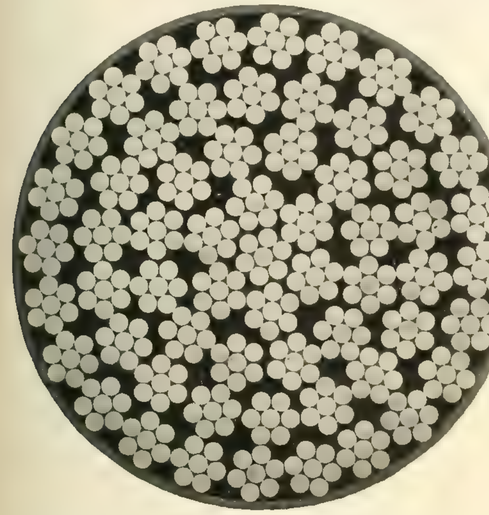
To compound the machines a proper series field winding must be added to each machine. These

windings must be connected so that they are all on the positive or all on the negative side of the armatures. From each junction of the series field to the armature terminal a connection, including a single-pole switch, must run to an equalizer bar which in effect connects the different series field in parallel with each other.

A 5,000,000 Circular-mil Cable.

A further answer to the inquiry of F. J. T., Chicago, in relation to large single-conductor cables, published in this column on February 29th last, is furnished by Mr. J. R. Wiley of Chicago:

A 5,000,000-circular mil single braid weatherproof copper cable, which is doubtless the largest conductor ever manufactured, has just been installed



ACTUAL SIZE OF 5,000,000-C. M. WEATHERPROOF CABLE.

by the Transit Development Company of Brooklyn. In order to have the required flexibility, this cable was made up of 427 wires arranged in 61 strands of seven wires each. The dimensions of this cable are: Diameter of bare strand, 2 57-64 inches; diameter over insulation, 3 1-16 inches; weight of bare strand, 16.2 pounds per foot; weight of the completed cable is 16.6 pounds per foot. The cable was furnished in 440-foot lengths, each length constituting 7,300 pounds of cable. This immense cable was furnished by the Standard Underground Cable Company of Pittsburg, Pa.

Opening of the Omaha Electrical Show.

Omaha, Neb., May 5.—Omaha's first electrical show was opened at the Auditorium last night, and will be continued during the remainder of the week. The show promises to be a great success. It has been received with a hearty welcome by citizens of Omaha and surrounding country. Nothing of this kind has ever before been attempted here, and the venture was somewhat of an experiment, but it is proving so popular that the management had difficulty in accommodating the throngs which packed the Auditorium on the opening night.

The Auditorium is brilliantly illuminated and the decorations are artistic, representing the work of a large number of men during the last two weeks. It is stated that the Omaha Electric Light Company alone expended more than $5,000 on its electrical cottage, besides the many thousands of dollars spent by the other exhibitors.

Aside from the electrical display, there is a musical and vaudeville programme offered each evening. Among the features are the Elks' Quartette (vocal music), Charles H. Keefer (pianist), the "Teddy Brothers" of Omaha (acrobats) and "Onetta, the electrical dancer," who gives her famous fire dance every night. On Tuesday night each lady who visits the electrical cottage will receive a souvenir.

All the electrical work has been done under the direct supervision of City Electrician Waldemar Michaelsen, who has taken great pains to have everything up to standard. On Wednesday and Thursday the Nebraska Electrical Association will hold its annual convention at either the Rome Hotel or upon the stage of the Auditorium. On Thursday the Sons of Jove will also meet at the Auditorium, and a rejuvenation is planned. Friday is another souvenir occasion in honor of the telephone interests, and Saturday is to be given over to the children.

Manager J. M. Gillan deserves much of the credit for the success of the show, and Omaha can boast of an electrical exhibition far greater than any yet held west of Chicago.

The list of the exhibitors includes 90 different companies whose exhibits of electrical machinery and electrical appliances cover the entire electrical industry very thoroughly. A. K. M.

Annual Report of the General Electric Company.

The sixteenth annual report to the stockholders of the General Electric Company has been issued, covering the year ended January 31, 1908. Business for the year, as indicated by the total sales billed, was larger by more than [illegible] than for any previous year, but the profits were considerably reduced on account of certain reserves, allowances for depreciation of factory plants and the shrinkage in inventory values.

Following are portions of the report, which contain much of interest:

C. A. COFFIN, PRESIDENT.

The profits of your company for the year ending January 31, 1908 (including [illegible] from securities sold, and [illegible] from resulting dividends, bond interest, readjustment in stocks and bonds account, and sundry profits), after deducting all patent, general and miscellaneous expenses, and allowances for depreciation and losses, and writing off $3,745,980.00 from factory plants, were........ $ 6,586,653.37

Paid in dividends during the year. 5,183,614.00

Carried to surplus account ..... $ 1,403,039.37

Surplus at the end of last fiscal year 15,110,796.77

Total surplus January 31, 1908 $16,513,836.14

Late in the year there was a sudden and severe shrinkage in the value of all merchandise and materials used by your company, notably copper. All said materials, whether raw, manufactured or in process of manufacture, which were on hand January 31, 1908, were inventoried at the lower prices then prevailing. The book value of such inventories was thereby reduced by about $2,000,000.

In valuing the notes and accounts receivable, in amount the largest in your company's history, great care has been exercised and liberal reserves have been established to provide for possible losses thereon. These reserves and allowances for depreciation of factory plants, and the shrinkage in inventory values, have greatly reduced the profits of your company. As a result the amount in excess of dividends upon its share capital, which is carried forward to surplus account, is relatively small. During the year all the assets and liabilities of the Stanley G. I. Electric Manufacturing Company, Pittsfield, Mass., were taken over by your company, and the factories owned by that company at Pittsfield are now a part of the factory plants of your company. In this practical liquidation of the Stanley company there has been a considerable shrinkage in the valuation of its factory properties, inventories and other assets, thus adding to the otherwise large depletion in the profits for the year.

In view of the then great expansion in business, your directors deemed it wise, early in 1907, to provide for future development at some point nearer the Central West, in preference to a further enlargement of the plants at Schenectady and Lynn.

For this purpose the unencumbered fee of about 700 acres of land adjacent to the city of Erie, Pa., was purchased at a cost, including engineering and other expenses, of $232,301.53. In view of the existing depression the erection of buildings thereon is deferred for the present.

The various securities included in the stocks and bonds account of your company have been carefully revalued, item by item, with the result that the book value thereof has been fixed at $18,000,089.85.

The past year has been one in which the energies of all the departments of the company have been taxed to their utmost, and in which the pressure upon the department heads has been particularly severe. The arduous and effective work done by them is worthy of the highest commendation.

J. R. LOVEJOY, VICE-PRESIDENT.—SALES AND ORDERS.

Total sales billed..............................$70,977,168

Total orders received.........................$59,301,040

Comparison with five previous years:

Years ending January 31st.	Sales Billed.	Orders Received.
1903	$36,685,598	$39,944,454
1904	41,699,617	39,060,038
1905	39,231,328	35,094,807
1906	43,146,902	50,044,272
1907	60,071,883	60,483,659
1908	70,977,168	59,301,040

"Orders Received" include only apparatus manufactured by the General Electric Company, and do not include such items as services of experts, labor of installation, freight and transportation, supply material, boilers, engines, etc., of outside manufacture, and bare copper wire.

All these items are included in "Sales Billed." In the 10-year period ending January 31, 1908, sales billed have increased from $12,396,093 to $70,977,168, an average increase of 19.8 per cent. per year.

[illegible]

past three years.

[illegible]

Great Western Power Company, San Francisco, Cal., three water-wheel generators, 10,000 kilowatts each, together with the necessary transformers and other electrical apparatus for transmitting current at 100,000 volts from its power house on the Feather River to Oakland, Cal., a distance of about 165 miles.

The Central Colorado Power Company, Colorado Springs, Colo., four 5,000-kilowatt generators and other electrical apparatus for water-power development at Glenwood Springs on the Grand River, the electrical energy to be transmitted throughout the central portion of the state for mining, general power, lighting and railway service.

The Detroit River Tunnel Company, a subsidiary of the Michigan Central Railway Company, apparatus for equipment of the Detroit tunnel under the St. Clair River. The contract includes several 1,000-kilowatt motor-generator sets with accessories and six 100-ton locomotives, each equipped with four 250-horsepower motors.

The Great Northern Railway, for electrification of the Cascade tunnel, water-wheel generators and 100-ton locomotives, each equipped with four 250-horsepower alternating-current motors giving a continuous output of 1,000 horsepower per locomotive.

The Southern Pacific Railroad Company, for electrification of its suburban lines in Oakland and Alameda, Cal., 44 four-motor equipments, with Sprague-General Electric control. The motors are 125 horsepower each.

The Hudson Tunnels Company, the turbine generators, rotary converters, motors and controlling apparatus for complete electrical equipment of its system of tunnels under the Hudson River connecting New Jersey and Manhattan. A portion of this system was put into successful operation on February 25, 1908, and regular service is now maintained between Nineteenth Street (Sixth Avenue), New York city and Hoboken, N. J.

The West Jersey and Sea Shore Railroad Company, a branch line of the Pennsylvania Railway running from Camden to Atlantic City, mentioned in last year's report, has maintained its record of satisfactory operation and orders for additional equipment have been received during the past year to provide for the increased traffic.

The New York Central and Hudson River Railroad Company is now operating in its New York city terminal 35 electric locomotives of our manufacture, each equipped with four 550-horsepower direct-current motors. Twelve additional locomotives have recently been ordered, making a total of 47 locomotives purchased from us by this company.

The use of electrical apparatus for industrial purposes is extending rapidly and large purchases of our apparatus have been made during the year for completely equipping mills with turbine and engine-driven generators for lighting and power, and with motors of standard and special design for driving machinery of every description.

Orders for supplies, such as meters, transformers, arc lamps, wiring devices, electric-heating devices, repair parts of electrical apparatus, etc., show an increase over last year. Our list of supplies comprises upward of 50,000 items, separately catalogued and priced. In addition to the large stock of finished product carried at the several points of manufacture, we maintain 14 warehouses in various cities, from which shipments to the value of over $6,000,000 were made during the year.

1,200-volt Direct-current System.—To meet the requirements of interurban railways where a potential higher than 600 volts is desirable and the conditions are unfavorable to the adoption of the single-phase alternating-current system we have developed a high-voltage direct-current railway system to operate at 1,200 volts. Two roads have been operating under this system for several months with entire success. Equipment for several additional roads of this character is in process of installation.

The Curtis Steam Turbine.—The Curtis steam turbine continues to give excellent service and the confidence of users is evidenced by numerous additional orders for existing installations. The total number of Curtis turbines shipped to date is 960, having a total capacity of 1,086,000 horse-

power. Orders were received during the year for turbines aggregating 380,000 horsepower. We now have in process of manufacture for the Commonwealth Edison Company of Chicago and the New York Edison Company a number of turbine generators of 14,000-kilowatt capacity each, which will be the largest steam-driven electrical units ever produced.

Incandescent Lamps.—The consumption of carbon-filament lamps has steadily increased during the year, and with our enlarged capacity we are prepared to take care of the demand. In addition, we have received large orders for different types of high-efficiency metal-filament lamps, first consideration being given to such sizes and types as will aid central-lighting stations in providing for the requirements of their customers and the extension of their business.

Foreign Business.—The business of our foreign department has been well maintained.

Organization.—In addition to the several departments at the general office in Schenectady, we maintain fully equipped local offices in Atlanta, Boston, Chicago, Cincinnati, Denver, New York, Philadelphia and San Francisco, supplemented by resident agents in 22 other cities. I desire to express my appreciation and commendation of the excellent work of the department and local-office managers and agents during the year.

E. W. Rice, Jr., Vice-president.

Manufacturing.—Expenditures aggregating $6,350,576.74 have been made during the year for real estate, erection of new factory buildings, extensions to existing buildings, additional machinery, patterns, special tools, fixtures, etc. (The manufacturing plants include the Schenectady works, the Lynn works, the Pittsfield works and the lamp works.) The manufacture of incandescent lamps is now carried on at Harrison and Newark, N. J., Fort Wayne, Ind., and Toledo, Ohio. The total land area at all the works is now about 515 acres.

Engineering.—During the first part of the last year our engineers were fully occupied in supervising the technical details of our greatly expanded business. Upon the decline in business which followed they have had more time to devote to improvements and economies in design of our apparatus. More attention has also been given to the design of special apparatus intended to meet novel conditions and to the extension of our business along profitable lines.

The apparatus designed by our engineers for the long-distance transmission of electricity has proved most reliable, economical and satisfactory in operation.

There has been a continued increase in the capacity of electric generators and transformers.

Our high-tension switching apparatus has been still further improved, and we have been favored with the most important orders for such installations.

The details of our steam-turbine generators have been improved, great economy and proved reliability are now assured, and the turbine generator is now standard for all new important electrical installations where steam is utilized. We are now building turbine units of a capacity of 14,000 kilowatts, the largest electrical generating units ever produced. The Commonwealth Edison Company of Chicago has now in operation in one station ten large turbines capable of generating a total of 103,500 kilowatts.

Our engineers have devoted considerable attention to the design of a line of turbine generators for use with exhaust steam. Such steam turbines are so much more efficient than steam engines when operated by low-pressure steam that they can be most usefully employed to supplement steam engines in existing installations. Their use will result in large increases in output without any increase in coal consumption.

Our single-phase alternating-current railway equipments have been greatly improved during the past year.

Our new direct-current railway motor, mentioned in my last report, has proved so satisfactory in practical operation that it is rapidly being adopted as the standard type. It marks an important advance in economy and durability.

We have extended the range of economical operation of direct-current railway apparatus by designing it for use at 1,200 volts, about double the existing standard, and have sold a number of such equipments to the Southern Pacific Railroad Company.

We have sold to the Great Northern Railroad Company four 100-ton, three-phase electric locomotives designed to handle all trains traversing the 2½ miles of Cascade tunnel in Washington. This installation will be especially notable as the first instance of the substitution of electricity for [illegible] of the continental railways. The traffic conditions are pe[illegible] grades and tunnels. These electric locomotives, because of their increased speed and better control, will practically [illegible] present [illegible] locomotives. Electricity for their operation will be supplied from water power hitherto unused.

A gas-electric car, which fully meets the requirements of steam-railroad companies for service on branch lines has been perfected. The equipment consists of a gasoline engine driving an electric generator, which furnishes current to standard railway motors. The engine and generator are located in the forward end of an especially designed car conveniently divided into passenger and baggage compartments, making a complete self-contained unit.

We have made many valuable improvements in the design of machinery for electric reduction of metals and in apparatus for various industrial applications.

We have shipped several large motors of special design of about 10,000-horsepower capacity each for driving rolling mills, and have received orders for additional equipments.

Important improvements in the design of our lines of wiring devices, rheostats, circuit-breakers, switches, instruments and other small devices have been made during the year.

Our new tungsten incandescent lamp, which gives more than double the illumination of the carbon filament for the same expenditure of power, has been further developed and has now become a standard commercial article.

Several novel types of arc lamps of greatly improved economy have also been perfected and sold in large quantities.

It is a pleasure to call attention to the work of our engineers and factory managers, which is of the highest order of ability and originality, combined with unusual loyalty and devotion to the company's welfare.

Financial Report.

The financial report is submitted by Henry W. Darling, treasurer, and Edward Clark, general auditor. The balance sheet and statement of profit and loss given herewith include the assets

CONSOLIDATED BALANCE SHEET OF JANUARY 31, 1908

Assets				Liabilities	
Patents, Franchises and Good-will			$1 00	3½% Gold Coupon Debentures of 1892	33,000 00
				4½% of 1902	2,047,000 00
				3½% of 1907	12,872,750 00
				Accrued Interest on Debentures	108,791 47
				Accounts Payable	1,759,517 47
				Unclaimed Dividends	1,469 66
Cash			12,250,720 92		$16,844,520 00
Stocks and Bonds		16,000,080 85			
Real Estate (other than factory Plants)		541,900 00			
Notes & Accounts Receivable		29,537,726 84			
Work in Progress		1,276,294 29			
		49,676,011 41			
Merchandise Inventories					
At Factories	18,339,653 86				
At General and Local Offices	2,422,678 59				
Consignments	234,723 16				
		20,997,055 61			
			70,673,067 22	Capital Stock Issued	65,167,400 00
Factory Plants (including all lands, buildings and machinery)		12,900,000 00			
Copper Mining Investment		2,701,976 00			
			15,601,976 00	Surplus	16,513,836 14
			$98,525,765 14		$98,525,765 14

and liabilities and profit and loss accounts, as of January 31, 1908, of the Edison General Electric, Thomson-Houston Electric and Stanley G. I. Electric Manufacturing companies (which, for the convenience of bookkeeping, are consolidated with those of the General Electric Company). The Stanley G. I. Electric Manufacturing Company is

CONSOLIDATED PROFIT AND LOSS ACCOUNT OF JANUARY 31, 1908

Expenses		Earnings		
Cost of Sales (including depreciation of Plants $3,743,989 06)	$65,540,305 00	Sales		$70,977,108 40
		Royalties, Dividends, Bond Interest, readjustment in Stocks and Bonds accounts and Sundry Profits	$[illegible]	
		Interest and Discount	[illegible]	
				1,498,040 67
Interest on Debentures	362,020 63	Profit on sales of Stocks and Bonds		9,778 93
Profit for the current year	6,580,653 37			
	$72,484,988 00			$72,484,988 00
Dividends paid in Cash	$5,184,614 00	Surplus brought over from last year		$15,110,796 77
Surplus at January 31, 1908, carried forward to next year	16,513,836 14	Profit for the year ending January 31, 1908		6,580,653 37
	$21,697,450 14			$21,697,450 14

included in this consolidated statement this year for the first time.

A consolidated balance sheet of affiliated companies is given in the report, showing assets of $9,149,985.75. These companies include a copper-mining company, local lighting, railway, selling and other companies.

Electrical Dealers Should Be on Their Guard.

The Western Electrician is informed on what it considers reliable authority that a man giving his name as George Williams, and stating that he is connected with the Brenham-Compress Oil and Manufacturing Company, Brenham, Tex., has approached several electrical companies, including some dealers in Buffalo, with the apparent intention of defrauding them. One of his methods has been to place a substantial order for electrical material, with which he seems to be thoroughly familiar, and, after offering checks, and referring to his credit with Texas banks, attempting to borrow money.

Subsequently, it turned out that the checks offered in payment were not honored by the local banks in which the man claimed he had deposited, or would deposit, money to cover his purchases. Further, it is alleged, that the stranger used the receipt for the checks in an attempt to secure more material from another dealer. This man is described as about five feet nine inches in height, of stocky build, weighing about 170 pounds; has light hair, blue eyes, smooth face and large, rough, weather-beaten features; an upper front tooth is broken or missing.

Studio Lighting with Enclosed Arc Lamps.

It is generally supposed that it is impossible to do color work requiring any degree of exactness under anything but daylight. And it is true that practically all artificial illuminants as ordinarily used are unreliable for accurate color work. The importance of the demand for an illuminant for such work can readily be realized when one stops to consider the number of commercial processes in which color determinations are required. All such processes are limited to the daylight hours and well-lighted buildings, unless the proper artificial illuminant is used. This limitation becomes quite a hardship, particularly where the business demand is high during the short winter days. The condition is often further accentuated in large, crowded cities, where suitable daylighting is not easily obtained.

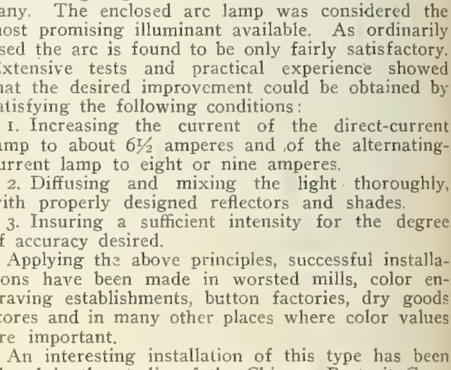
In response to the demand for a suitable substitute for daylight, experiments have been carried on for several years under the direction of the illuminating experts of the General Electric Company. The enclosed arc lamp was considered the most promising illuminant available. As ordinarily used the arc is found to be only fairly satisfactory. Extensive tests and practical experience showed that the desired improvement could be obtained by satisfying the following conditions:

1. Increasing the current of the direct-current lamp to about 6½ amperes and of the alternating-current lamp to eight or nine amperes.
2. Diffusing and mixing the light thoroughly, with properly designed reflectors and shades.
3. Insuring a sufficient intensity for the degree of accuracy desired.

Applying the above principles, successful installations have been made in worsted mills, color engraving establishments, button factories, dry goods stores and in many other places where color values are important.

An interesting installation of this type has been placed in the studio of the Chicago Portrait Company. In this company's large studio, which has an area of about 3,000 square feet, are employed from 100 to 125 artists sketching in and coloring photo enlargements. The studio is provided with a saw-toothed roof and finished in a dull neutral gray, which provides an even soft daylight illumination. The dull finish of the room makes it somewhat difficult to light artificially, yet under the pressure of the busy season the work has been carried on satisfactorily in the evening under the artificial light.

The large studio is lighted by means of nine six-ampere enclosed arc lamps, with the suspended-type ceiling diffuser which has been developed by the General Electric Company. The lamps are



STUDIO LIGHTING WITH ENCLOSED ARC LAMPS.

hung about 15 feet from the floor. In addition to this a unit of the same type illuminates a small private studio. Four projecting-type ceiling-diffuser equipments with 6½-ampere lamps illuminate the shipping room. The shipping room, in which portraits receive their final inspection, contains about 1,700 square feet of floor area and employs from 15 to 25 inspectors and shippers.

The accompanying illustration, which was taken at night purely by the light of the lighting installation, illustrates the character of the rooms and the evenness of the illumination. Mr. J. S. Sharp, office manager for the Chicago Portrait Company, is highly pleased with the illumination and says that the artists have been very successful in matching colors by it.

The threatened trouble between the Winnipeg Electric Street Railroad Company and the conductors and motormen has been amicably settled. The same wage schedule will be in force as before, but the company has granted seats to the motormen and several other minor concessions.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Tact and System.[1]

By J. W. Ferguson

To the proper, successful transaction of business whatsoever be its nature, these two subjects seem to me to be of almost, if not quite, equal importance. No matter how tactful one may be in his dealings with customers or others with whom he may come in contact, he must still have a system in handling his subject matter in order to avoid the many pitfalls which will constantly present themselves. One's system may be absolutely flawless, yet, without tactful handling, instead of a help, may prove a menace or even the cause of failure.

In this advanced age of business life these statements may seem trite and unnecessary. So, too, would they be were it our unfailing practice to conduct ourselves on their lines, but it is the unfortunate fact that we ofttimes neglect or overlook them, which brings worry to ourselves and disaster to our undertaking.

It has been a noticeable, and, to the minds of most of us, a pleasing fact that the last few years have shown a tendency in arranging conventions of electric-light and other technical associations, to assign some time to the discussion of the business end of the profession and to the mutual interests of the different departments.

As I am fully convinced that tact and system combined form a subject in the discussion of which it would hardly be possible to spend too much time, as it is a subject that strikes directly at the life blood, i. e., the income of the central-station company, and as it is a subject that intrinsically affects the standing in the community of the corporation, be it a railroad, a lighting and power plant, or any other form of public service, it is my opinion that a full and ample discussion of the subject must at any and all times be "apt and of much moment."

To central-station managers it is a question of the utmost importance. On them devolves the duty not only of defending and advancing the interests of those who are financially interested in the corporation, but, and almost more important, is the duty assigned them as representatives of the franchise rights granted by the body politic, to which body they will be held for a strict accounting.

A question today seriously occupying the attention of the public—and one that, if not provided against by the just and tactful treatment of customers, will surely in the near future play an important part in our political life—is that of municipal ownership of public utilities. It is not my intention to discuss the pros and cons of this issue, but, as you, gentlemen, or most of you, represent public-utility corporations, it is fair to assume that you are opposed to any legislation looking to a change in existing conditions. Then you should show by your methods in operating your companies that you recognize the limitations as well as the privileges vested in your franchise rights. You should show by your acts your realization of the fact that those rights have been granted by the people, and that they have the right at all times to demand from you an account of your stewardship; that your duties, well and courteously performed, will disarm criticism, while such duties neglected or discourteously performed will result in a just upheaval that will bring disgrace to you and disaster to the financial interests you are chosen to defend.

A very important link in the systematic conduction of business is the handling of mail. Letters received from customers should be very carefully investigated, and such methods adopted as will assure their prompt and careful attention, both before and after the final transaction of the business called for in the letters. They should be carefully safeguarded, and, the business having been transacted, should be filed away in such a manner as to be of easy access should such afterward become necessary. Copies of answers to letters should always be attached to the letters when they are sent to the files.

The method adopted in the contract department of the company with which I am associated is that all letters coming to the department are filed under the names of the agents. A notice is sent to the agent that such letter is on file. He may see that letter by going to the file and reading it, but under no circumstances is he allowed to remove the letter itself from the file. His report on the letter must be in writing, and should he not make a report within a reasonable time a supplementary notice is sent him. This notice is followed up in case of further delinquency until the matter is finally closed. The letter is then removed from the department file, and, with all reports on the matter, sent to the general file, from which it may be removed only upon written request and the [illegible] of a receipt by the party authorized to remove it temporarily. The [illegible] has proved [illegible] of [illegible]vantage, and has eliminated almost, if not quite, altogether, complaints which we sometimes formerly received that letters had not been given proper attention.

Mistakes are often made by heads of business houses or corporations in seeking to control and handle within themselves all the various duties and details of the business. This is a very serious error. There is a limitation to the ability and versatility of every man, beyond which he may not go. The limitation of the one-man company is spelled in the limitation of the man. The manager, superintendent or president, whoever may be the active head of the organization, should (yes, must) be the moving force in that organization. He should surround himself, as heads of the various departments, with men capable not only of seeing that the duties of the departments over which they preside are properly performed, but quickly to note and fearlessly to recommend such changes as they deem for the best interest of the general business. These men should form a kind of cabinet, who would, from time to time, be brought in conference to make reports as to progress and to devise ways and means. The force of the moving spirit will infuse itself into the heads of departments.

The methods of the various employes will in most cases be found to be in line with the methods of the head of the department, and for this reason "suaviter in modo, fortiter in re," mildness in method, force in execution, should be the governing principle for all heads of departments in the central-station company. Never losing sight of his duty to the company, although at times the fulfilling of that duty may cause temporary displeasure to the customer, it is always possible to so perform the duty that the minimum amount of dissatisfaction shall result, and this should be the object of the head of each and every department in every company. Of course we all know that it is impossible for the head of the department to look after every detail. He is not a success unless he is a detail man, but that should mean his having his department so systematized as to produce the detail when he may need it. He should therefore surround himself with assistants, and so impress upon them their duties to the company and the public, both by precept and example, that the tactful relations with the customer may be maintained without jeopardizing the best interests of the company.

From the office boy and the elevator conductor, through all the ramifications in the organization of a great company, up to the president, upon each and every one depend the reputation of the company and its popularity, or lack of it, with the public. The office boy of today may be the president of tomorrow; the bookkeeper or bill clerk may later be the comptroller; but this can only be if he so fulfills his duty as to impress favorably the outside public, to accomplish which he must continually strive to maintain the friendly relations of the company with the customer.

The perfunctory performance of duties devolving upon us never produces preferment. Every employe should be ambitious to improve his position in his company. To secure this advancement, he should not be content simply to do his duty, but should strive to do it better than anyone else could perform the same duty. It may at first seem that I am now away from my subject. Not so. Much good or much harm may be done the company in the minds of the public by those with whom the public may never come in personal contact.

The introduction of the telephone in business life has been at once a great blessing and a great curse. To the acquisition of the telephone is attributable much of the development of business possibilities. This we all know. But unfortunately we also know that to the misuse or careless use of the telephone is due much of the ill-feeling exhibited by the public toward public-service corporations. Too much care cannot be exercised by the department manager in impressing on the minds of those under him the necessity of courteous telephone treatment.

It is one of the peculiar weaknesses of human nature that we are all more or less prone to adopt, at times, an acrimonious or peremptory tone on the telephone which we would not dream of employing if dealing with the customer in persona propria, and this is particularly true of the junior clerk or office boy who conceives an exaggerated idea of his own importance. To school those whose duties bring them into frequent daily contact with the public over the telephone, to be patient, polite and exact, is a task of no small magnitude; but it is one that cannot fail to commend itself to the men in authority who carefully study the situation. I do not think I am overstating the case when I affirm that a company's reputation with the general public depends, in the last analysis, upon [illegible] in telephone communications, is rapidly passing [illegible]

[illegible] friendly relations with customers. This is, of [illegible] is the relation to the customer of the contract [illegible] in daily and close contact with the customer, and on them devolves [illegible] the duty of maintaining the friendly relations with customers. The repair man may maintain the friendly relations more intimately by carefully and promptly attending to his duties in the connecting up or cutting off of a customer.

I have known men whose primary duty it was to cut off customers for non-payment of bills, who have so performed their duties that not only was the customer not cut off (because he paid his bill) but was made a valuable customer for the company. The meter reader can make himself valuable by his "suaviter in modo," while answering questions asked by the customer. To say, "If you want to know how much your bill is, go to the office," is one extreme of folly. To say, "Your bill for this month is so much" (not regarding the previous reading), is the other extreme. Between the crow's monosyllable of the first and the parrot's chatter of the second, the Scylla and Charybdis, lies the road to the "presidency." I have known collectors who so approached customers in demanding payment of a bill that they not only collected the bill, but left a satisfied customer after they departed.

The inspector is considered by the customer as one link in the chain of his friendship with the company, and much depends upon the tactful manner in which he may tell the customer he can or cannot be connected to the station, and the reason therefor. For instance, to speak to the customer in terms that he will understand is a delicate courtesy, and one bound to be appreciated. Harm may sometimes be done by thoughtlessly expressing oneself in technical terms. To say, "You have no City," may be English to the inspector, but Greek to the customer. It would not consume much more time to say, "It is necessary for you to procure the approval of the city inspection department and pay its fee, and this may be done, etc." But still the amicable relation might thereby be better maintained. To say, "This wiring will not pass city inspection," may be true. It would be more satisfactory to the customer if he were told, not in technical terms, but in good, every-day expression —and such is possible—wherein exist the defects that prevent that customer from furnishing his share of the income due to the company.

And now I come to him who can best show the advantage of tactful relations—the agent. The time has passed when the contract agent can be considered as a result of the central station—a something necessitated by the inherent extension of the business. He is now a prominent and necessary factor in the growth of that business. He leads, let others follow. But, because he leads, because he is on the firing line of the progress of his company, greater duties and obligations devolve upon him. To him, almost more than to any other man in the company, appears to belong the right to cherish ambition for advancement. Honorable ambition is the right, the duty, of every man. Honorable ambition means the seeking to uplift oneself only by uplifting that body or people through which one seeks to be uplifted. Therefore, while the agent has a greater opportunity, from his daily association with the business world, to find means to gratify his ambition, there rests upon him, for that very reason, a greater responsibility—that he shall so conduct himself and so perform his duties that he will advance the interest of the company he represents.

The agent in his methods and his treatment of customers will almost inevitably grow to be a replica of the head of the department. Much care should then be taken in the choice of and after-handling of those agents, and on this point I feel that the advice of a well-known essayist cannot be improved upon, but is as true today as when it was written, almost a hundred years ago. He says:

"You should behave to your subordinate agents in such a manner that they would not be afraid to be frank with you. They should be able to comment freely upon your directions, and may thus become your best counselors. For those who are intrusted with the execution of any work are likely to see things which have been overlooked by the person who designed it, however sagacious he may be."

You must not interfere unnecessarily with your agents, as it gives them the habit of leaving too much upon you. Sir Walter Scott says of Canning: "I fear he works himself too hard, under

1. This excellent paper, given here in full, was read before the Iowa Electrical Association at Des Moines on April 22, 1908. Mr. Ferguson is the assistant to the general contract agent of the Commonwealth Edison Company of Chicago. His paper deserves a careful reading by every solicitor for a central-station company.

the great error of trying to do too much with his own hand, and to see everything with his own eyes. Whereas the greatest general and the first statesman must, in many cases, be content to use the eyes and fingers of others, and hold themselves contented with the exercise of the greatest care in the choice of implements." Most men of vigorous minds and nice perceptions will be apt to interfere too much; but it should always be one of the chief objects of a person in authority to train up those around him to do without him. He should try to give them some self-reliance. It should be his aim to create a standard as to the way in which things are to be done—not to do them all himself. That standard is likely to be maintained for some time, in case of his absence, illness or death; and it will be applied daily to many things that must be done without a careful inspection on his part, even when he is in full vigor.

With respect to those agents whom you employ to represent you, your inclination should be to treat them with hearty confidence. In justice to them, as well as for your own sake, the limits which you lay down for their guidance should be precise. Within those limits you should allow them a large discretionary power. You must be careful not to blame your agent for departing from your orders, when, in fact, the discrepancy which you notice is nothing more than the usual difference in the way in which different men set about the same accomplishment. For a difference of this kind you should have been prepared. But if you are in haste to blame your representative, your captiousness may throw a great burden upon him unnecessarily. It is not the success of the undertaking only that he will thenceforward be intent upon; he will be anxious that each step should be done exactly after your fancy. And this may embarrass him, render him indecisive, and lead to his failing altogether.

The surest way to make agents do their work is to show them that their efforts are appreciated with nicety. For this purpose you should not only be careful in your promotions and rewards, but in your daily dealing with them you should beware of making slight or haphazard criticisms on any of their proceedings. Your praise should not only be right in the substance, but put upon the right foundation; it should point to their most strenuous and most judicious exertion. I do not mean that it should always be given at the time of their exertions being made, but it should show that they had not passed by unnoticed.

Gentlemen, take home to yourselves the question of the careful choosing of solicitors. When the coal agent or the man from the oil company calls on you, you will instinctively judge the company by its representative and govern yourself accordingly. Choose, then, solicitors who do, in the true sense of the word, represent you. Finesse and diplomacy are qualities that every solicitor should cultivate, but never at the expense of good faith. In the long run, it is sincerity that wins the business and holds it. A customer ignored is a customer antagonized. A mountain of contracted business may be piled up by solicitors who fail to realize the vital relations of promise to performance. The successful consummation of a contract is only attained when the customer is made to feel that his best interests and those of the company are identical.

As to the agent. The man who feels thoroughly the responsibility and dignity of his position is usually the most successful. He will use every means in his power to reflect credit upon his company; he will note carefully all minor details as well as those of major import; he will endeavor to acquaint himself with the full nature of his subject before approaching the customer; and, above all, will not allow false pride or fear or appearing unduly ignorant to deter him from asking questions of his superiors, the failure to do which may tend to a necessary display of that ignorance and his discredit in the eyes of the customer. "Be sure [illegible] right, then go ahead."

Each agent, in his district, is the company, and he should so deport himself in his relations with the public that he may demonstrate the good effect of "tactful relations with customers." Let him not be arbitrary in his statements, so as to antagonize [illegible] "but [illegible] gently." "Be not too tame, neither." "Be just, and fear not." With these trite but true quotations as his mottoes, he will maintain the tactful relations and may justly find himself imbued with the inspiration of hon- [illegible] disappointed.

Unfortunately, some agents show a tendency to [illegible] individual personality in its securing for them an introduction [illegible]

it difficult and expensive to extricate itself. The wise man will rather assure himself first of his position as represented in the ultimate advantage to be derived by the company. He will satisfy himself that the financial terms of the contract are fair and profitable; that the clauses in the contract are carefully and legally drawn. The agent is often too anxious to sign his name to a contract for three or four thousand lights, to study well whether the contract is worth the paper on which it is written. But with the financial terms of the contract fair and profitable, with the clauses carefully and legally drawn, the agent may cheerfully approach that customer. He may then supplement the "suaviter in modo" with the "fortiter in re," and nine times out of ten he will land a customer, and one who, with tactful handling thereafter, will be a satisfied income-producer and a good advertiser.

I will take up one other department—one so important, and in its very essence depending so very much upon tact, and, if tactfully administered, of such great and lasting benefit to the central-station company, that to omit it in a paper of this kind would indeed be a grievous error. I refer to the department dealing with complaints from customers. I am sure you will agree with me that here indeed is the opportunity for a display of tact of the highest order. The customer appearing before the representative of the claim department is, from the very fact that he is there, almost always in a state of antagonism to the company. If he comes honestly to complain, he feels that he has suffered an injury. He feels that, intentionally or unintentionally, the company has done him harm; that he has been asked to pay for that which he has not received, and, worse than all, he comes with a premonition that, dealing with a corporation, he is to receive no consideration, and that he must fight his battle to the bitter end. It is, of course, unnecessary, before you gentlemen, to argue why he is mistaken. It would, of course, be superfluous to remind you that the employes of a corporation who have rendered him his bill have done so in all honesty and with fair intent; but, gentlemen, it devolves upon the claim agent to convince this exasperated man that no injury has been done him, or that, if he has suffered an unintentional harm, the company is only too anxious to right the wrong.

The claim man, therefore, should be one who would instinctively and at once be able to judge the character and temperament of him with whom he is to deal. In the majority of cases, I think it is a mistake to try to convince the claimant of the correctness of his bill at the first interview. Rather I would advise that his complaint should be carefully and respectfully listened to, and then he be informed that a thorough investigation would be made. When this investigation has been made the claim man should look well into the conditions and satisfy himself that, having once taken a position based upon that investigation, his ground should be so sure that no evidence could afterward be brought to cause him to withdraw therefrom.

Should the result of this investigation show that an error has been made in the reading of the meter, or in figuring the bill, or in any other way, he should at once hasten to apprise the customer of this fact, state to him the rebate to which he might be entitled, and make the customer feel that the company is grateful to him for giving it an opportunity to rectify the wrong. Where the result of the investigation shows that the readings are correct, and that no injustice has been done to the customer, then I believe he should, as far as possible, seek a personal interview in which he may explain to the customer why the bill appears to be right, and in which he may receive from the customer information which would tend to show the justice of the company's position.

The position of claim agent is a very trying one, but it has its ray of sunshine in that oftentimes the claim agent can afterward point to cases where he has proven to the customer's satisfaction that the bill as rendered was correct, and he will find that that honest contestant, once satisfied as to the company's just treatment, will thereafter not only cheerfully pay his bills so long as they are correct, but will at all times, in and out of season, bear evidence to the fair, just and tactful methods pursued by the company.

Finally, let us remember, gentlemen, that the primary object of our business, as of any other business, is financial advancement. What the citizen needs in our line we must give him; what he thinks he needs, we must find for him; what he is unaware of in his needs, we must show him, and all for the commercial betterment of our city and the financial advancement of our company.

"Damaged-by-Gas" Sales.

A damaged-by-fire (water or smoke) sale always suggests great possibilities and has a remarkable fascination for bargain hunters. But the trouble is, these sales are dependent upon a fire in the store or at least in the neighborhood, and many a neighborhood gets along for years without a first-class fire.

[illegible] a "damaged-by-[illegible]" sale? Some [illegible] will use gas as an illuminant, and such a sale could be indulged in at least twice a year. There are many classes of goods that the by-products of gas in combustion damage, and it doesn't take long to do it, either.—Lux.

The Use of Electric Signs.

There is no longer a question among the leaders in advertising about the merit or permanency of electrical signs.

The sale of current for advertising purposes presents a field worthy of consideration to every man who is interested in a central station.

The per capita expenditure in 1907 for printed advertising, according to the most authentic estimate, was $5. Few cities expended in 1907 upon electrical advertising more than 25 cents per capita, but for every central-station company willing to furnish the kind of service needed by advertisers as a class there awaits a gross income of at least equal to 25 cents per capita, and it is not limited to 100 cents.

No insipid effort or picayunish policy will yield such a return. It is a co-operative project.

The city to be thus supplied demands a colossal spectacle of illumination made up of individual electrical advertising features, varied and beautiful; the whole should constitute a leading attraction to the city and one that can be seen nightly until midnight.

The individual advertiser needs all these requirements and is willing to pay for them. He is of a class of patrons who demand originality, because he desires a sign that is not an imitation of the design of his neighbor's sign. He wants the central-station service in operating the sign, including its turning "on and off." For all this service he prefers quotation or charging in a monthly uniform amount of dollars—not kilowatts.

The central-station company will realize a marked advantage through supplying the controlled service as contrasted with that of undirected supply. The relative difference in many cities would be that of revenue from lamps burning 2,000 hours per year and lamps burning 500 hours per year; the difference between brilliant thoroughfares and dismal, deserted streets.

There is no stopping point in the development of electrical advertising. Its existence is an outcome of the progress of all advertising, which has been advancing like other methods of communication.

The patronage will increase correspondingly with the improvement in the signs. Merchants are not encouraged to handle old styles or employ antiquated methods. Perpetual improvement will advance the sale of signs as it has advanced the sale of other things.

The outlook for revenue in this class of patronage is vast. The number of possible patrons is greater than the number of purchasers of all magazine and newspaper advertising. Small or large cities, regardless of location, can yield $2 per capita and still the community will receive a surplus in benefits.

In these days, while there is more than ever a tendency upon the part of advertisers large and small to increase their efforts for more business, it will profit the central-station company to develop a class of service that is salable to advertisers to augment their printed advertising and to concerns that do not use printed advertising.

The central-station company as it increases its patronage along these lines will share in the general advantages thereby given to the community. An easier market is at the same time made for every other class of electrical service.—George Williams, in N. E. L. A. Bulletin.

Commercial Day at Chicago Convention.

Thursday, May 21st, will be "Commercial Day" at the National Electric Light Association's coming convention in Chicago. George W. Williams, who is one of the best-known commercial men in the country, and Frank B. Rae are joint editors of what will probably be one of the interesting features—"An Illustrated Talk on the Methods of Creating Demand for Electricity." This will include stereopticon views showing in detail the progress of the outline and sign lighting in large and small cities. Percy Ingalls, who has been actively engaged in the publicity and public-policy work of the Public Service Corporation of New Jersey for a number of years, has been secured as editor of the paper on "Publicity." This subject is divided in two parts: (a) Methods to create public sentiment; (b) dormant publicity opportunities of lighting companies.

Transatlantic wireless telegraph service by the Marconi Company had an interruption a few days ago when the antennæ at the Glace Bay receiving station were snapped by a severe storm. The manager explained that the broken wires were at the top of a slim 210-foot pole covered with ice and sleet. The interruption was due to the inability to find someone who was willing to be hoisted to the top of the pole to make repairs while the storm was raging.

Arc Light Electrodes.

At a recent meeting of the Armour Institute Branch of the American Institute of Electrical Engineers, A. B. Cornwell, '08, read a paper on "Arc Light Electrodes." Electrodes were grouped into three general classes: (1) carbon electrodes, (2) electrodes of carbon combined with other minerals, (3) electrodes of metallic oxides and of metals.

Carbon electrodes will maintain a steady arc on alternating current at a low voltage. This together with low cost are their chief advantages. To increase the conductivity of carbon electrodes they are copper coated. The one-half-inch carbon is in most general use, but experiments on the small carbons speak well for them. It is said that five-sixteenth-inch carbons have higher efficiency, whiter light and hold a steadier arc. The expense of trimming, however, is increased with the smaller carbon. The life of the five-sixteenth-inch carbon is from 65 to 70 hours, while that of the one-half-inch is about 100 hours. The total increase in maintenance for the five-sixteenth-inch carbons is about 20 per cent.

The second class of electrodes is frequently spoken of as mineralized or impregnated carbons. The minerals are placed in the electrode as a core in a carbon shell or in the paste when the electrode is made. It is contended that the cored carbons prevent the arc wandering around the crater. Not all cored carbons are classed as mineralized carbons. A few of the minerals commonly used are silicates, chlorates, phosphates, magnesia and borates of soda and potash. To reduce combustion, silicates, chlorates, phosphates and boric acid are used. To augment conductivity, magnesia, borates of soda and potash and boric acid are used. To increase luminosity, salts of lime, and particularly the phosphates are added. The proportion of minerals in impregnated carbons reaches as high as seven per cent. The arc does not give the continuous spectrum of a heated solid but the line spectrum of a heated gas.

In the third class electrodes are made up of metallic oxides. The fundamental principle in the production of these electrodes consists in the combination of oxides possessing luminiferous properties with oxides of non-luminiferous properties but which are more conductive. Pure metals, as iron and copper, are used as electrodes when a particular color is desired. Magnetite and hematite are in quite common use. Titanium oxide makes the most luminiferous material but is a poor conductor at ordinary temperatures.

One of the most notable examples of the use of mineralized carbons is in the flaming arc lamp. Electrodes of metallic oxides are used also in the magnetite arc lamps. Most of the light from such lamps emanates from the arc itself and very little from the electrodes. Tests made in the Electrical Testing Laboratories, New York, on a Koerting and Mathiesen flaming arc and a standard five-ampere single-globe enclosed arc show the flaming arc gives five times the luminous flux for the same energy consumption.

The flaming arc has a number of drawbacks. It must be trimmed once a day to the enclosed arc's once a week, requires a higher pole for mounting and is a much more expensive lamp to buy.

In the magnetite arc the negative electrode contains oxides of magnetite, titanium and chromium. The positive electrode used with this negative is usually a metal. Copper has been used to some extent. The magnetite arc shows a very good efficiency and has a good distribution. The life of a magnetite electrode is longer than that of a carbon, being about 175 hours for the magnetite to about 100 to 125 hours for the carbon. The copper electrode used with it has a life of nearly 3,000 hours in many cases. A magnetite arc requires no inner globe, and while designed to operate on direct current, it may be run from an alternating-current circuit with a mercury-arc rectifier.

Confer on Distribution Rights of the Sanitary District in Chicago.

The advent of the Sanitary District into the lighting field in Chicago has raised the question of what rights the Drainage Board has to distribute its current and what privileges it shall be accorded by the city. The power, generated at Lockport, was made available by money raised by taxation, and this fact, it is contended by some authorities, places certain restrictions as to the manner of disposing of the current.

The Sanitary District plant at Lockport is constructed for an ultimate capacity of 40,000 horsepower, and half of this is now available. The city of Chicago is now using 6,000 horsepower and the parks are preparing to use 2,000. The remaining 12,000 horsepower, according to a statement by President McCormick of the Drainage Board, has been contracted for by private consumers.

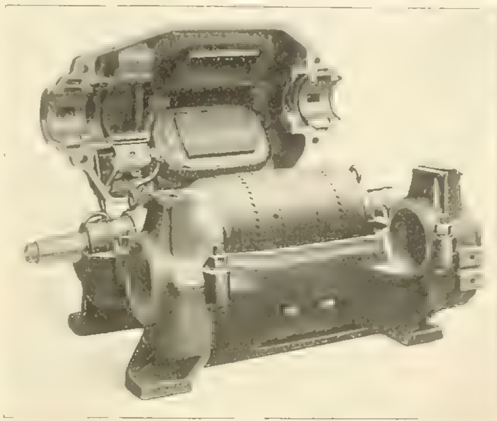
Current for use in Chicago, as is well known, is distributed from the Sanitary District sub-station at Western Avenue and the canal. Power for municipal and park lighting is transmitted from the sub-station over the city's pole lines and conduits. But it is in the distribution of the supply for private consumers that the question arises.

[illegible] regarding the rights of the district to build distribution lines and what privileges it was entitled to from the city. It is understood that no further action will be taken until a report is made by City Electrician Carroll covering various phases of the situation.

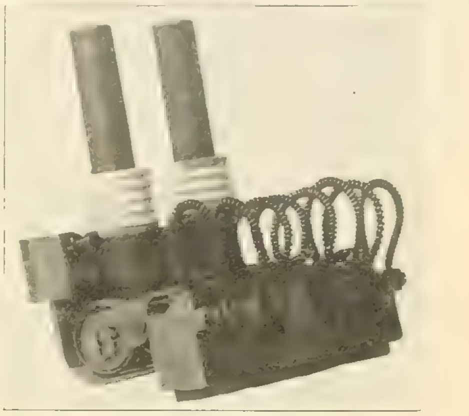
Westinghouse Mill Motor.

The installations of electric motors for driving auxiliary machinery in steel mills have increased rapidly in the last few years, largely because their general characteristics make them particularly adaptable for this class of service; and, owing to their ruggedness, mechanically and electrically, and the perfection of the control systems now developed, the electric drive gives results that are satisfactory and reliable. The temperature in the mills is generally high; great quantities of metallic dust are present; the loads vary rapidly between wide limits, subjecting the motors to excessive mechanical and electrical strains; frequent reversals are required, and uninterrupted service with practically continuous operation is a necessity.

The Westinghouse mill type of direct-current motor, which has recently been put on the market to meet these conditions, has been carefully designed, after a conference with a large number of prominent steel-mill engineers, with a full knowledge of all the electrical and mechanical requirements.



WESTINGHOUSE MILL MOTOR WITH UPPER FRAME RAISED.



BRUSH-HOLDER AND BRUSHES OF MILL-TYYE MOTOR.

The illustration shows the motor opened for removal of the armature. As shown, the motor frame is divided horizontally and is hinged, allowing the upper half to be swung back and repairs made in the minimum amount of time. The heavy section of the frame insures rigidity and freedom from vibration. The frame is provided with handholes for inspection of the commutator and windings, but the covers fit tightly and the frame is dustproof. The bearing housing is extended beyond the bearing and a dustproof construction is secured by means of a steel washer and felt lining.

The bearings are particularly satisfactory because of the large amount of wearing surface, which insures a long life. The air-gap between the fields and the armature is large, which allows of considerable wear in the bearings before the revolving and stationary parts could rub. Special provisions have been made which prevent oil from being drawn into the armature as well as from creeping along the shaft.

The commutator and brushes are constructed with a low-current density, and thus tend to reduce the heating to a minimum. The commutator is mounted on the same spider as the armature laminations, so that the shaft may be readily removed.

The carbon holder is of very substantial design and so constructed that by the removal of one holding bolt the entire holder, as one piece, can be removed from the motor. The insulation is thoroughly protected from moisture and mechanical injury.

The armature coils are made of strap copper, insulated with mica tape, hand-wound. This form of coil can be easily repaired by the customer, which is not possible with wire-wound coils, as they are useless if the insulation becomes badly damaged.

Simplicity and accessibility of all parts for repair or removal are characteristic features of the motors, giving the advantage of quick changes and little loss of time.

The Union Industrial Railway Company has been incorporated at Aline, Okla., with a capital of $15,000. George W. Graham of Aline and H. A. Noah of Alva are among the incorporators.

A Great Power Plant

[illegible] engine is rated nominally at 8,000 horsepower, but [illegible] power of six such vessels as the Connecticut, flag- [illegible] power to spare. The combined engine power of three or four leviathans of the deep, like the Kaiser Wilhelm II., the Oceanic, and the new turbine steamers built for the Cunard line, would be re- [illegible] ways. Measured in electrical terms, the daily average output of the nine engines is about 800,000 kilowatt-hours. Roughly, this is equivalent to 1,250,000 horsepower exerted for one hour. One thousand tons of coal and 1,800,000 gallons of water, or enough to supply the needs of a city of 30,000 to 40,000 inhabitants, are required daily. Naturally, the outcome of a test of an installation of this magnitude is of much interest.

Street-railway Settlement in Cleveland.

Street-car service was absolutely free in Cleveland on April 28th, such action having been decided upon after the papers had been finally signed ending the long street-car war, in order that the occasion might be duly commemorated. The three-cent rate of fare went into effect on April 29th.

A. B. Du Pont is president of the newly organized Cleveland Railway Company, which is now sole operator of the entire street-railway systems of Cleveland under three-cent fare and a security grant.

BOOK TABLE.

Cement Workers' Hand-book. By W. H. Baker. Fourth edition, revised. Atlanta, Ga.: The Concrete Age Publishing Company. 1908. Pp. (3½ by 5¾ inches), 98. Price, cloth, 50 cents.

The subject of cement and concrete construction is presented in a practical way. Written in simple language by a man who has spent years in the business, the book is compiled to meet the requirements of the common workman. Information is given as to mixing cement, sand, gravel, etc., in the right proportions to get the best results. About fifty subjects are covered in the five parts bearing the general title, respectively: Introduction to Commercial Hydraulic Cements; Mortars; Concretes; Cast Masonry; Practical Notes on Cement Work.

Street-railway Veterans in Boston.

Old times in street railroading in Boston and vicinity were recalled at a meeting of many of the veterans in the service a few days ago which resulted in the formation of the Cambridge Horse Railroad Veterans' Association. The president of the Boston Elevated Railway Company, Maj.-Gen. William A. Bancroft, was chosen as president of the organization, and most of those who were present are employes of the Elevated system. The line to Harvard Square from Boston was one of the first electric railways in the world. It was also the pioneer horse railway in New England, dating back to 1853.

At a recent meeting of the City Council of Edmonton, Alberta, the proposal to build a municipal street-railway system was again discussed, and it was the opinion of the aldermen that it would be unwise to burden the city with the debt. It is likely that a franchise will be given to some company to construct a system. Mayor Macdougall may be addressed.

New Central Union Exchange at Indianapolis.

After months of preparation for the change, the Central Union Telephone Company has transferred the service of its Main Exchange in Indianapolis from the building on West Ohio Street to its new building at Meridian and New York streets. The exchange equipment occupies the three top floors of the new structure, which is said to be one of the most complete and modern exchanges in the country. The transfer of the exchange was made at midnight without the knowledge or interference of subscribers.

The switchboard contains more than 250,000 spring jacks, which occupy an area of more than 450 square feet of surface. The simplest of these jacks have three electric contacts, some having as high as nine, and on the average there are seven wires connected to each jack, making, with the auxiliary wiring, a total of more than 2,500,000 connections, all of which had to be carefully made and tested. On the sixth floor the third, or toll switchboard, is located. This board is attended by 36 operators, all long-distance calls being handled from this room. It is asserted that many of the features of the toll board are entirely new, having been specially designed to fit the special conditions which have been found to arise in the Indianapolis toll service.

GENERAL TELEPHONE NEWS

J. E. Proffitt and associates have organized a new telephone company in Cook, Neb.

There were 18 new telephone companies in South Dakota organized during the first quarter of 1908.

The Independent Telephone Company of Waco, Tex., is said to have sustained a fire loss of $50,000, half covered by insurance.

The Iowa Telephone Company of Clinton will erect a building and construct an underground telephone system, representing an expenditure of $150,000.

Government telephone ownership is likely to be expensive in Manitoba, and those who are looking forward to a reduction in the rates are apparently doomed to disappointment.

The Western Electric Telephone Company of Mason City, Iowa, will expend $75,000 to $100,000 on improvements this year, including the erection of poles, substituting copper for iron wire and building new lines.

Among recently incorporated telephone companies are the following named: Beacon Telephone Company, Emerson, Neb.; Wilcox Telephone Company, Wilcox, Neb.; Strang Mutual Telephone Company, Strang, Neb.; Farmers' Mutual Telephone Company, Elk City, Kan.; Rector Co-operative Telephone Company, Rector, Ark.; New State Telephone Company, Lone Wolf, Okla.

The Central Union Telephone Company has abandoned the telephone business in Yorktown, Ind., and vicinity to an Independent concern controlled by F. E. Barber of Dalesville. The Central Union abandons nearly 200 telephones in this instance, and the new company starts out with nearly 300 subscribers. An agreement with the Delaware and Madison Counties Telephone Company gives the Yorktown company connection with the Muncie exchange.

The Indiana Independent Telephone Association has prepared an excellent programme for its third annual convention, which will be held at the Claypool Hotel, Indianapolis, May 13th and 14th. J. B. Ware of Grand Rapids will give an address on "The International Association and Its Work," and M. L. Clawson of Indianapolis will talk on the "Legal Impediments to Consolidation." There will be interesting reports from the eleven vice-presidents who are the presiding officers respectively of the eleven district associations of the state. An exhibit of appliances will be made, and there will be a smoker on the thirteenth.

An ordinance intended to give legal effect to a settlement of disputes between the Missouri and Kansas Telephone Company and the authorities of Kansas City has been introduced in the City Council. It proposes an immediate reduction of telephone rates from $96 to $60 in the business dis- [illegible] in residences. Accompanying this ordinance was another effecting a compromise between the city [illegible] two per cent. of the gross earnings of the com- [illegible] wires. If enacted the new ordinance places the [illegible]

CORRESPONDENCE.

Great Britain.

London, April 24.—The report and accounts of the Marconi Wireless Telegraph Company for the year ended September 30, 1907, has just been issued. The directors have decided to ask the shareholders to approve of an issue of $1,250,000 seven per cent. participating cumulative preference shares. The proceeds of the new issue will serve to pay off the company's engagements to bankers and others. Dealing with transatlantic communication, the report refers to the completion of the Clifden and Glace Bay stations and mentions the fact that one newspaper in New York has during five months received dispatches totaling 68,404 words "promptly and efficiently transmitted by the Marconi Company." The two stations mentioned above are to be brought up to the same level of efficiency as the Poldhu and Cape Cod stations. On the basis of an improved Irish-Canadian service and of the contemplated English-American service, working the four stations 12 hours a day at an average net wireless rate of eight cents per word and at a speed of 20 words per minute, it is estimated that a net revenue (after deducting working expenses) approaching $750,000 per annum is capable of being earned by these four stations.

The London Electrobus Company will next week ask for public subscriptions for new capital. It is probable that this second appeal to the public will be successful, as the small service now running is producing a revenue of about 27 cents per car-mile. The idea is to place 150 omnibuses upon the streets. The company, it may be mentioned, is now supplying omnibuses for other companies, and one of 14 which are to do service in and around Brighton recently made the trip to that seaside resort, a distance of over 55 miles, on one charge. Only mechanical troubles were encountered.

The accounts of the British Aluminum Company for the year 1907 show a net profit of $225,000. In comparison with the previous year there has been a decline in the profits, but this is attributed to the slump in copper last July and to the resulting demoralization in metal markets generally. There has been no recovery in the price of aluminum, but it is stated that the demand has been more brisk of late and improved prices are anticipated.

G.

New York.

New York City, May 2.—Yesterday was marked by the opening of the extension of the Brooklyn Subway from Borough Hall to Atlantic and Flatbush avenues, where the terminal of the Long Island Railroad is located. The occasion was fittingly celebrated on the previous day, when the official inspection of the extension was made by a large number of public officials and prominent citizens. On January 9th last the subway to Brooklyn under the river was opened. The present extension runs under Fulton Street and Flatbush Avenue and adds three more subway stations. It is important because it forms the connecting link between the fast transit lines of Manhattan and Long Island.

At the continuation of the Fire Department investigation before the commissioners of accounts yesterday, Kempster B. Miller of Chicago, who made an examination of the fire-alarm-telegraph system at the instigation of the Board of Fire Underwriters, testified to the generally poor condition of the system, corroborating the testimony given the day before by Superintendent Martin, and asserting that a slight accident might, at any minute, put the system out of business and seriously endanger millions of dollars' worth of property. Mr. Miller testified that he believed the telegraph system was the worst thing about the department at this time; that there ought to be twice as many alarm boxes as there are, and that they all should be of a modern type. He suggested a site in Central Park as the proper place for a new building to house the central station of the system.

The New York Electrical Society held its two-hundred-and-seventy-sixth meeting in the Engineering Societies Building on Wednesday night. Mr. W. N. Dickinson, Jr., manager of the foreign department of the Otis Elevator Company, gave an interesting lecture on "Modern Progress in Elevator Practice." His remarks showed the pronounced tendency toward the operation of elevators from electric circuits, the degree of perfection which has been attained in direct-current elevators and the outlook for the duplication on alternating-current circuits of all classes of service now possible on direct-current circuits. Pictures were shown for the first time illustrating the latest developments in the magnetic control for alternating-current elevators using alternating-current magnets throughout.

Mr. and Mrs. Thomas A. Edison have just returned from their winter home at Fort Myers, Fla. While in Florida their 10-year-old son, Theodore underwent an operation on the ear, which prevented a more serious operation for the relief of [illegible]. This was the ailment for which Mr. Edison was operated on just before his departure for the South.

The Public Service Railway Company of New Jersey, which owns the various trolley lines in North Jersey, formerly owned by the Public Service Corporation, will authorize an issue of $25,000,000 five per cent. gold bonds, to be offered upon terms not yet fully determined. The proceeds are to be used for the reconstruction of the existing lines, and the retirement of the $7,500,000 five per cent. five-year loan, made in 1904.

W.

Michigan.

Detroit, May 2.—The Detroit, Jackson and Chicago Railway will reduce the running time of local cars between Detroit and Jackson 15 minutes, and the limited cars will make the run in 2½ hours instead of 2¾ hours as formerly.

The Common Council of the village of East Jordan has contracted with the East Jordan Electric Light and Power Company for a term of 10 years for pumping and street lighting. The previous contract has three years to run, but on account of the growth of the village, necessitating extensive changes in the pumping plant, and additional street lighting, a new contract was necessary.

It was announced that work on the Kalamazoo, Elkhart and South Bend traction line would be started this month. The route includes Kalamazoo, Vicksburg, Parkville, Three Rivers, Constantine, Mottville, Bristol, Elkhart, Mishawaka and South Bend, and is 73 miles long. It is expected that more than half of the line will be completed this summer.

The Toledo and Western Railway and J. D. Avis of Hudson presented a proposition to the Common Council of the village of Morenci in regard to street lighting. No definite action was taken and a formal proposition will be presented at the next regular meeting of the Council.

The Detroit Trust Company, receiver for the Detroit, Flint and Saginaw Railway Company, has petitioned the Circuit Court at Flint for permission to renew franchises which the railway company holds and which expire within a week. The franchises are on the proposed route of the road from its present terminus at Frankenmouth to Flint, and the petition is filed to protect the interest of the purchasers of the road when it is sold under mortgage-foreclosure proceedings in June.

The electric road between Dexter and Chelsea, known as the Boland Line, is being taken up and the rails being used to rebuild the line between Ypsilanti and Saline. Nothing will be done at present on the line between Dexter and Pacey's Corners, a distance of about three miles, but it will probably be constructed during the summer.

The demand for an electric-light plant and street lighting for Hastings is becoming more insistent.

D.

Pacific Slope.

San Francisco, May 1.—The new hydro-electric plant of the Pacific Gas and Electric Company on Deer Creek, Cal., was recently turned over and is now in successful operation. The capacity is about 8,000 horsepower.

The town of Gridley, Cal., has voted favorably on the question of a municipal electric-lighting plant.

Stockholders of the Escondido Mutual Water Company, Escondido, Cal., will establish an electric-light and power plant at an estimated cost of $30,000.

The announcement is made simultaneously with the increase of the capital stock of the Oregon Electric Company of Portland, Ore., from $2,000,000 to $10,000,000, that the company will begin at once actual construction on 283 miles of branches and laterals to the Portland-Salem Electric Railway, which was placed in operation a few weeks ago. The roads mapped out are from Portland to Tillamook, Portland to Eugene, Salem to Mill City, Salem to Dallas, Salem to Albany, and Albany to Cascadia. The road is backed by Moffatt & White of New York city. The company, of which Charles M. Pratt of New York is president, has just finished the electric road to Salem, and when the additions are completed the system of electric roads of the company terminating in Portland will exceed 330 miles.

An electric-railway company has been organized by Portland and Seattle men, including H. I. Keeny, Geo. C. Mason and Mark W. Gill, for the purpose of building an electric railway from Condon to Bend, Ore., crossing the John Day River.

The United States authorities visited the officers of the Oakland Transcontinental Aerial Telephone and Power Company, Oakland, Cal., on April 28th and arrested six of the promoters. A United States postal inspector secured sufficient evidence against the men to warrant their arrest on a charge of using the United States mails to defraud.

The electric generating station in the power-house annex of the Claus Spreckels Building on Stevenson Street, San Francisco, is practically completed, although the interior of the new portion of the building is not quite finished. The two 650-kilo-

watt, 2,250-volt Westinghouse-Parsons turbo-generators have been turned over and found to be up to the requirements. It is said to be the intention of Mr. Spreckels to lay underground mains within a radius of about one-half mile and distribute the surplus current among several other buildings in which members of the Spreckels family are interested. A.

Northwestern States.

Minneapolis, May 2.—The electric-light substation at Hudson, Wis., has been burned, entailing a loss of several thousand dollars.

The General Electric Company of Schenectady, N. Y., has been awarded the contract for new machinery at the municipal lighting station, at St. Peter, Minn. Two generators will be installed.

The City Council at Fergus Falls, Minn., has rejected the bid of the Union Engineering and Construction Company of Chicago, for the completion of the light dam, and may construct it by day labor. The bid was $41,893.

William McCoy and J. H. Holmes of Rochester, Minn., have opened a general electrical supply business at 312 S. Broadway.

L. C. Lane and others of Kendal, N. D., are forming a company to furnish the city with electric lights.

The power plant of the Sioux City Traction Company at Sioux City, Iowa, will be improved by the installation of new boilers and machinery.

The question to issue electric-light bonds was carried at the election in McCook, Neb.

The town of Gresham, Neb., recently voted bonds for electric lights.

Capitalists of Grand Forks, N. D., are interested in the proposed construction of a street-railway system at that place to cost $50,000. Mr. Bachellor may be addressed.

The construction of an electric interurban line from Knoxville, Iowa, to Dallas, will be begun shortly.

The Watertown Water, Light and Power Company of Watertown, S. D., has been granted a 10-year renewal of its franchise with the city.

The Mississippi River and Electric Power Company of Minneapolis, Minn., will construct two power dams, one in Monticello and the other near Clearwater. R.

PERSONAL.

Mr. Frank W. Frueauff, vice-president and general manager of the Denver Gas and Electric Company, was a Chicago visitor last week.

Mr. William R. Wilcox, chairman of the Public Service Commission of New York city, was in Chicago last week and made several interesting addresses before various organizations.

Mr. F. H. Petrie, secretary of the Mechanical Appliance Company, Milwaukee, Wis., has resigned to accept the position of assistant sales manager of the Northern Electrical Manufacturing Company, Madison, Wis.

Prof. Elihu Thomson has written an interesting "Retrospect" for the General Electric Review for May. The article, which is illustrated, is devoted to the methods and expedients adopted in the early days of electrical manufacturing.

John Sprague Vogler, age 65 years, a veteran naval paymaster of the Civil War, and for the last 16 years identified with the Edison Electric Illuminating Company of Boston, died on April 25th at his home in Atlantic, near Quincy, Mass.

Mr. Adolf Müller, president of the Accumulatoren-Fabrik Aktien-Gesellschaft, of Berlin, maker of Tudor storage batteries, is spending a couple of weeks in this country, and he was in Chicago early in the week. He visited the plants of the Commonwealth Edison Company and was the guest of Mr. Godfrey H. Atkin, local manager of the Electric Storage Battery Company, with which Mr. Müller's company is allied.

Friends of Mr. Frank N. Boyer, and they are numerous, will be delighted to learn that he has been appointed assistant manager of the Chicago office of the General Electric Company, succeeding Mr. James W. Johnson, the new manager. Mr. Boyer will continue as manager of the supply department. Mr. W. T. Dean has been made manager of the power and mining department. Mr. Dean has been in this department for some time, having had special charge of the company's business with the steel and rolling mills. He was formerly electrician for the Illinois Steel Company.

Mr. Harry B. Ivers, who for the last year has been assistant to the president and treasurer of the Bangor (Me.) Railway and Electric Company, has resigned to go to Lewiston, Me., where he is to assume the position of general manager of the Lewiston, Augusta and Waterville Railway Company, the consolidation of electric roads in the middle and western part of Maine which has been brought about by John R. Graham, president of the Bangor Railway and Electric Company, and [illegible] the [illegible] Mr. James W. Cart[illegible], Jr. [illegible] Bangor [illegible] Walter [illegible] Sawtelle [illegible] purchasing agent and will also continue in charge of the work of soliciting new business.

ELECTRIC LIGHTING.

The Menomonee Falls (Wis.) Electric Lighting Company will put in improvements to cost $16,000.

F. Hagemeister of Farmers' Valley, Neb., has bought the electric-light plant at Henderson, Neb.

The Concordia (Kan.) Electric Light Company has passed into the hands of L. K. Green of Osborne.

The Iberia Mill and Electric Light Company of Iberia, Mo., has been incorporated with a capital of $9,000.

L. C. Lane and others of Kensal, N. D., have formed a company and will install an electric-light plant and take over the local telephone system.

The Edison Electric Illuminating Company of Brockton, Mass., has issued $100,000 first-mortgage five per cent. bonds of the company, due December 1, 1930.

The electric-light company operating at Fernie, B. C., has made an offer to sell out its plant to the city, and a special committee of the City Council is now considering the offer.

The Algonquin Light and Power Company of Oklahoma City has been incorporated with $100,000 capital. Thomas F. Spealman, R. S. Galer and A. J. McMahon are the incorporators.

The city of Lima, Ohio, will have a municipal lighting plant as a result of the action of the City Council. The ordinance provides for the issuing of $80,000 worth of bonds, and it is anticipated that the plant will be completed and in operation within two years.

The realization of a "Way of Light" in the downtown district of Minneapolis was brought closer a few days ago, when the City Council authorized the Publicity Club to erect lights on Nicollet Avenue between Washington and Tenth Street and on Seventh Street between Nicollet and Hennepin. The club has been actively at work upon this proposition for some time and has secured the co-operation of practically all of the property owners in the territory affected.

The City Heat and Light Company of Fostoria, Ohio, has gone into the hands of a receiver at the suit of the Consolidated Railway and Light Company of Philadelphia, which secured a judgment of $72,945 at Tiffin recently. E. W. Allen and A. R. Law were appointed by the court to take charge of the business. There will be no interference with the operation of the plant, and it is said that the action is simply to readjust the relations of the local company and the holding company.

Directors of the Atlantic City Electric Company announce that they have sold $1,000,000 of first and refunding mortgage five per cent. gold bonds, part of an authorized issue of $6,000,000. The Atlantic City Electric Company controls all the public-lighting business of Atlantic City, N. J. It is a consolidation of four companies, three of which have perpetual franchises and one a franchise for 100 years. The American Gas and Electric Company, which guarantees the bonds, owns plants in nine cities.

ELECTRIC RAILWAYS.

The Oklahoma City (Okla.) Belt Line Railroad Company has been incorporated, capitalized at $250,000. W. W. Bierce heads the incorporators.

The Oregon Electric Railway Company of Portland has begun the construction of the branch from the main line to Hillsboro, which will be the main line to the Tillamook country. The company is outlining further plans for the construction of extensive projected roads in the Willamette Valley.

The subway problem has been taken up in earnest by the local transportation committee of the Chicago City Council. Already arrangements are being made for inspecting subways in other cities, and all details in reference to the problem are being taken up with the idea of making an early decision as to the best methods to be employed and then building the subways without further loss of time. The committee promises some definite plans in the near future.

According to the annual report of the State Bureau of Railways, the total capital of the electric railways of Pennsylvania amounts to $464,553,942, divided between $240,224,061, the capitalization and current liabilities of companies engaged in direct operation and $224,329,881 reported by companies which have leased their lines and equipment. The capital and liabilities of the former show an increase of $36,571,020. More than 300 miles of [illegible]

[illegible] trolley wires by attaching the span wires to build- [illegible] wooden ones.

The Illinois Traction System has a new time card between East St. Louis and Springfield, giving 15 limited cars each way daily. In addition to which there will be the local service for the towns closer to the cities. The limited service which the company intended to commence between Peoria and Springfield has been postponed till the company can finish the ballasting of the line between Mackinaw and Lincoln, which has been delayed by the heavy [illegible]

POWER TRANSMISSION.

Fire in a building adjoining the main sub-station of the Nooksack Falls Power Company in Bellingham, Wash., destroyed all the transmission and distribution wires leading from the station. For a day the city was without light, street cars did not run, and factories and mills were idle.

An American consul in Eastern Europe reports that an official of the local government is desirous of securing from American manufacturers full information in reference to machinery for the transmission of power. A river flowing through that region has in places great power possibilities, and the local government desires to develop this power and assist in the establishment of manufacturing plants. If this plan is feasible it should result in the sale of a large amount of American machinery. Interested firms should address their correspondence to the consul for transmission to the proper person. The Bureau of Manufactures, Washington, D. C., will give information if reference is made to file No. 2201.

PUBLICATIONS.

The F. Bissell Company's calendar card for May is adorned with a crooked wire, from which an appropriate moral is drawn.

Westinghouse mill motors are described in Circular No. 1144, issued by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

The Cutter S. F. plug and receptacle illustrated on a leaflet from the Cutter Company, Philadelphia, has some attractive features. It is made for 220 volts and less.

Easy digging is made possible by the use of Iwan's patent improved post-hole and well auger. This device and others made by Iwan Bros., Streator, Ill., are illustrated and described in a booklet entitled "Easy Digging."

The Signal Engineer, a new publication to be devoted exclusively to the subject of signaling and kindred subjects, is to make its appearance in June. The announcement is made by the Signal Engineer Company, 140 West Van Buren Street, Chicago.

The Central Electric Company of Chicago has issued a new trade discount and price list, applying to its 1906-1907 General Catalogue. This price-list is dated May, 1908, and is now being distributed. Holders of catalogues who do not receive a copy of this price list are urged to write for one.

The Wagner Electric Manufacturing Company of St. Louis, Mo., is sending out a card folder giving some interesting information about the various types of Wagner single-phase and polyphase motors. Instruments and transformers are also illustrated. The company says that a Wagner motor will carry the load of the next size larger motor of any competitor.

The "Engineer's Twin City Corliss Book" is the name of a unique 26-page pamphlet just issued by the Minneapolis Steel and Machinery Company, Minneapolis, Minn. The book is well illustrated and contains a system of numbers and names which very much simplifies the matter of ordering repair or spare parts, as no two users or builders of Corliss engines use the same terms in describing the various parts. Pictures are given that will enable anyone to recognize any part of the engine, and by referring to a list the name of each part as used by the company can be easily ascertained. There has also been added an easy and quick method of setting valves, and a number of tables that should be of value to engineers.

SOCIETIES AND SCHOOLS.

At the regular weekly meeting of the Electric Club of Chicago on April 29th Mr. W. R. Bonham gave a talk on the subject of illumination, following much the same line of thought presented in his article which appeared in the Western Electrician

of April 11th. Mr. E. H. Haughton discussed some of the points brought out.

The next meeting of the Chicago Section, Illuminating Engineering Society, will be held on May 14th at the Grand Pacific Hotel as usual. A general discussion on the subject of "Wrinkles" in lighting problems that have come to the notice of anyone interested in illumination will be the programme for the evening. Details of the meeting can be had from Geo. H. Jones, secretary, 139 Adams Street.

The Society for the Extension of Technical Knowledge at the University of Grenoble, France, has published two booklets, entitled "La Distribution de l'Energie Electrique dans la Ville de Grenoble," which describes the hydro-electric installation of that city, and "La Houille Blanche et la Question Sylvo-Pastorale," which is a plea for the conservation and utilization of the natural water powers.

Mr. A. S. Michener, comptroller of the Stone & Webster Corporation, recently delivered a lecture to the senior class of the Massachusetts Institute of Technology on "The Philosophy of Accounting and the Relation of the Accounting Department with the Executive and Engineering Department." This is one of a series of lectures delivered by practical men in Prof. D. C. Jackson's course on electric light and transmission of power.

The Civil Engineers' Club of Cleveland, Ohio, has issued its annual register for 1908. The book also contains a list of officers and members of the Electric Club of Cleveland and the Cleveland Architectural Club, the former having been amalgamated with the Civil Engineers' Club on April 18th. Willard Beahan is president of the Civil Engineers' Club and Joseph C. Beardsley is secretary. Meetings are held once a month and the clubrooms are open every day but Sunday. The club had a membership on March 1st of 276 members.

The recently organized Fox River Valley Electrical Association held a meeting and banquet a few days ago in Fond du Lac, Wis. N. C. Draper, general manager of the Eastern Wisconsin Railway and Light Company, president of the association, presided. The matter of co-operation between the various interurban companies for improved service conditions and closer connections at terminals was discussed. Eighteen were present, including representatives from the interurban and electric companies in the association and several guests from Chicago. In the evening a banquet was held at the Palmer House.

The next meeting of the American Society of Mechanical Engineers will be held on the evening of May 12th in the Engineering Societies Building, New York. The paper will be by Mr. Henry Souther, of the Henry Souther Engineering Corporation, Hartford, Conn., on the subject of "Clutches," with special reference to the types used on automobiles. Their development will be shown by lantern slides. The meeting will be important to all who have to do with the use of clutches for machine-tool work, power transmission, hoisting machinery, and the like. The discussion will be continued at the semi-annual meeting of the society at Detroit, Mich., June 23d to 26th.

The May meeting of the New York Section of the Illuminating Engineering Society will be held on the evening of May 14th, at 33 West Thirty-ninth Street. Dr. E. L. Nichols, professor of physics, Cornell University, president of the American Association for the Advancement of Science, etc., will present an illustrated paper on "Daylight and Artificial Light." Dr. Nichols has recently traveled extensively throughout Europe and Northern Africa, making spectro-photometric determinations of the quality of daylight under widely varying conditions, involving about 150 sets of observations. Deducing from these an average value for daylight, he compares various artificial illuminants to such value through spectro-photometric measurements.

A special catalogue of the School of Engineering of the University of Kansas, Lawrence, Kan., contains announcements for 1907-1908. There is an electrical engineering course. In the School of Engineering there are 416 students, or about one-fourth of the total enrollment. The Legislature of 1907 appropriated $150,000 for a civil and mechanical engineering building and equipment; $50,000 for a mining engineering building, and $50,000 for additional shops. These buildings will be erected during the biennium 1907-1909. Blake Hall, named in honor of Prof. L. I. Blake, contains the laboratories. Prof. F. O. Marvin is dean of the School of Engineering; B. V. Hill is acting professor of physics and electrical engineering; M. E. Rice is [illegible] of electrical engineering.

MISCELLANEOUS.

[illegible]

750,000 in the corresponding months of 1906, yet the quantity imported was over 42,000,000 pounds, against 58,000,000 in the corresponding months of 1907 and 43,500,000 in the corresponding months of 1906.

A Berlin dispatch says that the German government has taken the preliminary steps to negotiate a patent agreement with the United States, in consequence of the prospect of federal legislation requiring foreign patentees to manufacture in the United States, otherwise their patents will be forfeited. The German law provides for forfeiture in the event of a patent remaining unused for three years if a German subject makes application to have it set aside.

The United States Civil Service Commission announces an examination on June 3, 1908, to secure eligibles from which to make certification to fill such vacancies as may occur in the positions of laboratory assistant in the Bureau of Standards, at salaries varying from $900 to $1,200 per annum, and vacancies requiring similar qualifications as they may occur in any branch of the service. The duties in connection with these positions are identical with those of the assistants in the physical laboratories of scientific and technical institutions. As far as practicable, appointees are assigned to work in the subjects for which they are best fitted. Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for application form 1312.

There appears to be a division of sentiment among paint manufacturers in relation to proposed legislation in Congress and in state Legislatures requiring the labeling of all packages of paints, oil and turpentine to show the character of the contents. At the present time such legislation is pending in several states, including Massachusetts, New Jersey, New York and Maryland. The bills are said to have been framed along the lines of the western manufacturers' ideas, as they are practically a unit in urging the proposed legislation. On the other hand, eastern paint manufacturers are said to be generally opposed to the bills. These measures would compel manufacturers to place on the outside of each package a full statement of the ingredients. The eastern manufacturers are opposed to this proposal, holding that it is tantamount to presenting the entire trade with the secrets of their business. The Paint, Oil and Varnish Club of New York and other eastern organizations have adopted resolutions opposing the proposed labeling law.

TRADE NEWS.

The address of the American Circular Loom Company has been changed to International Trust Building, 45 Milk Street, Boston, Mass.

Cross & Mack is a new firm of consulting electrical, mechanical and hydraulic engineers, located at 711 Nicollet Avenue, Minneapolis. Mr. A. B. Cross is the electrical engineer, Mr. Mack taking care of the mechanical and hydraulic end.

During the nine months ended in March, 1908, the United States exported to Germany copper ingots, bars and plates to the value of $15,182,014; electrical appliances, $174,583; electrical machinery, $59,445. The figures for the corresponding period ending with March, 1907, were $13,765,113 $275,198 and $74,335.

The district office maintained by Allis-Chalmers Company at San Francisco, in charge of Mr. H. D. Scribner, manager, has been removed from the Atlas Building to the Phillips Building, 599 Mission Street. As it is only a step from one building to the other, callers will have no difficulty in finding the new location.

Mr. W. R. Burrows, formerly purchasing agent for the Norfolk and Southern Railway, has taken charge of the railroad department of Topping Brothers, 122 Chambers Street, New York, who manufacture ball-bearing jacks, track drills, tool grinders, and Totten's brake-beam clamp invented by "Gene" Totten of the New York Central lines.

At the office of the supervising architect, Treasury Department, Washington, D. C., sealed proposals will be received until June 10th for the installation of a conduit and electric wiring system in the extension to the Postoffice and Court House Building at Ogden, Utah, in accordance with drawings and specifications, copies of which may be had at the above office, or at the office of the superintendent of construction, Ogden.

On May 1st the O. C. White Company, 17 Hermon Street, Worcester, Mass., opened a New York office and stockroom at 19 Park Place and 16 Murray Street. The company's line of standard adjustable electric fixtures is one of the most complete and substantial of this class of goods ever produced for offices, shops, drafting-rooms or factories. The New York branch is to be in the hands of Mr. Frederick Rall, who is experienced in the electrical trade in New York and widely and favorably known. The company has issued two well-illustrated circulars, one treating of White adjustable shop fixtures and the other of similar fixtures for office use. The practicability of these fixtures and their wide range of adaptability is worthy of investigation.

Robert W. Hunt & Co., the Rookery, Chicago, have established an analytical chemical laboratory in connection with their St. Louis office, 1445 Syndicate Trust Building. In addition to general analytical work, particular attention will be given to analyses of and advice on iron-foundry mixtures. This work and the laboratory will be under the direction of Mr. J. B. Emerson, who for several years past had charge of the metallurgical part of the wheel foundry of the Mount Vernon Car Company. Previous to that engagement he was in the employment of the Illinois Steel Company.

The American District Steam Company of Lockport, N. Y., originator of underground steam heating, will have an exhibit at the convention of the National Electric Light Association to be held in Chicago during the week of May 18th. This company, with more than 31 years of experience, has developed the underground steam-heating business to such a degree that its exhibit will be worth thorough investigation. Every detail of the operation of both live and exhaust underground steam-heating systems will be explained by the company's engineers and representatives, who will be in attendance.

Sealed proposals for electric supplies, including wiring material, lamps, fixtures, etc., will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., May 23, 1908. Blanks and general information relating to this circular (No. 439) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York city; custom house, New Orleans, La.; also from the U. S. engineer offices in Pittsburg, Buffalo, Cleveland, Cincinnati, Chicago, St. Louis, Detroit, Milwaukee, St. Paul, Chattanooga, Louisville, Mobile, Ala., and other cities.

The Duncan Electric Manufacturing Company, Lafayette, Ind., will exhibit at the Chicago convention during the week of May 18th one of its total-output station integrating wattmeters, also one of its latest graphic recording instruments, which it says is the most accurate and the most simple in use. These two instruments are so combined that the totalizing meter not only integrates or adds up the total output of the plant, but it also actuates the graphic recording instrument which shows the output on a moving strip of paper. This is the first public exhibition of a system whereby the output of any number of dynamos, irrespective of whether they are direct-current, or single or polyphase alternating-current, can be conveniently combined so as to show their total output on a single instrument, and is worthy of the attention of every central-station manager who is interested in the latest and most approved methods of keeping an accurate cost of the production of his electrical energy. There will be exhibited also a number of other types of Duncan meters. The exhibit will be in charge of Adrian Tobias, sales manager, and John A. Clark, laboratory expert.

The exhibit of the General Electric Company at the National Electric Light convention will occupy a space of some sixteen feet square near the center of the hall. A full line of heating devices, including the new mantel-type luminous radiator, will be shown. Prominent among the apparatus exhibited will be tungsten lamps for both interior and outdoor lighting and the luminous and flame arc lamps. There will also be exhibited the new aluminum-cell lightning arrester, a line of meters, both portable and stationary, and a number of motors, both alternating and direct-current, for small power purposes. An oscillograph will be in operation and records will be taken to show the effect of different values of reactance on the wave form. A daily demonstration of electric cooking devices will be held, and a substantial welcome is assured those who desire to judge the merits of the product. Among those representing the company at the convention will be E. W. Rice, Jr., J. R. Lovejoy, C. D. Haskins, P. D. Wagoner, F. G. Vaughen, D. R. Bullen, E. E. Gilbert, W. L. R. Emmet, C. W. Stone, N. R. Birge, C. B. Burleigh, C. P. Steinmetz, J. W. Kirkland, Theo. Beran, A. D. Babson, H. J. Buddy, A. D. Page, T. E. Bibbins, F. H. Gale, G. L. Thompson, D. B. Rushmore and F. W. Willcox.

BUSINESS.

The Arthur Frantzen Company of Chicago has the contract to equip electrically a large theater in Oaxaca, Mexico, the birthplace of President Diaz.

The Boston News Bureau says that at the Lynn works of the General Electric Company 7,000 men are now being employed. This compares with a normal force of 10,000 men.

No less than 10 machines, aggregating 25,000 horsepower, are included in a recent large shipment of Westinghouse turbo-electric power equip-

ment from East Pittsburg to the Far East. Most of these machines will go to Japan for the equipment of railway, lighting and manufacturing plants.

G. W. Armstrong, western manager of the Excello Arc Lamp Company, Chicago, recently returned from a western trip which resulted in further increasing the popularity of the Excello flaming arc lamp. The central stations which have adopted the Excello lamp are very much pleased with its performance. Mr. Armstrong attended the Omaha Electrical Show, which was held this week.

The Wirt Manufacturing Company, one of the industrial enterprises in the village of Burrage, town of Hanson, Mass., fostered by Albert C. Burrage of Boston, has filed an involuntary petition in bankruptcy. It is said that the concern has liabilities of about $110,000 and assets supposed to be about $75,000. The company was engaged in the manufacture of electrical supplies. Henry C. Wirt, formerly of the General Electric Company, is president of the concern.

Dossert & Co., 242 West Forty-first Street, New York, have designed a special extension fitting for [illegible] izers on the feeder cables supplying power to Brooklyn Rapid Transit trains which are to run over the new loop connecting the Williamsburgh and Brooklyn bridges. The cables range in size from 2,500,000 to 500,000 circular mils. The work is under the direction of Latey & Slater, consulting engineers. The Gore Engineering and Contracting Company has placed orders for 244 sets of these large double taps, 164 regular taps and a number of two-way Dossert joints, including 134 connecting aluminum to copper. An order has also been received from the Doubleday-Hill Electric Company, Pittsburg, Pa., for 500 solderless motor leads for the Ohio Valley Electric Railway Company.

DATES AHEAD.

[illegible] to July 2d.

National Electrical Contractors' Association (annual meeting), [illegible]

Michigan Electric Association (annual meeting), Grand [illegible]

[illegible] Hotel [illegible] 27th.

[illegible]

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 28, 1908.

885,745. Electric Furnace. Paul Girod, Ugine, France. Application filed December 20, 1905.

A receptacle forming a chamber is arranged to receive a number of objects to be heated, a mass of resistance material is arranged in layers in contact with the sides, ends and bottom of the receptacle, and there are two pole pieces of opposite polarity at each end of the receptacle.

885,754. System of Electrical Distribution. Albert S. Hubbard, Greenwich, Conn., assignor to the Gould Storage Battery Company. Application filed January 19, 1903.

A number of prime movers have direct-current dynamos connected therewith to regulate their speed, and connections are provided between the armatures of the dynamos, whereby the differences in speed in the prime movers are automatically compensated.

885,755. System of Electrical Distribution. Albert S. Hubbard, Belleville, N. J., assignor to the Gould Storage Battery Company. Original application filed June 24, 1903. Divided and this application filed August 24, 1905.

A storage battery has in series with it a booster with a shunt field automatically regulated to be neutral under normal loads and to give a positive or negative booster electromotive force under increase and decrease of loads respectively.

885,761. Process of Recovering Metals from Their Sulphide Ores. Edward F. Kern, Knoxville, Tenn. Application filed September 1, 1906.

This process of recovering lead and associated metals from lead sulphide-containing ore consists in fusing the same to form a matte and then electrolyzing a suitable fused electrolyte comprising lead chloride with the matte as anode.

885,763. Physical-laboratory Apparatus. Louie E. Knott, Boston, Mass., assignor to the L. E. Knott Apparatus Company, Boston, Mass. Application filed November 23, 1907.

In combination with a base having two posts and a pivotal pin rising therefrom is a brush holder loosely surrounding the pin, an armature member rotatably sustained by the pin, and a field member resting on the posts and secured thereto by screws.

885,769. Element for Electric Heaters. Abbot A. Low, Horseshoe, and Harry Hertzberg, New York, N. Y.; said Hertzberg assignor to said Low. Application filed May 4, 1907.

The element comprises a core of insulating and non-combustible material, blocks composed of resistance material and threaded on the core, metallic terminal members adapted to clamp the blocks into engagement with each other, and a mass of molded heat absorbing material permanently encasing the members.

885,771. Transformer-coil Insulation. Jesse E. Mateer, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 16, 1905.

The coil has spaced insulating strips at its sides, insulating channel pieces fitted over its edges, angle pieces fitted over the channel pieces, and barrier plates extending along the sides of the coil in contact with the strips and angle pieces to form an enclosing casing.

885,776. Trolley-pole Head. Garret Mott, New York, N. Y., and Adolph G. Koenig, Weehawken, N. J. Application filed April 25, 1907.

The head of the pole has a rearwardly extending shank into which the trolley fork is pivoted for partial movement on a vertical axis.

885,782. Rheostat. Granville F. Packard, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 28, 1906.

An outer circle of resistances is arranged to be cut out step by step. Inside this is an arc of resistance metal which can be cut out smoothly.

885,800. Coil Support for Electric Transformers. Herbert C. Soule, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed August 3, 1907.

An adjustable coil-supporting frame comprises side bars built up of angle irons, insulating strips secured to the side bars and cross bolts which connect the extremities of the side bars.

885,836. Insulated Canopy Collar. Thomas H. Bullock, Jr., New York, N. Y., assignor to John H. Dale, New York, N. Y. Application filed August 24, 1906.

In a canopy collar there is a split sleeve of insulating material adapted to be applied to [illegible] tubing and having an inclined or beveled surface.

885,847. Electrical Distribution. John S. Highfield, London, England. Application filed January 20, 1908.

In a series system of direct-current supply are means for connecting intermediate conductors to the main conductors at a number of points, so as to complete a circuit through a part only of the supply and consuming devices.

885,848. Circuit-breaker for Automobiles. William C. Horner, Indianapolis, Ind. Application filed May 27, 1907.

In combination with the sparking circuit of an internal combustion engine is a spark timer controlling lever, a throttle valve lever, and means controlled by each of the levers for breaking the sparking circuit when either of the levers is brought to proper position.

885,859. Telephone Stand. William B. Oliver, Collingswood, N. J., assignor to the Oliver Manufacturing Company, Philadelphia, Pa. Original application filed September 13, 1906. Divided and this application filed March 23, 1907.

A telephone support is composed of a pivoted counterbalancing supporting means, a stem comprising a switchbox carried by this means, and held from horizontal rotation thereon, a switch hook mounted upon the stem and a transmitter carried by the stem and mounted to rotate with relation thereto in a substantially horizontal plane.

885,864. Electrical Connection. Henry R. Read, Brooklyn, N. Y. Application filed April 26, 1907.

A connecting wire is provided with split terminal clips secured to the wire by a coiled spring wire, whose end engages the nut on the binding post.

885,882. Starting Device for Mercury Lamps. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 17, 1904.

A mercury-vapor tube has a plunger within the tube, a solenoid for operating the plunger, and a resistance device connected in series with the solenoid and receiving current independent of that transmitted by the vapor tube.

885,890. Lamp Socket. William C. Tregoning, Cleveland, Ohio. Application filed August 12, 1907.

There is a cross wall with lateral openings on opposite sides of the socket, a lamp receiving shell within the socket, separate conducting members front and rear of the cross wall and seated within the lateral openings, and a central screw and insulating disk jointly securing all the parts together.

885,894. Ignition System for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed November 17, 1906.

A sleeve has a cam integral therewith and a pair of flanges, a finger journaled between flanges, a roller on the finger, segments in the path of the roller, a circuit-breaking lever in the path of the cam, and circuits including the lever and the primaries of a number of induction coils.

885,906. Electric Arc Lamp. Heinrich Beck, Frankfort-on-the-Main, Germany, assignor to the Beck Flaming Lamp Company, Canton, N. Y. Application filed November 16, 1906.

In a flaming arc lamp there is an apertured frame, an electrode adapted to be fed through the same, and a number of sliding frames having apertures of progressively decreasing diameters through which the electrode also passes, the plates being free to be moved by the electrode, and co-operating to seal the aperture in the frame.

885,915. Busy-signal Apparatus. Charles J. Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed November 12, 1906.

In combination with an interrupter or buzzer of a relatively high rate of vibration is another interrupter of a relatively low rate of vibration, and means by which the two interrupters co-operate to produce an interrupted high-frequency alternating current. (See cut on next page.)

885,922. Telephone System for Fire Hose. Harry Growith, Philadelphia, Pa. Application filed March 8, 1905. Renewed March 24, 1908.

Wires are embedded in the wall of the hose and brought out to contact blocks on the coupling.

885,935. Rheostat. Edward L. Malon, Bellaire, Ohio. Application filed June 6, 1907.

In a rheostat adapted to contain water under pressure there is an insulated stationary conductor plate, a movable and adjustable conductor plate and means for supplying and discharging water.

885,941. Elevator Indicating System. Charles E. Moore, Los Angeles, Cal. Application filed September 3, 1907.

At each floor there is an electric light for each elevator, indicating "up" and one indicating "down." As the car travels up or down it closes the circuit of the corresponding light on the floor approached and breaks the circuit as it passes that floor.

885,942. Safety Flashlight Apparatus for Elevators. Charles E. Moore, Los Angeles, Cal. Application filed September 3, 1907.

In combination with the car-controlling lever is a normally open circuit, an electric lamp in the circuit and positioned to throw its light out along the floor of the car through the gateway thereof, means operated by the controlling lever to close the light circuit when the car is stopped, and to break the light circuit when the car is started.

885,953. Electrical Attachment for Clocks. Owen P. Ragan, Ridgeway, Mo. Application filed March 6, 1906.

A disk carries two sets of concentric conducting rings, each having a number of sockets formed therein. Movable plugs are adapted to fit in the sockets. There are means for electrically connecting the rings when two or more brushes attached to the hands are in engagement with two or more of the plugs.

885,967. Electric Controller. Reuben I. Wright, Cleveland, Ohio, assignor to the Electric Controller and Supply Company, Cleveland, Ohio. Application filed October 11, 1906.

A controller arm is composed of a metallic bar, a hub cast thereon, the hub being offset at right angles to the length of the bar, and contact members flexibly mounted toward either end of the bar and insulated therefrom.

885,988. Duplex Motor-control System. Fred R. Fishback, Cleveland, Ohio, assignor to the Electric Controller and Supply Company, Cleveland, Ohio. Application filed September 13, 1907.

In this control system there are two magnetic switch controllers, a motor controlled by each of the controllers, a master switch having contacts arranged to control the magnetic switches separately and both jointly, and a single handle for operating the master switch.

886,031. Toll Telephone System. Edward P. Baird, Evanston, Ill., assignor to the Baird Manufacturing Company, Chicago, Ill. Application filed January 27, 1902. Renewed March 19, 1906.

The toll apparatus has normally inoperative coin-refunding means and shifting means moved by the depositor for operating the refunding means, and means whereby this can be controlled by the exchange operator.

886,035. Direct-current Turbo-generator. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed October 31, 1906.

In a high-speed dynamo there is a shrink-ring surrounding the commutator, and a protective end-ring surrounding the ends of the coils and extending inward and engaging the shrink-ring.

886,049. Multiple-voltage System of Distribution. Budd Frankenfeld, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed November 30, 1906.

A balancer machine has a starting resistance therefor, and a single controlling device for connecting the balancer to the main conductors and to the starting resistance, gradually cutting out the starting resistance to bring the balancer up to speed, and finally connecting the balancer to a compensating conductor.

886,073. Cooling System for Electric Apparatus. Karl C. Randall, Edgewood Park, and Charles B. Gibson, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Com-

pany, Pittsburg, Pa. Application filed August 3, 1907.

In combination with a number of transformers are oil-containing tanks therefor, cooling chambers and means for maintaining a circulation of the oil through the tanks and the chambers, a throttle valve in the supply line of each tank and means for automatically controlling this valve. (See cut.)

886,093. Contact-post System for Transmitting Electric Power. George E. Titcomb, Philadelphia, Pa., assignor to the Dodge Coal Storage Company, Naugatuck, Conn. Application filed February 29, 1908.

A series of posts spaced a given distance apart and having contacts is connected by conduits extending from one post to another. A moving element having a shoe is arranged to bear against the contacts of the posts. There are removable covers for the posts, and removable covers for the conduits, so that on removing the covers the wires and terminals are exposed.

886,100. Automatic Water Heater. Gilbert S. Walker, Wheeling, W. Va. Application filed July 22, 1907.

A coil of pipe is heated by a thermostatically controlled gas burner which has an electric igniter.

886,109. Field-adjusting Device for Electric Generators and Motors. Frederick O. Ball, North Plainfield, N. J. Application filed January 11, 1907.

A device extending loosely between the field-frame support and base has opposingly protruding lugs, one opposing a portion of the base and the other opposing a portion of the support. There are adjusting means on one of the supports for adjusting the support laterally with relation to the base.

886,135. Wattmeter-testing Apparatus. Otto A. Knopp, Oakland, Cal. Application filed June 19, 1907.

A wattmeter-testing set includes a standard resistance unit having two sections, an ammeter, switches and connections between the apparatus arranged to permit the two resistance sections being connected both in series with the ammeter, or one in series with the ammeter and the other in parallel with the ammeter and the first section. (See cut.)

terminal, the coil being secured upon an insulating plate. A collector shoe on a railroad car consists of a resilient wire yoke having a laterally extending portion and upward extending limbs, and suitable supporting members.

886,176. Trolley Harp. Percy C. Bliven, Danielson, Conn. Application filed May 23, 1907.

This harp comprises a stationary member having spaced arms, a member pivotally connected to the stationary member at the outer end thereof, yokes pivoted to the stationary member and bearing caps connected to the member. The trolley wheel has a rigidly connected axle, the ends of which are journaled in the bearing caps.

886,179. Automatic Electric Cotton Chopper. David R. Bragunier and Alford B. Thompson, Columbia, Ala. Application filed May 14, 1907.

The chopper consists of a movable blade, movable means for disconnecting the blade from its actuating means which extends at intervals into the path of the blade, and an electrically operated catch mechanism for retaining the first means out of the path of the blade.

886,220. Registering Telephone Calls. Isidor Kitsee, Philadelphia, Pa. Application filed June 26, 1907.

The apparatus comprises a polarized electromagnet to register a call located at the outlying station and at the central station, an auxiliary source of current independent of the source normally connected to the circuit of the outlying station and comprising switching means adapted to disconnect the normal source and connect the auxiliary source to the circuit independent of the means for connecting the circuit to a cord circuit.

886,225. Current-distributing Device for Igniting Explosive Engines. Henri de La Valette, Paris, France. Application filed May 8, 1906.

A high-tension distributing device consists of a plate and a lid of insulating material, a revolving disk of insulating material located between the plate and the lid, contact pieces arranged in a circle in the plate, a contact ring located in the lid, and a brush located within the revolving disk, adapted to ride on one side on the contact pieces and on the other side on the contact ring.

886,269. Railroad Danger-signaling and Telephoning Apparatus. Edward Sughroue, Bartley, Neb. Application filed May 18, 1907.

The apparatus includes a number of signaling devices, a telephone system including generators, and means for connecting the generators in circuit for setting off the signaling devices or producing ringing current in the telephone system.

886,302. Combined Tuning Coil and Condenser. Walter W. Massie, Providence, R. I., assignor to the Massie Wireless Telegraph Company, Providence, R. I. Application filed April 3, 1907.

In this device there are provided an inductance coil, a condenser having movable plates, a lever for operating these plates to vary the capacity of the condenser, and a substantially circular inductance coil operatively associated with the condenser, approximately concentric with the axis of motion of and engageable by the lever.

886,303. Spark-gap Apparatus. Walter W. Massie, Providence, R. I., assignor to the Massie Wireless Telegraph Company, Providence, R. I. Application filed May 2, 1907.

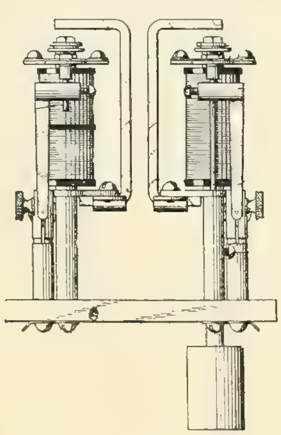
A rotary spark-gap wheel has an air chamber with an inlet leading to and an outlet leading from the chamber, and spark-gap rods co-operative with the wheel.

886,319. Support for Electric Contact Shoes. Ed W. Farnham, Chicago, Ill., assignor to Allen G. Mills, Chicago, Ill. Application filed August 2, 1905.

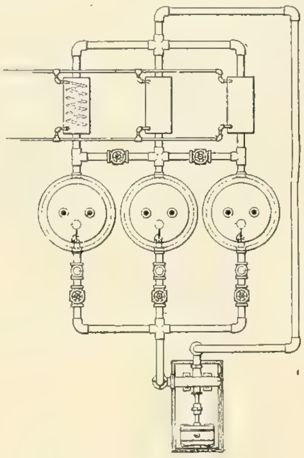
A hanger adapted to be secured to the car carries means for yieldingly holding a contact shoe upward into contact with an inverted third rail.

886,327. Mechanism for Making Type. Francis H. Richards, Hartford, Conn., assignor to the American Typographic Corporation. Original application filed July 29, 1899. Divided and this application filed June 19, 1900.

In combination with means for holding and feeding a type body or blank is a series of type-forming dies, means for carrying the dies, an actuator for a selected die, and electrical apparatus for subjecting the metal being operated upon to the action of an electric heating current.



No. 885,015.—TELEPHONE BUSY SIGNAL.



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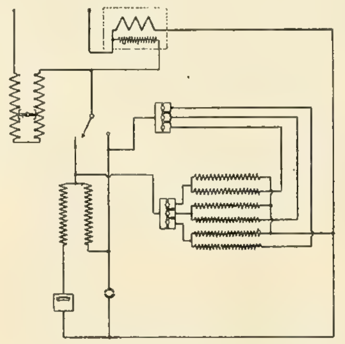
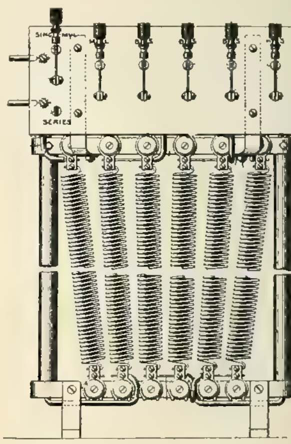


No 886,135. WATTMETER TESTING APPARATUS.



No. 886,230.—RHEOSTAT.

886,138. Electric Igniter. John N. Lansinger, Kent, Ohio. Application filed April 24, 1907.

The igniter is shaped like a curling iron, one of the prongs having an angular extension with a contact engaging the end of the other and insulated prong. Circuit wires pass through the handles to the prongs.

886,141. Interrupter. August R. Luschka, River Forest, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 11, 1905.

This pole changer has a vibratory arm carrying insulated contact fingers. A pair of contact springs is mounted on edge and intermittently connected to each finger during the operation of the arm.

886,148. Signaling Device for Incubators. Georg Mücke, Reisenberg, Austria-Hungary. Application filed December 31, 1907.

The rise of mercury in a thermostat closes a circuit and rings an alarm.

886,154. Oscillation Receiver. Greenleaf W. Pickard, Amesbury, Mass. Application filed September 30, 1907.

A member of an oscillation receiver for radio telegraphy consists of a fused mass of oxide of zinc.

886,157. Electrically Operated Clock. Dominic Sandretto, Ladd, Ill. Application filed November 21, 1907.

[illegible]

[illegible] munication with Moving Trains. Joel Ames, [illegible]

[illegible]

886,230. Rheostat. John W. Mertz, Mount Clemens, Mich. Application filed January 14, 1908.

The rheostat has a framework, windings supported upon the framework and provided with electrical connections, a switch panel connected with the framework, and a number of switches mounted upon the switch panel and connected with the windings. (See cut.)

886,239. Trolley Wheel. William W. Neighbour, Denison, Tex. Application filed July 13, 1907.

This trolley wheel has a central metallic disk provided with a hub, disks of insulating material on opposite sides of the metallic disk and perforated to receive the ends of the hub, and a conducting rim secured to the disks and in contact with the central disk.

886,246. Cooling System for Transformers. Karl C. Randall, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed August 3, 1907.

This is a modification of Patent No. 886,073.

886,261. Furnace. Clarence W. Smith, Cambridge, Mass. Application filed December 28, 1905.

Means for supplying air under pressure to passages in the bridge wall comprise a blower, a motor for operating the blower, a rheostat for controlling the motor, a pressure regulator connected with the boiler, and means for communicating movement from the regulator to the rheostat.

886,262. Switch-cord Plug. Eugene L. Smith, Oak Cliff, Tex., assignor of two-thirds to George F. Childress, Wills Point, Tex. Application filed September 1, 1906.

The switch-cord is provided with a hollow ball secured thereto by a hollow neck and the switch-cord plugs provided with a socket adapted to receive the ball, the plug being formed of two semi-cylindrical members rigidly secured together to hold the ball within the socket, and a cylindrical casing surrounding the plug.

886,267. Means for Supporting Lamp Receptacles James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Application filed April 12, 1907.

In combination with a lamp receptacle having an integral head or rib formed thereon, a fastening device having an annular portion adapted to surround the head and having means co-operating therewith to prevent relative rotation.

886,328. Apparatus for Making Types and Lines of Type. Francis H. Richards, Hartford, Conn., assignor to the American Typographic Corporation. Application filed July 15, 1902.

This is a modification of the above.

886,329. Manufacture of Type Bars. Francis H. Richards, Hartford, Conn., assignor to the American Typographic Corporation. Application filed July 29, 1899. Renewed August 1, 1903.

Further details of No. 886,327 are described.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 5, 1908:

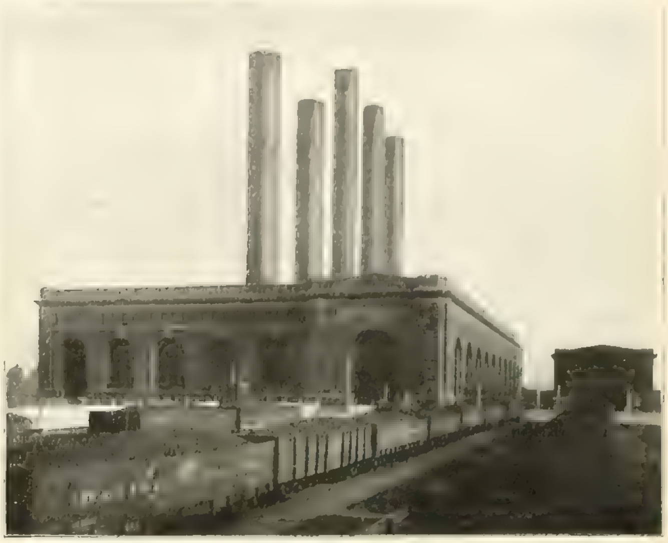
451,445. Secondary Battery. T. H. Aldrich, Cincinnati, Ohio.
451,449. Telegraph Repeater. A. C. Booth, Cedar Rapids, Iowa.
451,491. Electric Railway Truck. W. H. Knight, Boston, Mass.
451,512. Multiple Signal Transmitter. B. J. Noyes, Boston, Mass.
451,514. Electric Brake. J. M. Payne, Cressona, Pa.
451,520. Electric Meter. E. W. Rice, Jr., Lynn, Mass.
451,540. Secondary Battery. G. W. Washburn, Cleveland, Ohio.
451,541. Secondary Battery. G. A. Washburn, Cleveland, Ohio.
451,587. Insulated Electric Conductor. J. B. Williams, Oakland, Cal.
451,634. Telephone Receiver. W. S. Corwin, Newark, N. J.
451,637. Electric Railway System. C. K. Harding, Atlantic, Iowa.
451,639. Alarm Signal. M. A. O'Donnell, Chicago, Ill.
451,649. Electric Stop Motion. C. A. Dayton, Preston, Conn.
451,666. Watchman's Time Recorder. E. C. Gee, Bayonne, N. J.
451,696. Switch for Overhead Electric Conductors. J. Kuehnle, Detroit, Mich.
451,732. Electric Car-lighting Apparatus. B. J. Jones, Chicago, Ill.
451,786. Method of Operating Reciprocating Electric Engines. C. J. Van Depoele, Lynn, Mass.
451,870. Electric Motor. E. M. G. Hewett, Boston, Mass.
451,884. Electric Motor or Dynamo-Electric Machine. S. S. Wheeler, New York, N. Y.
451,894. Electric Motor or Dynamo-electric Machine. W. F. Collins, Chicago, Ill.
451,902. Fire-alarm-telegraph Apparatus. J. W. Stover, Newtonville, Mass.

WESTERN ELECTRICIAN

EVERY SATURDAY

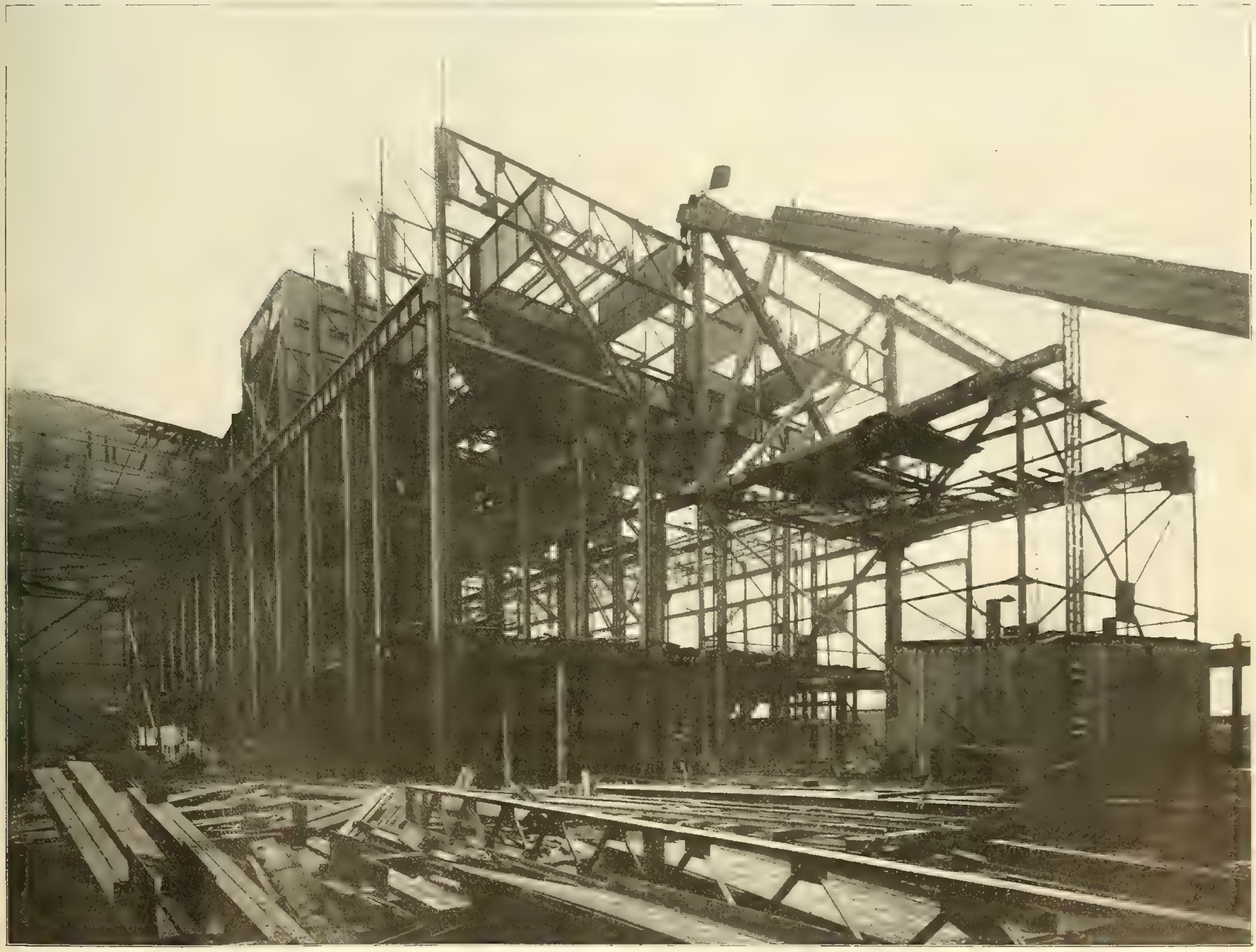
Vol. XLII. CHICAGO, MAY 16, 1908 No. [illegible]

FISK STREET STATION AS IT APPEARED DURING THE VISIT OF MEMBERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION IN 1903.



Present Capacity, 100,000 Kilowatts. Ultimate Capacity, 168,000 Kilowatts.

FISK STREET STATION OF 1908.



Ultimate Capacity, 84,000 Kilowatts.

VIEW OF QUARRY STREET STATION IN PROCESS OF CONSTRUCTION, TAKEN MAY 8, 1908.

WHAT FIVE YEARS HAS WROUGHT IN CENTRAL-STATION POWER-HOUSE EXTENSION IN CHICAGO.

Recent Development of the Central-station Industry in Chicago.

Marking the beginning of the third decade of central station activity in Chicago, the year 1908 is not without a special significance.

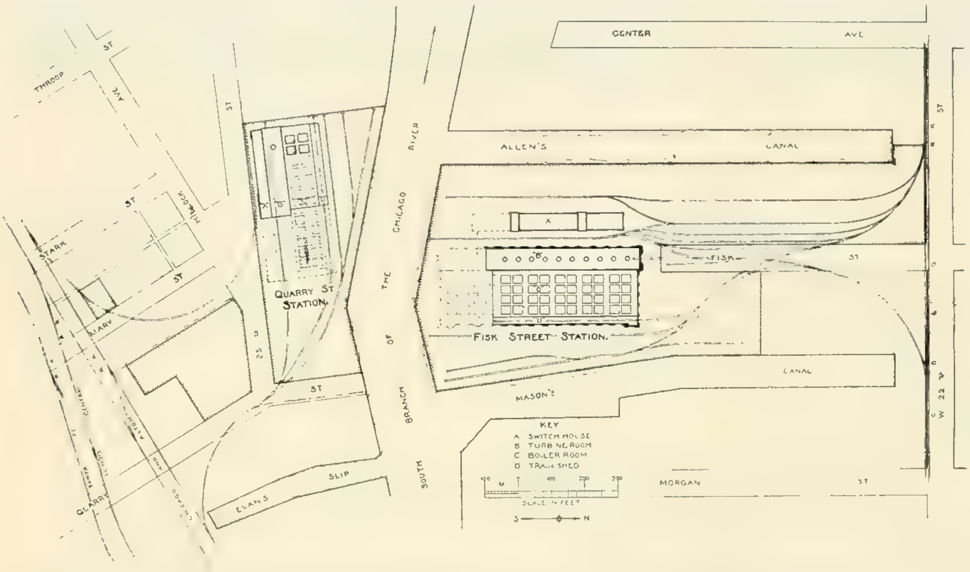
In 1887 the Chicago Edison Company was organized, and this was the first company in Chicago and practically in the West to engage in the regular business of selling electricity for various kinds of lighting and power service. From those days of infancy the industry has steadily grown with giant strides to its enormous size today.

This growth has been made possible by the rapid and harmonious development of the administrative and engineering branches of the business. On the one hand there has been the adaptation of high-tension transmission which has permitted the concentration of the generating power into a small number of large, highly developed and economical generating plants. On the other hand there has been the consolidation of a large number of small and more or less competitive companies into a single, large, economically administered corporation, the Commonwealth Edison Company.

This company operates within the city limits of Chicago. Working in harmony with it is the North Shore Electric Company, operating in the suburban territory outside the city limits and supplying electrical energy to over 30 villages, towns and cities in the crescent-shaped zone around Chicago. This great belt supplied by those two friendly companies extends along the curving shore of Lake Michigan from the Indiana state line to a point between 60 and 70 miles northward, north of Waukegan, Ill. In the neighborhood of Elmhurst, Ill., this belt attains its greatest width of about 18 miles. These figures bear out the belief that this is the largest interconnected system operating from steam-driven generating plants in the world.

The result of these centralizing tendencies has been an enormous extension of the business accompanied by relatively reduced fixed charges on the [illegible] in stations as well as transmission and distribution systems and reduced operating expenses. [illegible] factors combined have permitted a steady reduction of rates to the consumers which has brought further increases in business. On the [illegible] the growth of these two allied companies is [illegible] public benefits that [illegible] from the centralized control of a great public utility.

[illegible] years. On May 23, 1903 (coincident with the last Chicago convention of the National Electric Light Association), there appeared an elaborate article in the Western Electrician on the developments in cen- [illegible] lines since that time.



PLAT OF FISK STREET AND QUARRY STREET PROPERTIES OF COMMONWEALTH EDISON COMPANY.

GENERATING STATIONS.

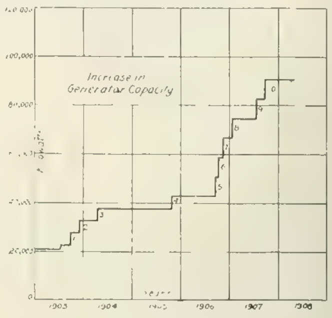
[illegible] older one at Harrison Street, now operated as such only about half of each day, and the large station at Fisk Street, which for several years has been the pride of the system. A new station is being built at Quarry Street on the opposite side of the river from the Fisk Street station. At the Fifty-sixth Street, Market Street and North Clark Street sub-stations, which were formerly among the generating stations, a number of steam-driven generating units are held as reserve and are operated in emergencies to help out the winter peak load.

Harrison Street Station.

In the year 1903 the station on the west bank of the river at Harrison Street was the principal generating station of the system. There had been installed a total of 25 generators, comprising three different types. Of these there were eight 200-kilowatt and twelve 400-kilowatt direct-current machines operating in pairs on the Edison three-wire system. Most of these machines had been in continuous service for nearly 10 years. Two pairs of these units had been changed to double-current generators, developing three-phase, 25-cycle current at 85 volts on the alternating-current side. This was stepped up to 9,000 volts for transmission to substations. Of the five large generators one was a 2,500-kilowatt double-current unit, developing twice the voltage of the similar small machines. The remaining four units were three-phase, 25-cycle machines, generating 9,000 volts, their sizes were two units of 1,000 kilowatts each, one of 1,800 and one of 3,500 kilowatts. The total rated capacity of the station thus aggregated 16,200 kilowatts. All the engines were vertical triple-expansion or compound engines.

Since this period two engine units, comprising two pairs of 200-kilowatt three-wire generators, have been removed, one of the 1,000-kilowatt alternating-current generators is being removed and the other one will be before long; the two latter machines had been driven by a rope drive, and the entire set took up considerable room. The double-current generators have been disconnected from the engine-connecting rods and [illegible] being run [illegible] rotary converters. A [illegible]

The generating plant [illegible] 7 [illegible] to about 9 p. m. daily and shut down at night. While running the plant is operated at practically constant full load, thus working each machine at its point of maximum efficiency and therefore yielding the highest station efficiency. The rotary converters are in continuous operation and convert current from Fisk Street for local direct-current distribution. On account of its nearness to the center of the load and its railroad and water facilities this station will probably be operated in this way for some time to come. Steam turbines may replace its reciprocating engines and thus enlarge its capacity.



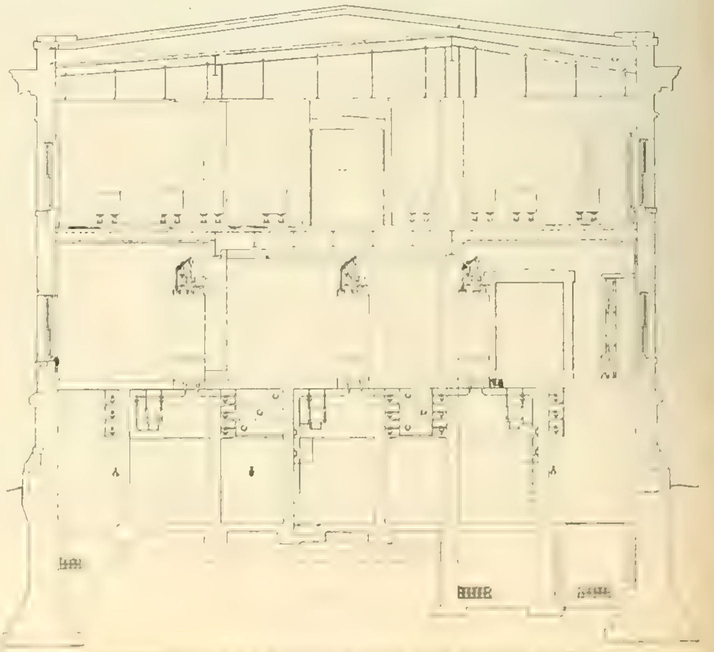
INCREASE IN CENTRAL-STATION RATED GENERATING CAPACITY IN CHICAGO.

In its 14 years of operation this station has passed through many stages of the development of electrical generating machinery. Keeping pace with the times, the most noteworthy changes have been the gradual elimination of the small and bulky units; installation of rotary converters to help feed the low-tension, three-wire distributing network during the day and carry all its load at night; and the installation of three-phase 9,000-volt generators to supply sub-stations in the business district during their periods of heavy load. It should be noted that since 1897 there has been practically no increase in the direct generation of 250/125-volt direct current in either this or any other station. All additional increase in the low-tension system has been supplied by rotary converters taking alternating current transmitted to them at 9,000 volts.

As the economy and reliability of this transmission was demonstrated by the operation of the 9,000-volt machines at Harrison Street, and as the load on the entire system was growing so rapidly that possible enlargements of this station's capacity could not supply the increase for more than a few years, it was decided to build a new station on a tract of comparatively low-priced land some 2½ miles further from the business center. The site chosen was at Fisk Street, between Twenty-second Street and the river, where excellent railroad and water facilities were available and where there was considerable room to expand.

Fisk Street Station.

The construction of this justly called historic central station was begun in 1902. Its design had been carefully considered by the company's engineers, and the apparently radical decision to use vertical-shaft steam turbines of 5,000-kilowatt ca-



CROSS-SECTION OF SWITCH HOUSE, FISK STREET STATION.

pany had back of it enough confidence in their reliability to warrant their use for the first time. In view of the fact that practically no Curtis turbines had been built up to that time, except some run in the shop, the installation of these large vertical machines was watched with interest by engineers all over the world. That the confidence in their reliability was justified has been amply borne out by the service these machines have rendered. Their performance has been studied in great detail and has enabled the General Electric Company, who manufactured them, to so improve on their design that the latest units installed are nearly twice as efficient as the pioneer 5,000-kilowatt unit.

Thus the Fisk Street station occupies a unique place in the recent rapid development of the steam turbine. It was not only the first great central station to be equipped exclusively with steam turbo-generators of large capacity, but here in a few years the steam turbine has achieved such satisfactory results as to secure its installation in most of the large modern power plants, where efficiency and reliability of operation as well as economy of floor space are important.

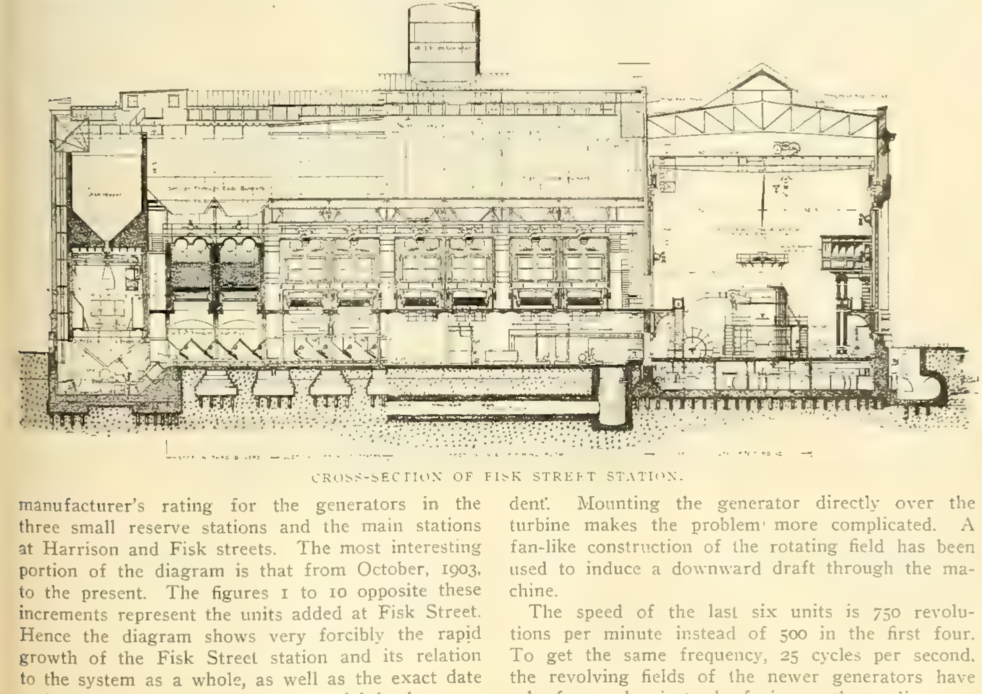
General Design.

The general features of the design and construction of this station have been described in many articles from time to time in this and other journals. Particular attention should be called to two long and well-illustrated articles in the Western Electrician of May 23, 1903, and January 6, 1906. the first article was the first extended description of the plant to appear in the technical press; the latter article contained detailed plans and elevations of the station as then completed with four units installed. It will be necessary here, therefore, to mention only such essential points as will make clear the improvements in the new sections that have taken place during the growth of the plant.

The original design of the station provided for the ultimate installation of 14 Curtis turbo-generators rated at 5,000 kilowatts each, thus giving a total station output of 70,000 kilowatts at full load. It was found, however, that the turbines were capable of carrying enormous overloads and that the capacity of the generators, due to dangerous heating on these overloads, really limited the output attainable from the turbines. Moreover, the efficiency of the first units was actually better on overload than at rated full load. This led to the installation of larger generators on the turbines put in after No. 4. This fact, added to improvements in the design of the turbines, has given the last six units a manufacturer's rating of 8,000 kilowatts each, although the turbines themselves are not much larger than the first four. Thus, with the 10 units now in, the rated load of the station has reached 68,000 kilowatts, or practically as much as was originally contemplated for 14 units.

Growth of the Plant.

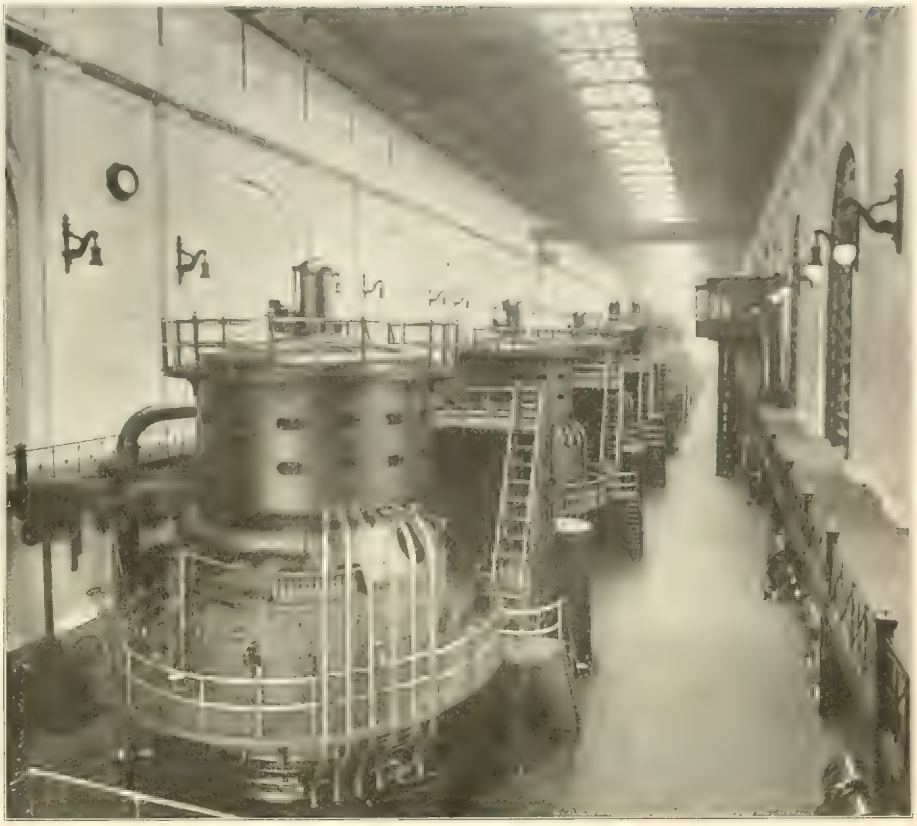
A diagram is given showing the increase in generating capacity of the system based on the



CROSS-SECTION OF FISK STREET STATION.

manufacturer's rating for the generators in the three small reserve stations and the main stations at Harrison and Fisk streets. The most interesting portion of the diagram is that from October, 1903, to the present. The figures 1 to 10 opposite these increments represent the units added at Fisk Street. Hence the diagram shows very forcibly the rapid growth of the Fisk Street station and its relation to the system as a whole, as well as the exact date each new unit was put on commercial load.

[illegible]



Here is a Row of Ten Turbo-Generators Having a Total Maximum Capacity of [illegible] Kilowatts

INTERIOR OF TURBINE ROOM, FISK STREET STATION

station at peak load. The generators were designed for continuous operation at their rated load and the increased capacity of the turbines for continuous running above this load was one of the surprises developed in their performance.

To increase the amount of overload these large generators can carry without dangerous heating of their windings, various experiments have been carried on to provide induced or forced-draft ventilation. When it is considered that in an 8,000-kilowatt generator about 400 kilowatts is normally converted into heat from the unavoidable energy losses in the machine and that this vast heat must be dissipated, the importance of ventilation is evident. Mounting the generator directly over the turbine makes the problem more complicated. A fan-like construction of the rotating field has been used to induce a downward draft through the machine.

The speed of the last six units is 750 revolutions per minute instead of 500 in the first four. To get the same frequency, 25 cycles per second, the revolving fields of the newer generators have only four poles instead of six on the earlier ma-

[illegible]

Considering their capacity, these generators are extremely compact.

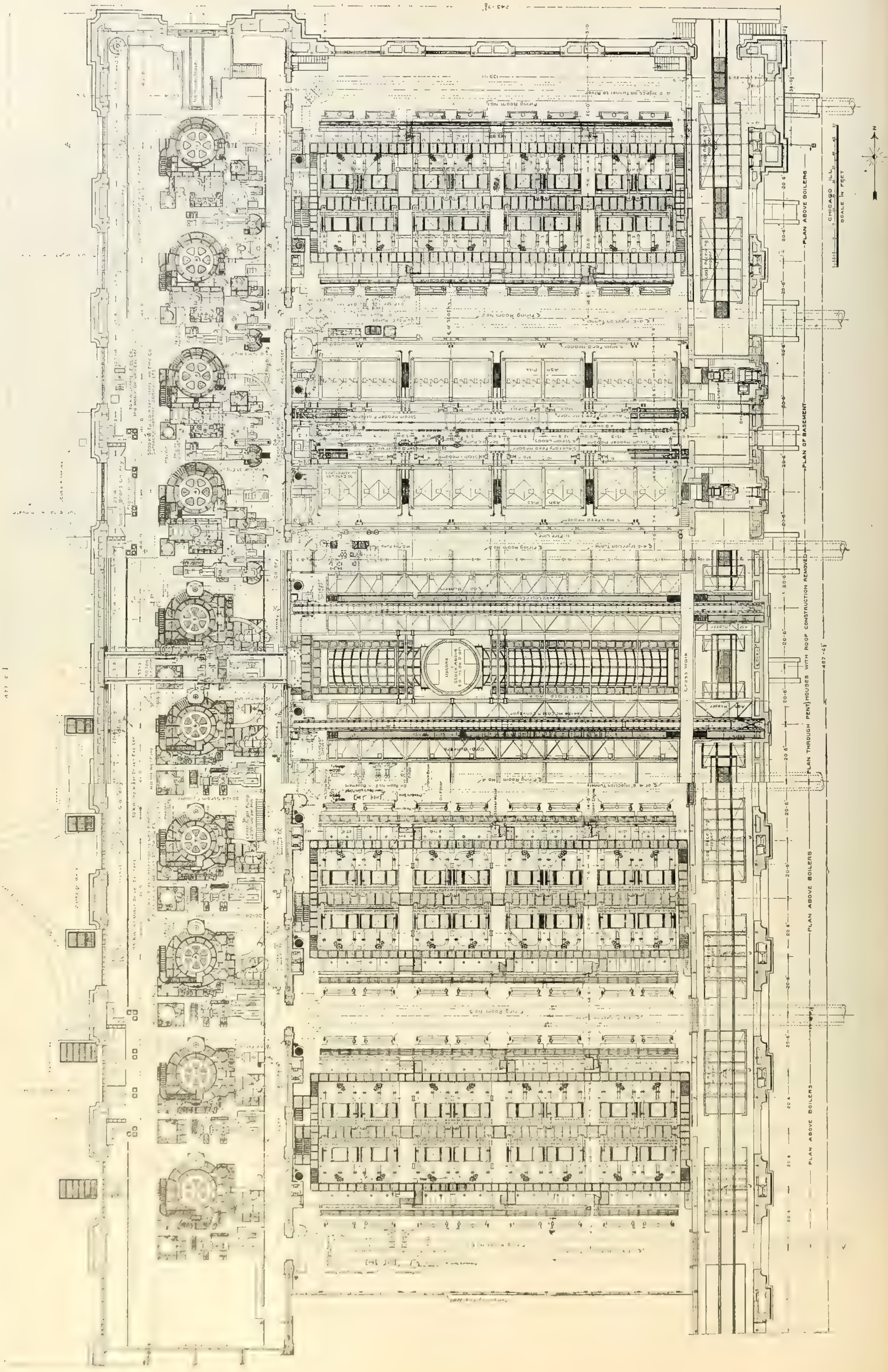
The turbine units Nos. 1, 2 and 3 are two-stage machines with three steam chests, each containing 12 nozzles. Unit No. 4 was built as a four-stage machine with only two steam chests, each having 15 nozzles. The last six units were built with five stages. The governing mechanism on these turbines is different from that used on the first four. The earlier machines had electrical control, a solenoid being connected with each valve. To get a more positive action of the valves the newer turbines are provided with hydraulic control.

Condensers.

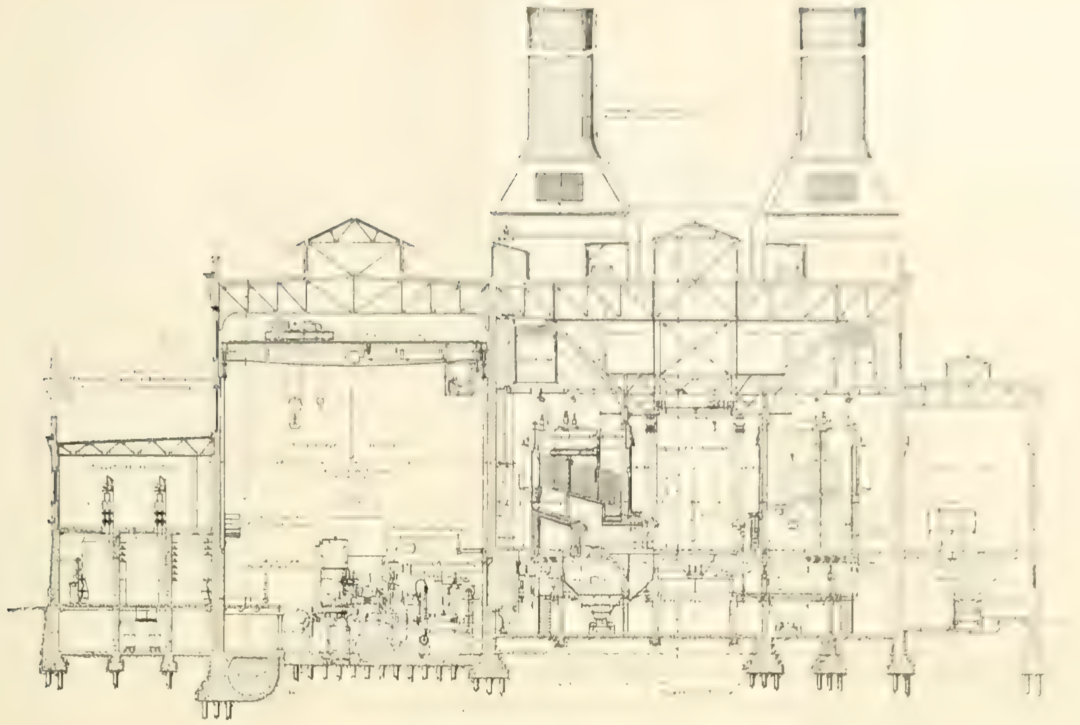
Structurally the newer units differ from the first four by having sub-base condensers, i. e., the turbines are mounted directly over the condensers instead of having the latter placed alongside of the turbine. The new condensers have 25,000 square feet of condensing surface as compared with 20,000 in the older units. This construction has been found to possess certain marked advantages, the two most important being, first, much more direct connection with the turbine exhaust, and consequently a higher vacuum and better efficiency (comparative tests of units Nos. 1, 4 and 8 showing vacua of 28.52, 28.30 and 29.50 inches, respectively, as related to 30 inches barometric pressure); second, further economy of floor space, the height of the entire unit being raised somewhat to compensate for this.

Performance of the Turbines.

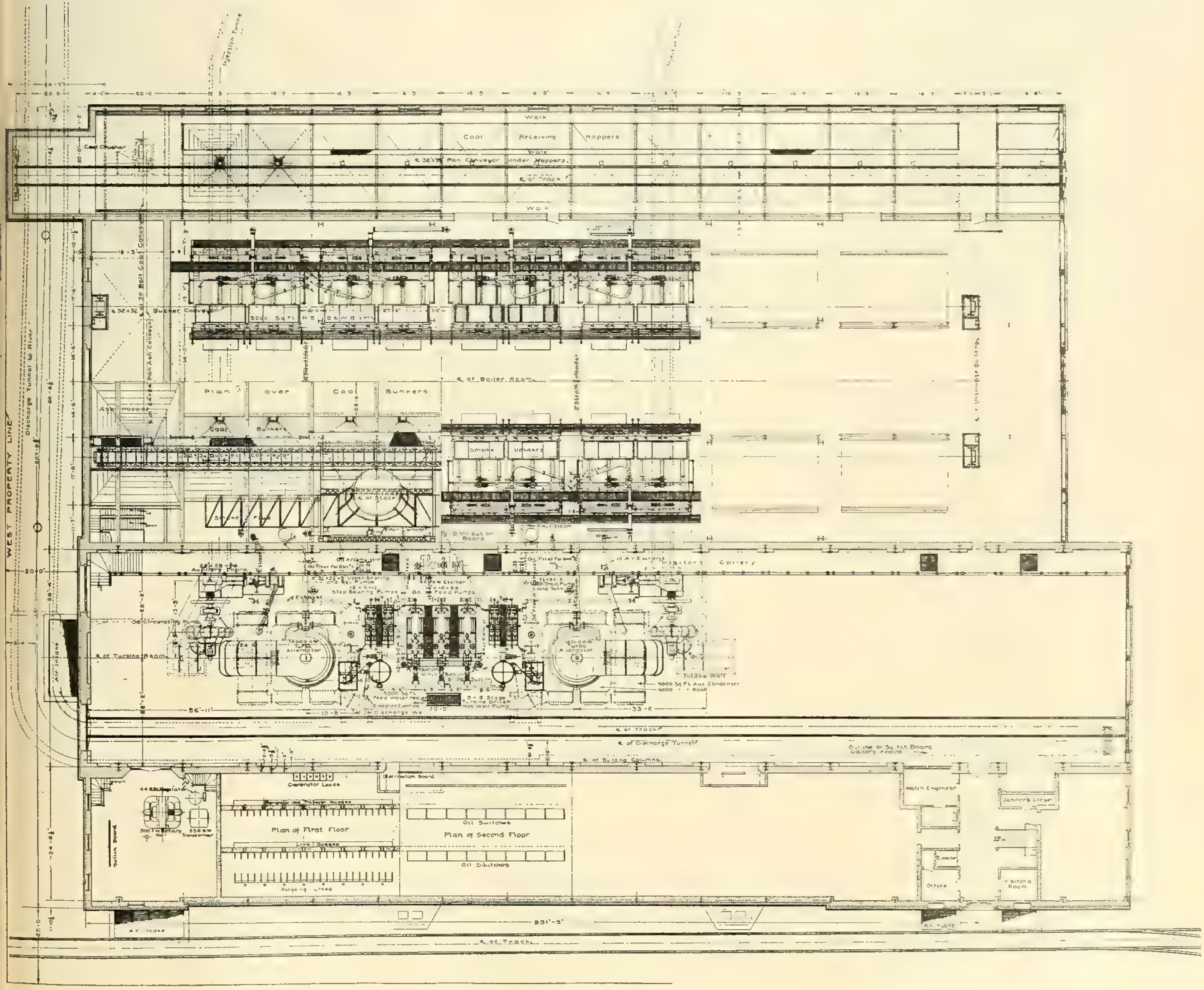
Extensive tests have been made on all these units from time to time. Some of the results as to heating and vacua have been alluded to already. In a paper by Prof. J. C. Thorpe of the University of Illinois on "Steam Turbine Development," read before the Western Society of Engineers on May 6th and abstracted on another page of this issue, some interesting performance data and curves obtained on turbine units Nos. 1, 4 and 8 are given. These machines were run on a steam consumption of 23.94, 16.72 and 13.07 pounds per kilowatt-hour, respectively. This shows a wonderful improvement



GENERAL PLAN OF FISK STREET STATION OF COMMONWEALTH EDISON COMPANY, CHICAGO, WITH TEN UNITS.



CROSS-SECTIONAL ELEVATION.



WEST 25th STREET

Ultimate Capacity to be 84,000 Kilowatts.

GENERAL PLAN FOR TWO 14,000-KILOWATT UNITS.

QUARRY STREET STATION NOW BUILDING FOR THE COMMONWEALTH EDISON COMPANY

in efficiency of these turbines inside of three years. The last figure places this steam turbine in the front rank among prime movers. Another feature brought out was the flatness of the economy curve for a large range of load. Maximum steam economy was obtained at loads varying from 115 to 130 per cent. of the rated capacity of the machines, and it was practically the same to over 150 per cent. of the manufacturer's rated load.

New System of Rating.

As the result of those determinations it has been decided by the General Electric Company to adopt a new system of rating its turbines. Instead of using as a basis a certain value as the normal load and giving certain guarantees of overload operation for limited periods, the rating will represent the continuous maximum operating capacity of the unit. No overloads beyond this continuous maximum will be provided for. The generators for future turbines will be of such a size as to permit of continuous running at this maximum without dangerous heating. The turbo-generators of the new Quarry Street station will be rated in this manner.

Other Features.

In the boiler-room practice at the Fisk Street station no very radical changes are at first apparent. However, it is to be noted that the same rated capacity of boilers was installed for the first unit of 5,000 kilowatts as for the last one of 8,000 kilowatts, which is largely accounted for by the better steam economy of the latter. The boiler equipments for the last six units are also giving a better evaporative performance. The last three stacks corresponding to the last six units have a height of 260 feet instead of 205 feet for the first two stacks.

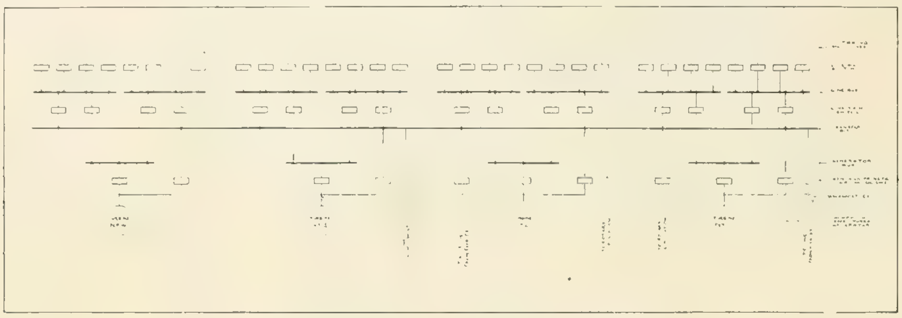
The exciter sets at first comprised three 50-kilowatt exciters direct driven by induction motors and one 75-kilowatt exciter driven by a vertical Corliss engine. For the later units there have been added a 75 and a 150-kilowatt motor-driven exciter and two 75-kilowatt turbine-driven exciters. Two additional storage batteries for floating on the exciter bus-bars have been installed on the second floor of the switch house. The original battery placed over the north end of the boiler house is still in service. The three batteries insure absolute continuity of exciting current.

An important feature of the operation of the Fisk Street station has been carried out within the last year. It is its operation in two distinct sections. The unit system so extensively carried out in all parts of the station permits the running of each turbo-generator independently in every respect, and this is made use of in testing. However, when connected to the system load sectionalizing is not carried out in such great detail, as this is unnecessary for all normal requirements of the system. Nevertheless, the advantages of sectionalizing in isolating any possible troubles are so great that it is now the rule to run the entire system in two sections instead of entirely in parallel. The first four units are connected to one section and the last four to the other, the two intermediate units being ar- [illegible] section.

There are so many interesting features about the Fisk Street station that it is impossible in a lim- [illegible]

QUARRY STREET STATION.

The rapid growth of load on the entire system in the last few years showed that before many more years the Fisk Street station would be taxed to its utmost capacity, even with the addition of the four more units contemplated in the ultimate plans. It was deemed advisable to plan and proceed with the erection of another station before its need became imperative. By thus anticipating the future requirements, the system would not only be better prepared for any abnormal increase of load but would have a larger factor of safety in reliability of service by not concentrating almost all its generating capacity in a single station. Property on the other side of the river from the Fisk Street station being available, it was decided to build the new station there and obtain all the advantages in the way of water and railroad facilities and nearness to the center of load possessed by the Fisk Street plant.



9,000-VOLT CONNECTIONS QUARRY STREET STATION.

General Design.

A study of the plat of the properties of the company in this neighborhood shows that the land on the south side of the river chosen as the new site was much narrower than the Fisk Street site. This had a decided influence on the design of the station and accounts for many of its features that differ from its near-by prototype. It is evident from a comparative glance at the plans that the Quarry Street station, first mention of which in the technical press was in the Western Electrician of January 4, 1908, will be relatively long and narrow. The switch house is joined to the main building, and the boiler room runs longitudinally parallel with the turbine room instead of being in sections at right angles thereto.

The station building is designed for an ultimate size of about 463 by 208 feet and a total equipment of six turbo-generating units of 14,000 kilowatts each. At the present time a little more than the west half of the building is being erected, and this year only the first unit will be installed. This is at the west end of the building, so that the addition of subsequent units can go on without interfering with the service of the completed machines. When fully completed the maximum capacity of the station will be 84,000 kilowatts for continuous operation, or approximately equal to the present capacity of Fisk Street station under a similar rating. According to the present plan the new Quarry Street station will be entirely equipped before the four additional units contemplated at Fisk Street will be added.

The completed building will occupy over one-half the available ground space, the remainder being [illegible] Another plat of ground south of Twenty-fifth Street, owned by the company, will be similarly utilized.

The four main sections of the building—switch house, turbine room, boiler room and train shed—are separated by heavy fire walls. The boiler and turbine rooms have roof trusses at the same level, which is 61 feet clear above the floor in the turbine room. Architecturally the station will not be a replica of Fisk Street, though it will hamonize with it. The ornamentation will be along simpler yet tasteful lines. The architects for the building were Shepley, Rutan & Coolidge, while Sargent & Lundy are the consulting mechanical engineers.

Coal Handling.

Coal trains will enter the train shed over a trestle east of the building. The train shed has a series of hoppers below its track, into which bottom-dump cars discharge directly. Ordinary gondola cars will be taken care of by a coal unloader having a grab bucket that takes up about a ton of coal and dumps into the extended hopper alongside the car. These hoppers discharge into a 32-inch pan conveyor, which dumps the coal into a crusher. From this it drops on a belt cross-conveyor, which supplies the two main bucket conveyors passing over the coal bunkers situated above each row of boilers.

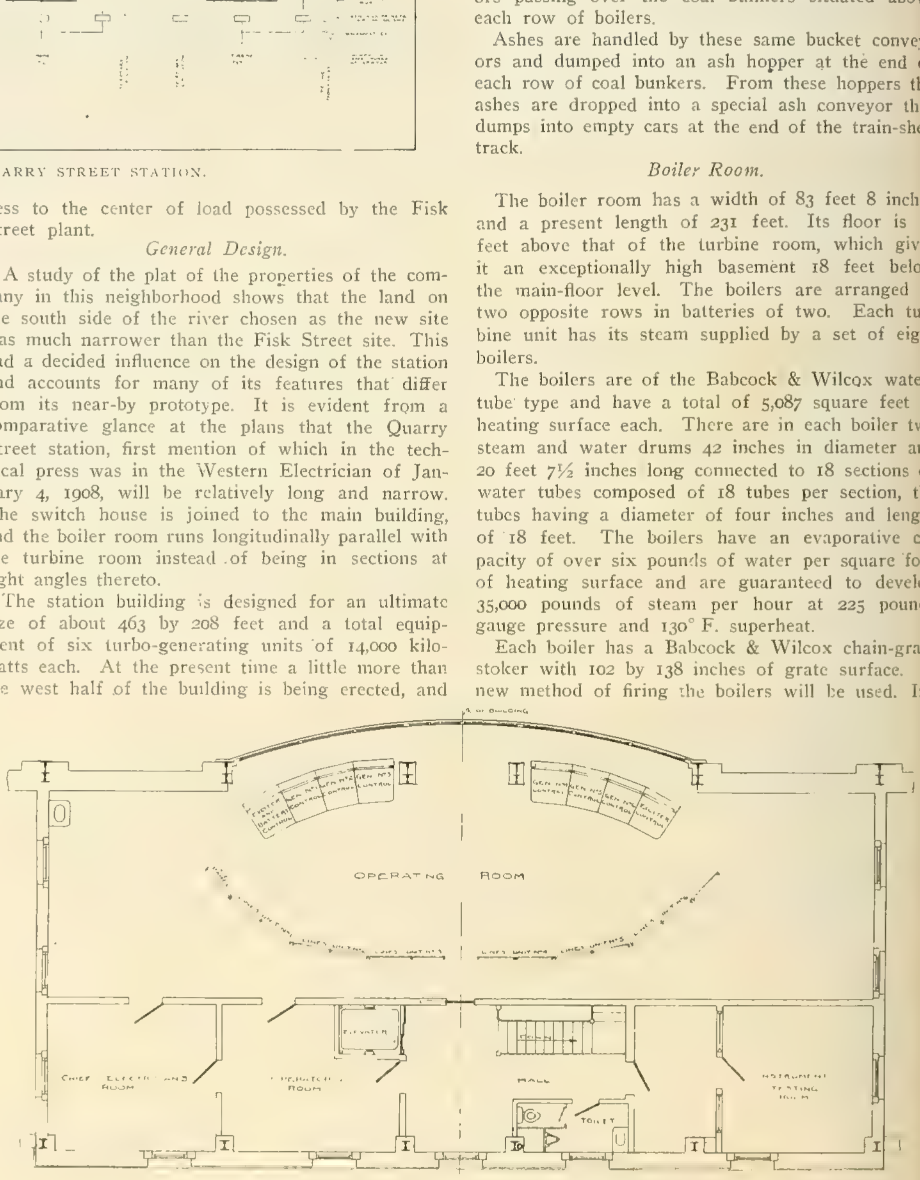
Ashes are handled by these same bucket conveyors and dumped into an ash hopper at the end of each row of coal bunkers. From these hoppers the ashes are dropped into a special ash conveyor that dumps into empty cars at the end of the train-shed track.

Boiler Room.

The boiler room has a width of 83 feet 8 inches and a present length of 231 feet. Its floor is 12 feet above that of the turbine room, which gives it an exceptionally high basement 18 feet below the main-floor level. The boilers are arranged in two opposite rows in batteries of two. Each turbine unit has its steam supplied by a set of eight boilers.

The boilers are of the Babcock & Wilcox water-tube type and have a total of 5,087 square feet of heating surface each. There are in each boiler two steam and water drums 42 inches in diameter and 20 feet 7½ inches long connected to 18 sections of water tubes composed of 18 tubes per section, the tubes having a diameter of four inches and length of 18 feet. The boilers have an evaporative capacity of over six pounds of water per square foot of heating surface and are guaranteed to develop 35,000 pounds of steam per hour at 225 pounds gauge pressure and 130° F. superheat.

Each boiler has a Babcock & Wilcox chain-grate stoker with 102 by 138 inches of grate surface. A new method of firing the boilers will be used. Instead of firing at the high end of the tubes, the reverse plan will be tried and the boiler in effect turned around. By firing from the low end a larger combustion chamber will be provided and more efficient combustion is anticipated.



PLAN OF THIRD FLOOR OF SWITCH HOUSE, QUARRY STREET STATION.

A steel stack 12 feet inside diameter and 250 feet high above the boiler-room floor will be erected over every second battery so as to take up the gases from six boilers. Two stacks will be erected at present, the completed station having eight. The stacks, coal bunkers and roof trusses are each supported on a separate set of columns and independent structural work. Between the opposite coal bunkers a clear space is left for a flood of daylight from above to the firing floor. This space is to be

spanned by a five-ton hand-operated traveling crane. The six-inch steam header from each boiler is carried to the space between two batteries and passes down to the header gallery in the basement where a 12-inch header connects the two batteries with the turbine room.

Turbine Room.

The present length of the turbine room is 268 feet 8 inches and its width 80 feet 4 inches. The basement under it is at the city datum level, and the turbine-room floor is 10 feet above this. Spanning the main room will be an electric crane of 90 tons capacity. A railroad track will be permanently laid along the south side of the room to facilitate the rapid unloading of machinery.

The main generating units are Curtis turbo-generators designed in accordance with the new rating referred to above for a continuous maximum operating capacity of 14,000 kilowatts. They will be installed right and left alternately at a distance of 67 feet center to center on the side where the circulating pumps are located and 70 feet center to center on the side where the other auxiliaries are placed. This arrangement is slightly different from that at Fisk Street, as can be seen from the accompanying plans, but it is believed it will permit greater economy of floor space and aid in the supervision of the machinery.

The turbines are to be only a little larger than the later units at Fisk Street. The generators, however, will be much larger so as to be able to carry 14,000 kilowatts continuously. Forced ventilation, as already alluded to, will be employed to keep the generators running cool. Air will be drawn in through air intakes from outside the building at about the basement level and passed through large ducts in the cool portion of the basement that will come up alongside the turbine and deliver the air to the top of the generator, which will be entirely enclosed. Here specially constructed fan blades on the revolving field will drive the air down through the windings of the machine. An auxiliary blower may be provided in the basement to furnish additional draft if necessary. It is believed this system of ventilation will be ample.

Condenser Equipment.

Condensers for the turbines will be of the subbase type and built in three sections as those at Fisk Street. The condensers will be entirely in the basement below the turbine room, however, so that the turbines will come level with the floor. Two sections of the condenser of 8,000 square feet condensing surface will be directly below the turbine proper, and the third or auxiliary section of 9,000 square feet will adjoin the others. An injection tunnel supplies water from the river to the intake well for two units. The first unit will have a separate tunnel of half the cross-section of the others. A 36-inch centrifugal circulating pump draws the water from this cold well, forces it through the condenser and then discharges it into a common discharge tunnel of about 10 feet diameter along the south wall of the basement, and this discharges into the river west of the building. The injection tunnels are provided with cribs and screens at the river similar to those at the Fisk Street station.

The circulating pump referred to is mounted directly on the shaft of a 20 by 24-inch simple Corliss engine, which also operates a 28 by 24-inch dry vacuum pump in tandem with the engine cylinder. There is also a five-inch two-stage hot-well pump to pump the water of condensation out of the bottom of the hot well. This pump is driven by a Kerr turbine. All the condensing equipment is furnished by Henry R. Worthington.

There will be three boiler-feed pumps 14 by 10 by 24 inches for each pair of units. These as well as the service pumps are supplied by the Dean Bros. Steam Pump Works. Each unit will have a feed-water heater of 3,000 square feet heating surface, built by the C. H. Wheeler Manufacturing Company. For the step bearing there will be two 12 by 3 by 12-inch pumps, and for the upper bearing and governor two 5¼ by 3½ by 5-inch pumps will be supplied for each unit.

Switch House.

In the switch house, which adjoins the turbine room on the south, the main floor is devoted chiefly to the bus-bar compartments which are arranged similarly to those in the new section of the Fisk Street switch house. The second floor is almost entirely given up to the oil-switch rooms. At the center of the building the switch house is carried up to a third story, the plan of which shows that [illegible]

[illegible] of conduits. In a part of the basement will be installed [illegible] exciter bus-bars. This will act as an auxiliary for the 150-kilowatt turbine-driven exciters that will be supplied, one for each generator.

Quarry Street Sub-station.

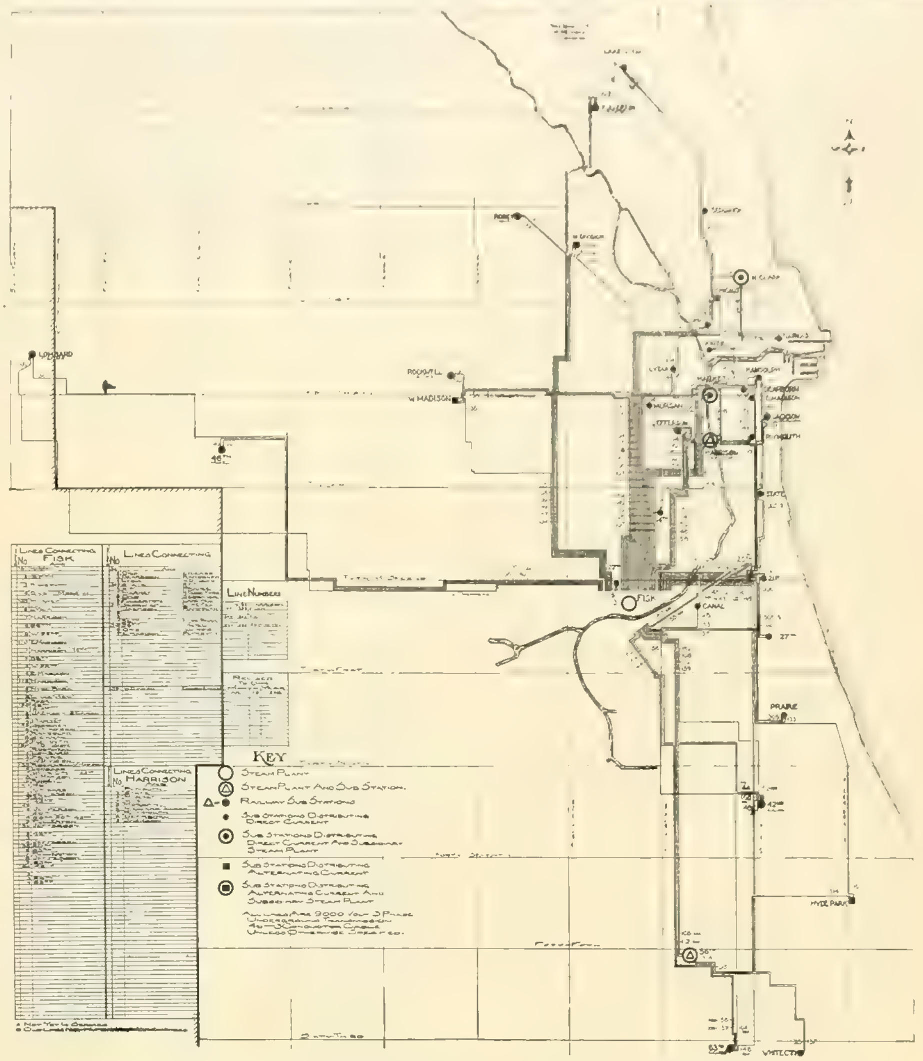
At the west end of the switch house will be located a sub-station for use at present principally in supplying direct current to the large number of motors in use around the plant and for lighting the premises. This will contain at first a 500-kilowatt horizontal rotary converter of the split-pole type that does not require a regulator. This type was recently described in a paper before the American Institute of Electrical Engineers by Mr. Stone. The subsequent addition of two 1,000-kilowatt vertical rotaries is contemplated.

General Features.

Among the distinctive features about the Quarry Street station is its compactness, which gives it an enormous capacity for its size. This is due to the great output of its units as well as to the careful arrangement of these units and their auxiliaries. Mostly all the auxiliaries will be steam-driven, thus giving a larger quantity of exhaust steam for the feed-water heaters. While the Quarry Street station will not have the unique relations to steam-turbine development possessed by its neighbor across the river, it probably will achieve some startling results in the net economy of generating electrical energy in a large central station.

TRANSMISSION SYSTEM.

The first transmission system from a generating station to a sub-station in Chicago was installed in 1894 on the completion of the Harrison Street station. It was an extraordinary underground line of 66,000,000 circular mils total cross-section and a length of 3,400 feet from the new station to what became the first sub-station at 139 Adams Street, [illegible]



MAP OF 9,000-VOLT TRANSMISSION SYSTEM OF COMMONWEALTH EDISON COMPANY.

bus-bars and converting it into three-phase, 25-cycle alternating current, which was stepped up by transformers to about 2,250 volts and transmitted in 2.7 miles of three-conductor No. 0 underground cable to the station at Twenty-seventh Street and Wabash Avenue. At this point it was stepped down to about 85 volts and reconverted to direct current at 125 volts by two 100-kilowatt rotaries. These machines were put in series and helped supply the 250-volt Edison three-wire system, fed from this station. The three machines used in this historic installation are still in service for the company.

From this modest beginning the transmission system of the Commonwealth Edison Company has grown steadily in a little over a decade to have almost exactly 100 times the mileage of high-tension underground cables. The voltage of the transmission system has been raised to 9,000, and this is the potential of all lines running from both the Fisk Street and Harrison Street stations. The diagram of the 9,000-volt transmission system shown gives a better idea of the extent of the system than is expressed by saying it consists of 270 miles of three-conductor cables.

The transmission voltage is generated directly without the need of step-up transformation. The insulation of mostly all outlying lines installed recently is capable of withstanding 20,000 volts, this value being designed ultimately for all lines running to remote sub-stations. One of these 20,000-v[illegible]

lines is already in service. It runs underground 11 miles from the Division Street sub-station, where the current from Fisk Street is stepped up to over double its pressure, to the Evanston sub-station of the North Shore Electric Company.

The standard size of transmission cables for 9,000-volt lines is No. 0000; for 20,000-volt lines No. 00. They are paper-insulated and lead-covered and laid in vitrified clay conduits with manholes about 500 feet apart. In the manholes and in the station buildings between the walls and the oil switches these cables are further covered with split tiles as a protection against mechanical injury.

To carry the transmission cables across the Chicago River and its branches six special tunnels have been built in the following order: Harrison Street, Washington Street, Indiana Street, Quarry Street, Twenty-second Street and Clybourn Place. The one at Quarry Street is built in solid rock. The last five tunnels were built in the last five years. They are of concrete and have an inside height of 6½ feet, and, with one exception, a width of six feet. Their average length is about 360 feet. In these tunnels the cables are arranged in isolated groups and carried up through the terminal shafts in this manner, and to separate manholes in many cases. The shafts are carefully designed to minimize any strains on the cables, eliminate crossovers, and to provide conveniently for any extensions or repairs.

All important sub-stations are connected directly with the generating station by one or more transmission lines and to one or more adjacent sub-stations by a tie line or lines. Ordinarily these tie lines are left open to prevent extensive disturbance by a ground or short-circuit on any part of the transmission system. In case of a breakdown in one of the main lines, however, these tie lines immediately become available as an indirect connection to the source of supply through another sub-station. These tie lines are well shown in the map of the 9,000-volt system referred to.

SUB-STATIONS AND DISTRIBUTION.

Sub-station Growth.

Since 1897, when the first transmission system was put in operation in Chicago, as described above, the number of sub-stations has rapidly grown and the number of generating stations has simultaneously diminished. The Commonwealth Edison Company has now 32 sub-stations in its own system and there are 11 more supplied with current by the system but owned and operated by the surface and elevated railway companies. The map already referred to shows the location of most of the sub-stations.

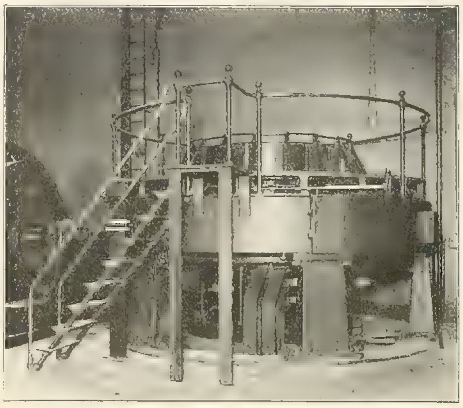
Three of the company's sub-stations are equipped with storage batteries only, 21 with rotary converters, four with motor-generator frequency changers, two with rotaries and frequency changers and two with step-down transformers only. Three sub-stations are provided with steam auxiliaries for winter peak load and emergency service. A number of the sub-stations are equipped with storage-battery auxiliaries, there being altogether 20 batteries in the system, with an aggregate capacity at the one-hour rate of discharge of 17,700 kilowatts. The rotary converters range in size from 100 to 2,000 kilowatts and have a total capacity of about 52,000 kilowatts. The frequency changers range from 250 to 2,000 kilowatts, with an aggregate capacity of about 22,000 kilowatts. The railway sub-stations contain rotary converters with a total capacity of nearly 50,000 kilowatts; some of them also have auxiliary storage batteries.

Distribution System.

In the central business district, bounded by the lake, the river and Harrison Street, and having an area of less than one square mile, there are 10 sub-stations carrying the densest load of the system. Lying about this is a zone of 15 to 18 square miles extent, where the load is fairly concentrated. The distribution from the sub-stations in these two areas is direct current on the well-known Edison three-wire system at 250/125 volts. These areas of direct-current distribution are within the old city limits which formed the operating territory of the old Chicago Edison Company. The direct-current network comprises about 118½ miles [illegible]

The distribution in the zone outside this area and comprising the remainder of the city is entirely by alternating current at 60 cycles. The sub-stations in this zone contain frequency-changing motor-generators. These change the 9,000-volt, 25- [illegible] tributing network. All but the smallest motors and large sections of the lighting load are run from the three-phase circuits directly. Residence lighting is largely supplied from single-phase branches of these circuits. While it would be feasible to carry the motor load direct on 25 cycles, it is not advisable to run the lighting load at so low a frequency. To avoid too great complexity of circuits, all the load is run on 60 cycles.

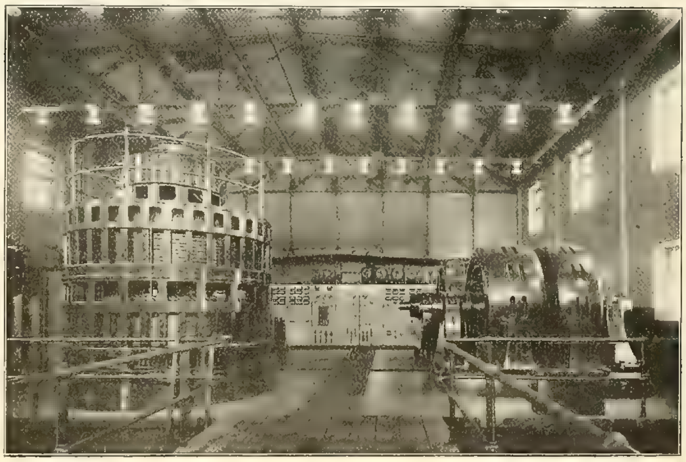
An exception to the standard adopted for the



2,000-KILOWATT VERTICAL ROTARY CONVERTER AT MARKET STREET SUB-STATION.

60-cycle distribution is in the method of feeding the two farthest south sub-stations in the city, South Chicago and Fernwood. Feeders from the Hyde Park and Fifty-sixth Street sub-stations are run to these outlying ones, carrying 60-cycle current that has been stepped up to 8,250 volts. At the remote sub-stations this is merely stepped down for local distribution at 4,000/2,300 volts.

The 60-cycle distributing system, ramifying the outlying parts of the city, where the load is frequently widely scattered, is carried largely overhead, although a steadily increasing part of it is being put underground. It aggregates now about



VIEW IN HYDE PARK SUB-STATION SHOWING VERTICAL AND HORIZONTAL FREQUENCY-CHANGERS.

3,600 miles of equivalent single-conductor overhead and about 280 miles single-conductor underground.

Sub-station Equipment.

In general the equipment of the various sub-stations has become more and more standardized along the lines established several years ago. A few changes are to be noted, however. The sizes of the units installed has steadily increased. In some of the sub-stations scarcity of room had to be contended with. To meet this difficulty vertical machines have been developed that have proved very satisfactory.

A vertical frequency changer is shown in the view of the Hyde Park sub-station. The motor is a three-phase, 25-cycle, 9,000-volt synchronous machine with revolving field. The generator is a 60-cycle, 4,000/2,300-volt, four-wire, three-phase machine, also with revolving field. A 100-kilowatt exciter is mounted on top of the machine. The unit is rated at 2,000 kilowatts. The view also shows two horizontal 1,000-kilowatt frequency changers.

Another view shows the new 2,000-kilowatt vertical rotary converter at Market Street sub-station. It has been running about half a year with excellent results. It gives not only more floor space but enables more convenient and accurate adjustment of the brushes and is more accessible in every way. It was first described in the Western Electrician of December 14, 1907. This sub-station is also equipped with four horizontal 1,000-kilowatt rotaries.

GROWTH OF THE SERVICE.

Some conception of the great extent of the system may have been obtained from the foregoing portions of this article. The diagram showing increase in generating capacity gives a good idea of how rapidly the generating equipment has been increased to keep pace with the demands on the system. A very forcible demonstration of the extraordinary increase in these demands is given by the accompanying typical load diagrams.

Close study of these load curves reveals many interesting facts. In 1903 both the summer and winter curves were not unlike those of any large central-station company that has developed considerable day load, particularly in motors. Four years later there was an increase of more than three times the total load, and the winter curve showed that the customary peak had become of relatively less importance.

Most interesting, however, is the series of dotted curves marked "Railway." These show that from a very small proportion in 1903 the railway load has increased to nearly half of the total load in 1907. Last year the railway load alone was over 50 per cent. greater than the total load of 1903. As this traction load has been developed in such a rapid manner and as this development has been entirely distinctive of Chicago, it is worth while considering it in more detail.

Railway Load.

Local traction conditions had an important bearing on the development of this load. The uncertainty of franchise renewal on their expiring grants prevented the street-railway companies from raising the capital requisite for enlarging or rebuilding their power plants to keep up with the growing traffic. Some of these plants were uneconomical and out of date; a few of them contained small generators belt-driven from simple non-condensing engines that were supplied by fire-tube boilers, hand fired. One elevated-railway company never had built a power house of its own. It bought its current from two of the street-railway companies. When these could not furnish an adequate supply, it found that the central-station company could, and so the first railway sub-station was located at Lake and Rockwell streets in 1902.

The readiness with which this service was established, as well as its convenience and low cost, soon demonstrated to the other companies the desirability of this means for securing additional power, and as a result sub-stations for their purpose were gradually established. When the old cable lines were electrified a decided addition to this service resulted. Two other elevated roads adopted this plan, and, in fact, in recent years all the local traction companies except the South Side Elevated have called on the central-station company for additional power.

There have now been established 11 sub-stations devoted exclusively to this service, as follows:

Railway Company.	Sub-stations.
Chicago and Oak Park Elevated Railroad Company.	Rockwell Street. Lombard Avenue.
Northwestern Elevated Railroad Company.	Chicago Avenue. Fullerton Avenue. Calvary.
Metropolitan West Side Elevated Railway Company.	Forty-sixth Avenue. Robey Street.
Chicago Railways Company.	Jefferson and Van Buren.
Chicago City Railway Company.	Twentieth and Dearborn. Forty-second and Wabash. Sixty-third and Wentworth.

These sub-stations are owned and operated by the respective railway companies and are supplied with 9,000-volt, three-phase current by the Commonwealth Edison Company, which is sold at its bus-bars and transmitted in its cables. The Calvary sub-station is supplied at 20,000 volts. This current is reduced in voltage and changed to direct current at 500 to 600 volts at the different sub-stations.

Besides these [illegible] sub-stations, one rotary converter at the Plymouth Place sub-station of the [illegible] company is operated for the Chicago City Railway and another rotary at the White City sub-station is similarly run for the Calumet and South Chicago Railway Company.

What is not usually classed as [illegible] load, but is actually used for traction purposes, is the current supplied to the Illinois Tunnel Company, at 250 volts from five rotary converters in three of the Edison downtown sub-stations.

No central-station company has developed anything like such a large railway load as this described above. It is a great credit to the Commonwealth Edison Company that it has so successfully shown the value of this service to the traction companies as well as to its own system. This load will probably grow to enormous proportions, as the company is steadily improving its facilities for producing current cheaply, and is in much better condition to do so even now than the traction companies.

OTHER LARGE CONSUMERS.

Very few central-station companies have made such an aggressive campaign or had such good results in getting new business as the local company here. A great force of energetic and capable solicitors has made a careful canvass of the conditions prevailing with both large and small power consumers in the city. By showing them conclusive figures of the economy and other advantages of central-station service a considerable number of large consumers has been added to the system.

These include most of the large downtown office buildings, including the two new public edifices—the Federal and County buildings. Almost all the great department stores, including Marshall Field & Co., have abandoned their isolated plants. The ease with which electrification of large establishments can be effected and extended when supplied by the central station has brought about the introduction of motors for much work in these places. An important increase of load in all high buildings has been effected by the rapidly extending use of electric elevators.

Outside the business district a rapidly increasing number of manufacturers has been supplied with electric power. In many cases this has been brought about to increase the power required in the plant instead of adding more engines to it. In many other cases all the power is electrically supplied. At the beginning of this year the aggregate horsepower in connected motors amounted to 171,880.

Among other large consumers must be mentioned White City, one of the most popular summer amusement parks. Here the load was so great that a sub-station had to be installed.

RESIDENCE LOAD.

While electric lighting still remains as the greatest feature of the residence load, considerable success has been met in Chicago in the introduction of cooking, ironing and other miscellaneous domestic uses of current. This has had a good effect on the load factor of this service.

A rapid extension of residence service has taken place in the last few years. Within the last year a very successful policy in the securing of consumers in old residences has been introduced, which provides for the installment plan of payments for wiring the premises. Thus what seems a prohibitive expense is made quite moderate by being spread over two years.

[illegible] cent. in the rates for electric lighting alone. In accordance with a recent ordinance sanctioning the consolidation effected September 17, 1907, of the Chicago Edison Company and the Commonwealth Electric Company into the present corporation, further reductions in rates are provided for. In 1909 the rate will be [illegible] 10 years ago.

These reductions in rates were made possible only by economic management of the entire industry. Economy in the production and distribution of the current have been most marked and are readily apparent. Other administrative economies have been no less real, even if not so evident. That further economies are to be effected is quite certain.

Other branches of the company's activity that have contributed to its success in its dealings with its many consumers are the sales, wiring, repair, testing and publicity departments. A well-equipped laboratory is maintained for testing of meters and all kinds of electrical instruments and machinery. The publicity department looks after the extensive advertising of the company, an important feature of which is the monthly publication, The Electric City. How well the company has succeeded in rendering Chicago the real electric city is attested by the stupendous increase in the connected load of the company, which has risen in 10 years from an equivalent of 600,000 16-candlepower incandescent lamps to a total of over 3,884,000, exclusive of railway load, at the beginning of the present year.

Typical Summer Load Curves 1903 and 1907.

Typical Winter Load Curves 1903 and 1907.

LOAD DIAGRAMS OF COMMONWEALTH EDISON COMPANY.

Dr. Steinmetz at Ithaca.

Dr. Charles P. Steinmetz visited the Ithaca Section of the American Institute of Electrical Engineers on April 17th, and delivered an address on "The Alternating-current Commutator Motor." Dr. Steinmetz's presence and the interest in the topic which he had chosen resulted in an attendance of over 350 persons, and the lecture was stimulating and instructive.

Dr. Steinmetz described the various types of alternating-current commutator motors, and explained the difficulties of commutation in such motors. He pointed out that compensation for the reactance and transformer voltages involved is a complicated problem, and showed the latest inventions and devices for insuring satisfactory commutation at various loads and various speeds. The lecturer added that the alternating-current commutator motor is not by any means new. One of his first tasks upon his arrival in this country in 1889, after joining Mr. Rudolph Eickemeyer at Yonkers, N. Y., was the designing of an alternating-current commutator motor. [Prof. Elihu Thomson had two years before invented and patented the repulsion motor.]

Dr. Steinmetz, while at Ithaca, delivered a most interesting reminiscent address before the annual dinner of Sibley College, at which about 350 students and members of the faculty were present. The speaker described his early experiences in Germany and Switzerland, as well as his later work with Mr. Eickemeyer at Yonkers, N. Y. He compared the different fields of electrical engineering, in regard to their relative attractiveness and promise. To say that the students appreciated his re-

[illegible] enjoyed.

Electrical Symbols for Airship Maps.

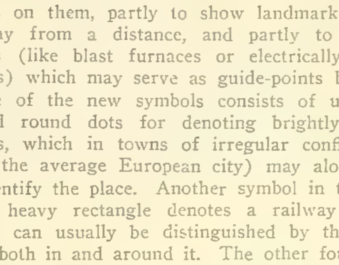
[illegible]

[illegible] it was from the viewpoint of the patent attorney, who realized the need of uniformity in patent drawings involving electrical symbols. The series of suggestions submitted by him was increased in number and scope by others and published by the Chicago Electrical Association (now the Electrical Section of the Western Society of Engineers) in a pamphlet to which [illegible] have often called attention.

However, the symbols thus published only partly filled the need, for they took no account of quantities, such as the candlepower or amperes at an outlet, which quantities enter freely into plans for wiring buildings. Besides, the original series came prior to the days of iron conduits, outlet boxes and allied fittings, which the modern contractor expects to find clearly designated on the plans submitted to him. Hence it was both fitting and timely for the National Electrical Contractors' Association to take up this subject a year or two ago, and to publish a chart of symbols which deserves even wider circulation than it has yet had. This chart was reprinted in the Western Electrician of September 29, 1906, page 249, while some modifications were mentioned in the issue of September 21, 1907, page 218.

Now still another, and in one sense loftier, point of view than that of the inventor, architect or contractor has just been heard from as suggesting the additional symbols pictured herewith.

When the International Aeronautical Federation held its third annual session at Brussels last September, the need of special maps for the use of aeronauts was set forth by one of the German delegates, Herman W. Moedebeck of Strassburg, and he was appointed chairman of an international commission on aeronautical maps. In reporting the results of this commission's work, Mr. Moedebeck recommends the preparation of an international series of maps on the uniform scale of 1 to 200,000, or, roughly, five-thirty-seconds of an inch to the mile. He also advocates the adoption of 40 standard symbols for indicating various landmarks on such maps, including six which relate to electrical circuits. These will have rather unusual guide-



SYMBOLS FOR AIRSHIP MAPS.

marks on them, partly to show landmarks visible by day from a distance, and partly to indicate others (like blast furnaces or electrically lighted streets) which may serve as guide-points by night.

One of the new symbols consists of uniformly spaced round dots for denoting brightly lighted streets, which in towns of irregular configuration (like the average European city) may alone serve to identify the place. Another symbol in the form of a heavy rectangle denotes a railway station, which can usually be distinguished by the bright light both in and around it. The other four relate to central stations and overhead circuits, which circuits the navigator will want to avoid both by day and by night, and particularly when attempting a landing. While the preliminary report of this international commission does not hint it, the time may not be far off when the needs of the aerial navigator will demand nocturnal landmarks akin to the lighthouses along our waters, thus opening another use of electric lamps of high candlepower.

Underground Chicago and Its Electric Freight Railways.

Chicago's remarkable system of freight tunnels is now practically completed, and the big project has passed from a constructive enterprise, in relation to which considerable speculation was indulged, to an actual operating proposition under business management. Only a small amount of work remains to be done to complete the system of 60 miles of tunnel. This does not take into account the lateral connections to buildings, which are being made from time to time.

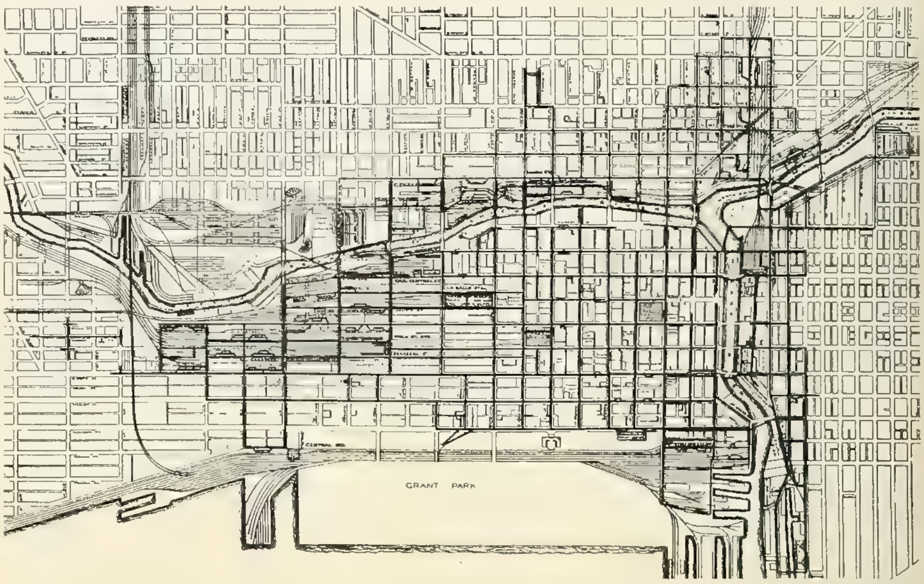
With the history of this great project, the methods of constructing the tunnels and the system of operating the trains, readers of the Western Electrician are familiar. Descriptive articles have appeared during the progress of the work, and the various features have been illustrated. The idea of building the subways was conceived by Albert G. Wheeler, work having been begun about seven years ago, and to Mr. Wheeler's originality and foresight must be given credit for the carrying out of an enterprise of great magnitude and entirely unprecedented.

The matter of putting the tunnels on a business basis and turning them into a profitable industrial enterprise was for other hands. Consequently in June, 1907, the Chicago Subway Company was taken over by a corporation in which railroad interests are largely represented, headed by J. Ogden Armour and E. H. Harriman. Samuel McRoberts, of Armour & Co., was made president of the Illinois Tunnel Company, the operating corporation of the subway; W. J. C. Kenyon was made vice-president and general manager, while A. J. Earling, president of the Chicago, Milwaukee and St. Paul Railroad, is chairman of the executive committee of the board.

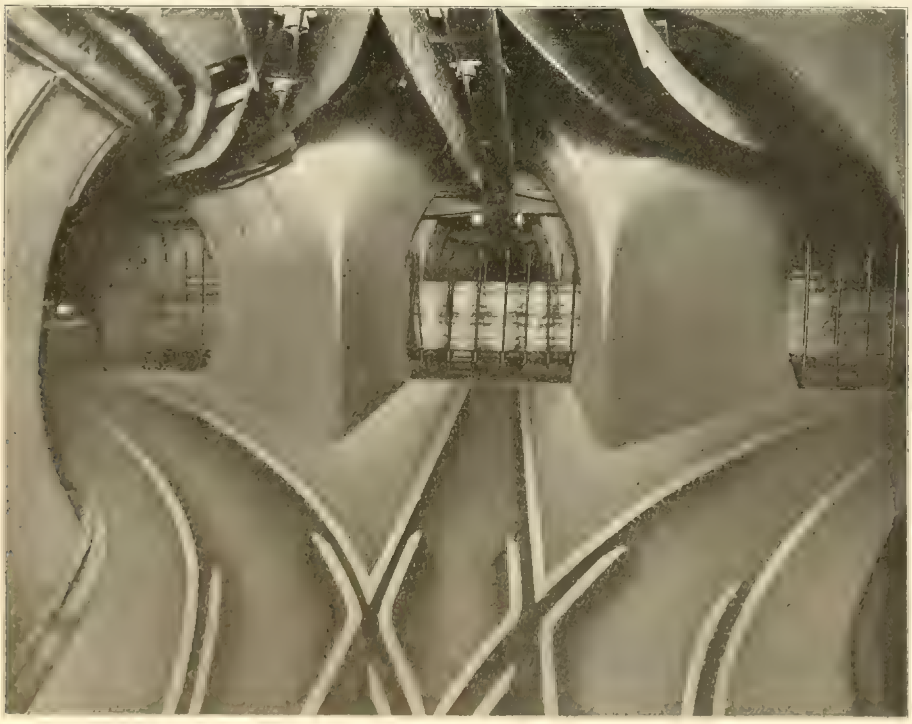
The tunnels are about 40 feet below the street level and are in the main six feet wide and 7½ feet high. The sides, ceiling and floor are of concrete, solid, clean and dry. Beneath every street in the Loop district there is a tunnel, and the bores extend under the river in 13 places, reaching to the intersection of Armour and Archer avenues on the south, Chicago Avenue and Kingsbury Street on the north and to Green Street on the west, the whole making a system of 60 miles. The accompanying map shows the tunnels in heavy lines. The tracks are of two-foot gauge; the trains are drawn [illegible] commercial interests, are so marked that a great [illegible] many teams are removed from the congested streets, and merchants and manufacturers can effect a saving through a reduction in the number of horses, wagons and teamsters needed.

For several years the company has been transferring all the mail between the railroad stations and to the United States postoffice, resulting in the abandonment of the clumsy wagons from the streets and a great increase in the efficiency of the mail service. During 1907 the electric trains made 337,060 trips with mail through the tunnels to the various railroad stations, transporting 10,659,567 bags, pouches and packages of mail. The record for this service was 99.51 per cent. perfect; that is, the mail was delivered at the proper station on time. On the day before Christmas, 1907, the tunnel company handled 44,341 bags of mail, 5,911 pouches and 195 packages, a total of 50,447 parcels. This was transported in 1,391 cars and in 1,229 trips. The performance was pronounced perfect, and there was not a single failure in the record.

The principal revenue for the company is expected to result from the transportation of freight. Many merchants and manufacturers have been impressed with the advantages of the new system and are doing their shipping through the tunnels. The accompanying illustration, Fig. 1, is a view taken by the Western Electrician on April 30th, [illegible] Fifth Avenue with a load of merchandise dispatched from a freight yard on the Northwest Side to a yard on the South Side. The rear headlight of the locomotive is visible at the left. Scenes of this kind are quite common.



MAP SHOWING THE TUNNELS IN UNDERGROUND CHICAGO.



[illegible] FIFTH AVENUE, CHICAGO.

Two large firms which have recently made connection with the tunnels are J. V. Farwell & Co., wholesale dry goods dealers, and Selz, Schwab & Co., wholesale shoe dealers. Fig. 2 is typical of these two installations. The view is in the tunnel-level basement of the shoe house, 40 feet below the first floor of the store. Packing boxes are lowered to and raised from this basement by an automatic conveyor, which does not show in the picture, but is located just to the right of the foreground. By the side of the conveyor is a large elevator which is used for passengers and merchandise. The car shown at the left in the tunnel is a part of a train of seven cars which started for the railroad station about 10 minutes after the picture was taken. This view shows the convenience, cleanliness and substantial construction of this type of shaft.

Fig. 3 is an excellent illustration of the method of connecting some of the large merchandising houses. In this instance there is a three-story basement, and cars can be run onto a large elevator and hoisted to any basement floor. This picture was taken on the lower basement floor of Marshall Field & Co.'s retail store. It shows the front end of a 10-car train just entering the tunnel with a load of empty crates bound for the company's large warehouse across the river, a run of about 15 minutes, which by wagon would consume close to an hour.

The tunnel company has now made connection with the freight yards of every railroad entering Chicago except one. Thirty-four of the large buildings, aside from the postoffice, are receiving the tunnel service. These include wholesale and large retail stores, warehouses and office buildings. The service performed for the office buildings is the delivery of coal and removal of ashes.

It costs about $20,000 to make a connection with the tunnel and sink and equip a shaft, and the company has put about $1,000,000 into this work. Obviously it cannot afford to make a separate connection for all the smaller concerns. But provision is being made for these through the placing of distribution yards in convenient locations, where the small shipper can receive and deliver his goods without driving across the entire city. In this way the company figures that one team will be sufficient where five or six are required without the tunnel service. One of these freight stations has been completed at 169 West Jackson Boulevard, and another is nearing completion on the North Side at the corner of Dearborn Avenue and North Water Street. This service is expected greatly to reduce congestion in the Loop district.

It is said that there is more freight hauled through the streets of Chicago than in any other city in the country. It is estimated that New York hauls about 75,000 tons daily, Philadelphia and Boston about 65,000 tons each, and Chicago about 100,000 tons a day. The money spent annually for hauling this freight, including the wages of en-

ployes and the money tied up in horses, wagons, harness and stables, amount to an enormous sum. The tunnel company does not expect to haul all the freight, but if it gets one-third or even [illegible] tons a day, the latter amount would reach [illegible] tons a year.

There are now ready for service [illegible] cars and 130 electric locomotives. For the coal and freight service 250 cars of similar design are used; [illegible] are of the shuttle type for hauling excavated material from new building sites, and the remainder are of the type shown in the pictures.

The locomotives are very much similar to those used in mining service, and while there are four different types they differ only in detail. The four manufacturers who have furnished locomotives are the Jeffrey Manufacturing Company, the Baldwin Locomotive Works, the General Electric Company and the Goodman Manufacturing Company. Each locomotive is equipped with two railway motors working at a pressure of 250 volts, direct current. The first 70 locomotives installed are of 25 horsepower each, the last 60 being 50 horsepower.

Direct current at 250 volts for operating the trains is supplied by the Commonwealth Edison Company. The trolley is of the ordinary type, substantially constructed and placed overhead. The return current is sent through the rails. The method of construction is clearly shown in the pictures. Trains are limited to 10 cars and the speed is 15 miles per hour.

The system of train movement is of considerable interest. All trains are controlled by a dispatcher through the telephone, and there is an automatic telephone in each street block. Fig. 4 shows the steel passenger car and locomotive which carried a representative of the Western Electrician through the tunnel system. The train is at the corner of Monroe and State streets (underground), and the motorman is shown getting telephone orders for further progress.

Trains are operated on the loop system and are permitted to run only in one direction on any one street. For instance, Monroe Street is for westbound trains only and Madison Street only for eastbound trains; similarly for the north and south streets. This system can be carried out very satisfactorily, as every street is fully equipped for operation, with switches at all the corners. There is thus no chance for collision except at street crossings, and to protect the crossings a number of signal systems have been tried. The company is now about to install an automatic system of its own, which is worked by the trolley wheel, a red

Fig. 3. Tunnel Entrance to Marshall Field & Co.'s Retail Store.

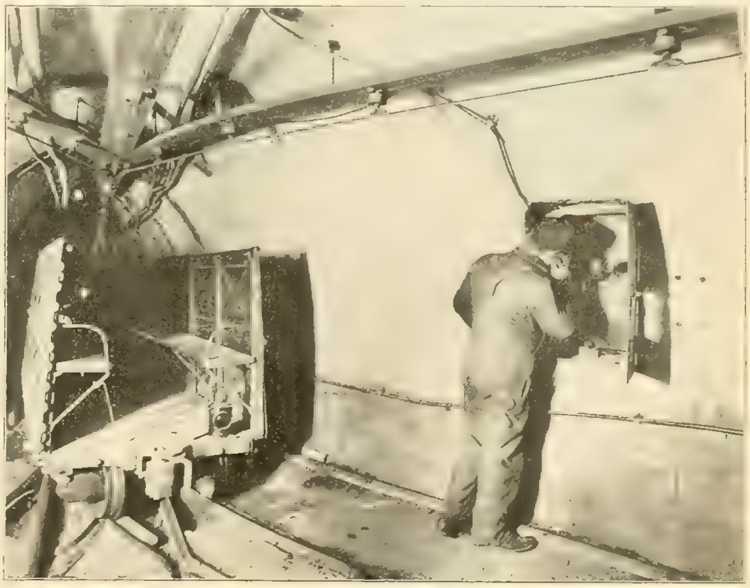


Fig. 4. Motorman Getting Train Orders.

UNDERGROUND CHICAGO AND ITS ELECTRIC FREIGHT RAILWAYS.

light being thrown into circuit as the train approaches the crossing and again thrown out as the train passes. On the same principle a sort of block signal system will be put in at the 13 river drifts to allow but one train on the incline at a time. Where the tunnels go under the river there is a grade of from 1½ to 3 per cent.

It is interesting to note that the Wabash Railroad, in the new tariffs just filed with the Interstate Commerce Commission, takes into account the Chicago freight tunnels. The notice and the tariffs filed show that on any shipment sent to the freight stations of the Wabash through the tunnel from any tunnel station the company will absorb the [illegible]

[illegible] satisfactory.

[illegible] Kenyon, the general manager, and Mr. J. W. Cal-[illegible]

Value of the Oscillograph in Transmission Work.

B[illegible]

[illegible]

FIG. 2. TUNNEL CONNECTION WITH WHOLESALE SHOE ESTABLISHMENT.

complex and difficult phenomena, instruments are developed in a form practical enough to provide data for the deepest experimental analysis of the actions and laws involved. Such was the case with the steam engine when the indicator was developed; such was the fact when the bomb calorimeter removed the study of heating values from the necessity of painstaking and slow chemical analysis, and so has been the development of the oscillograph in commercial form in the field of high-tension power transmission. In the latter case the use of higher and higher potentials on lines of increasing length, the added exposure of long cross-country circuits to lightning and other atmospheric disturbances, the use of generators of enlarged capacity, inclusion of underground cable runs in many high-tension transmission and distribution circuits, occurrence of peculiar surges and electrical disturbances in networks—these and many other things until recently seemed often to result in operating difficulties and troubles which could only be solved by mathematical and technical knowledge of the very highest grade. In fact, so rarely were the conditions known in connection with these disturbances that even the best engineers in the [illegible] instrument in the interpretation of electric circuit [illegible] matter of very little trouble. The data which it gives when applied to particular systems are so [illegible] of skill with which one analyzes the indicator dia-[illegible] to employ the oscillograph in dealing with the troublesome electrical problems of its service leaves [illegible]

[illegible] which the oscillograph secures, a great number of problems can be cleared up, so far as each particular system goes. Thus, the normal conditions of voltage and current in a system of bus-bars in a high-tension or low-tension plant can be shown in close relation, with the shape of the wave forms on a scale of a few hundredths or thousandths of a second; the fitness of different combinations of machines to work in parallel can be determined and the effect of remedies studied.

Abnormal conditions, artificially created, furnish another broad field of study, notably in connection with the use of different types of fuses on lines of very high tension, the value of one style of fuse for given conditions, and the surging of current and voltage as circuit-breakers are put in action. The effects of complete or partial short-circuits, the occurrence of resonance, the influence of synchronous apparatus on hunting and on power factor, the disturbing effect at a distance of artificial short-circuits or of grounds, the behavior of different styles of lightning arresters, effect of discharges on the voltage regulation, and the speed regulation of prime movers can all be studied intelligently with the aid of the oscillograph.

Even the problem of motor flashing in electric-railway service has been attacked with renewed vigor by the aid of this method of analysis. The behavior of one or two pairs of motors on a car in relation to the line voltage, and the effect of temporary artificial short-circuits on the line potential, conditions present as various controller changes are made, etc., can all be reproduced in detail with the oscillograph.

The component parts of such an event as a 60,000-volt fuse short-circuiting a 10,000-horsepower generator on the line side of a transformer can be shown with the oscillograph as in no other way.

By this instrument, which may well be called the indicator of the electrical system, the engineer can see events and relations occurring in fractions of a second too small for appreciation otherwise, and can take steps, without the mathematical knowledge possessed by few men in the electrical field, to remedy disturbances which but two or three years ago would have been problems of almost insuperable difficulty.

National Electric Light Association's Annual Convention in Chicago Next Week.

The thirty-first convention of the National Electric Light Association will be held in the Auditorium Hotel, Chicago, May 18-22, 1908. From present indications the meeting will be very largely attended and of great importance and usefulness. The programme is as follows:

Monday Evening.

8 to 9 P. M. Opening of the exhibition of appliances in Exhibition Hall, ninth floor of Auditorium Hotel. This is a private view for Class A and Class B members.
9 P. M. Reception in new gold banquet room on second floor of Auditorium Annex. To be followed by dancing. A supper will be served. Music will be furnished by an orchestra of 14 pieces.

Tuesday Morning.

10 A. M.—Opening of convention in Assembly Hall, adjoining Exhibition Hall, ninth floor, Auditorium Hotel.
Address of President Dudley Farrand of Newark, N. J.
Report of Committee on Progress—T. Commerford Martin, New York.
"Distribution in Suburban Districts"—George H. Lukes, Chicago.
"Tape"—Paul Lüpke, Trenton, N. J.
Report of Committee on Grounding Secondaries—W. H. Blood, Jr., chairman, Boston, Mass.
"Series Incandescent Lighting with Tungsten Lamps"—P. D. Wagoner, Schenectady, N. Y.

Tuesday Afternoon, 2:30 P. M.

"Observations on the Precision of Different Types of Photometer"—A. E. Kennelly and S. E. Whiting, Harvard University.
"Power Load Development for Central Stations of Moderate Size"—Charles Robbins and J. R. Bibbins, Pittsburg, Pa.
"The Small Station and Its Economical Operation"—J. T. Whittlesey, Newark, N. J.; Paul Spencer, Philadelphia, Pa.
Question Box—Alex. J. Campbell, editor, New London, Conn.
Report of Committee on Uniform Accounting—H. M. Edwards, chairman, New York city.
Candlepower Standard—The presentation of resolutions toward the adoption of an international standard.

Mr. McCutcheon's Lecture.

On Tuesday afternoon the ladies will attend an illustrated lecture at 3 p. m. on "The Philosophy of the Cartoon," by Mr. John T. McCutcheon. Mr. McCutcheon will draw pictures as well as talk. This lecture will be given in Fullerton Hall of the Art Institute, and afterward the visitors will inspect the various galleries in the Institute. Five o'clock tea will be served in the Rembrandt room. Information about all the entertainment features, and tickets where necessary, will be given at the Bureau of Information, parlor floor, Auditorium Hotel.

Tuesday Evening.

Visit to White City.

On Tuesday evening both ladies and gentlemen will be the guests of the association at White City, one of Chicago's best-known amusement parks, where a lavish use is made of electric light. Special trains will leave the old Congress Street station of the South Side elevated railroad [illegible] p. m., and coupon tickets will be furnished which will admit the holders not only to the grounds but to the various shows inside.

Wednesday Morning.

Report of Committee on [illegible]—W. C. L. Eglin, [illegible] Philadelphia, Pa.
[illegible]—John W. Kirkland, [illegible]
[illegible] Committee [illegible] L. A. Ferguson, chairman, [illegible]
[illegible] Hegeler in [illegible]
[illegible] Philadelphia, Henry [illegible]

[illegible]

[illegible]

Wednesday Afternoon.

Visit to Fisk Street Station.

The only feature of Wednesday afternoon is a visit to the Fisk Street power station of the Commonwealth Edison Company. This is the first and largest steam-turbine electric power house in the country. It is described and illustrated in this issue of the Western Electrician. Refreshments will be served in a large tent on the grounds west of the switchhouse.

Wednesday Evening.

8 P. M.—Executive session:—
Reports of secretary and treasurer and executive committee.
Report of Insurance Expert—W. H. Blood, Jr., Boston, Mass.
Report of Committee on Public Policy—Arthur Williams, chairman, New York city.
"The Status and Commercial Possibilities of High-efficiency Lamps"—W. W. Freeman, Brooklyn, N. Y.

Dudley Farrand, Newark, N. J., President.

Arthur Williams, New York, Past-president, Chairman Executive Committee.

W. C. L. Eglin, Philadelphia, Second Vice-president.

W. W. Freeman, Brooklyn, Secretary and Treasurer.

Louis A. Ferguson, Chicago, Past-president, Chairman Entertainment Committee.

OFFICERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Report of Committee on Rates and Costs—R. S. Hale, chairman, Boston, Mass.
Election of Nominating Committee.

Thursday, Commercial Day.

There will be morning and afternoon sessions at the usual hours. C. W. Lee of New York city is chairman of the programme committee for this day.
Henry L. Doherty, past-president, will preside during Commercial Day sessions.
1. Address, "Relationship Between the Engineering and Commercial Departments"—Louis A. Ferguson, past-president, Chicago.
2. "Preparation for a Campaign"—Editor: H. J. Gille, Minneapolis, Minn.
3. "The Contract Agent and the Representative"—Editor: V. A. Henderson, Memphis, Tenn.
4. "The Display Room"—Editor: L. D. Mathes, Dubuque, Iowa.
5. "Advertising"—Editor: Charles A. Parker, Detroit, Mich.
6. "Publicity"—Editor: Percy Ingalls, Newark, N. J.
7. "Creating Demand for Electricity"—Editor: Frank B. Rae, Jr., New York city.
8. "Evolution of New Business Building"—Editor: George N. Tidd, Scranton, Pa.
9. "The Electrical Contractor"—Editor: Joseph F. Becker, Jr., Brooklyn, N. Y.
10. "Co-operative Commercialism"—J. Robert Crouse, Cleveland, Ohio.
11. "Illuminating Engineering as a Commercial Factor"—[illegible] V. R. Lansingh, New York city.
12. Report of Committee on Solicitors' Handbook Prize [illegible] John F. Gilchrist, chairman, Chicago, Ill.
Report of Committee on Co-operative Electrical De[illegible] W. W. Freeman, chairman, Brooklyn, N. Y.

[illegible]

At 11 a. m. on Thursday the ladies will leave in [illegible] South Shore [illegible] Club [illegible] Lake [illegible] club, with building in the Spanish style. In the grounds there is a nine-[illegible] grounds [illegible] An elaborate luncheon, supervised by the club's noted chef, will be [illegible] returning the route will be through the South Side parks and boulevards, passing the buildings of the University of Chicago. The hotel will be reached on the return about 5 p. m.

Theater Parties.

Theater parties for both ladies and gentlemen will be given on Thursday evening, with the association as the host. Seats have been reserved for "The Hoyden" at the Studebaker and for "Miss Hook of Holland" at the Illinois. Both theaters are near the Auditorium. The Studebaker adjoins the hotel on the north, and as there is a connection between, on the second floor, it will not be necessary to go out doors to reach it. The Illinois is scarcely two blocks away, on Jackson Boulevard, between Wabash and Michigan avenues.

Friday, Closing Day.

A morning session will be held at the usual hour and perhaps an afternoon session also.
"Illuminating Engineering"—W. D'A. Ryan, West Lynn, Mass.
Report of Committee on Protection from Lightning and Other Static Disturbances—R. S. Stewart, chairman, Detroit, Mich.
"The Value of Care and Maintenance of Meters"—H. D. King, Hoboken, N. J.
"Some Experiments in Combustion"—S. J. Lenher, New York.
"Specifications for Construction on Joint Poles"—Paul Spencer, Philadelphia, Pa.
Final Report of 1907 Committee to Consider Specifications for Street Lighting—W. D'A. Ryan, West Lynn, Mass.
Memorials—T. C. Martin, New York.
Executive session.
Election of officers for the ensuing year.
Adjournment.

Parallel Session.

Unfinished business from Commercial Day programme (if any) from the Thursday session.
Council of Progress—Addresses by Elbert Hubbard of the Philistine, and others.

Officers and Committees.

The officers and convention committees of the National Electric Light Association are as follows:
President—Dudley Farrand, Newark, N. J.
First Vice-president—Alex Dow, Detroit.
Second Vice-president—W. C. L. Eglin, Philadelphia.
Secretary and Treasurer—W. W. Freeman, Brooklyn.
Assistant Secretary and Treasurer—Miss Harriet Billings, New York.
Master of Transportation—Geo. F. Porter, New York.
Insurance Expert—W. H. Blood, Jr., Boston.
Executive Committee—Arthur Williams, New York; Charles L. Edgar, Boston; John Martin, San Francisco; Frank W. Frueauff, Denver; Charles R. Huntley, Buffalo; Louis A. Ferguson, Chicago; Frank M. Tait, Dayton, O.; A. J. DeCamp, Philadelphia; George H. Harries, Washington, D. C.
General Convention Committee—Alex Dow, Louis A. Ferguson, W. C. L. Eglin, W. W. Freeman, Charles L. Edgar, Charles R. Huntley, Arthur Williams, Frank H. Gale of Schenectady, N. Y., George H. Harries, Frank M. Tait, John F. Gilchrist of Chicago.
Reception Committee (Mr. Samuel Insull, Chairman)—Mr. Bion J. Arnold, Mr. and Mrs. Godfrey H. Atkin, Mr. and Mrs. Frank J. Baker, Mr. and Mrs. Enos M. Barton, Mr. and Mrs. Louis A. Ferguson, Mr. and Mrs. William A. Fox, Mr. and Mrs. Truman P. Gaylord, Mr. and Mrs. J. Henry Goehst, Mr. Walter S. Goll, Mr. and Mrs. Charles E. Gregory, Mr. and Mrs. H. Rae Hixson, Mr. and Mrs. Robert C. P. Holmes, Mr. and Mrs. Fred W. Insull, Mr. and Mrs. Samuel Insull, Mr. and Mrs. James W. Johnson, Mr. and Mrs. William E. Keily, Mr. and Mrs. Edward B. Kittle, Mr. and Mrs. Edward W. Lloyd, Mr. and Mrs. Willard W. Low, Mr. and Mrs. Ayres D. Lundy, Mr. and Mrs. Homer E. Niesz, Mr. and Mrs. Frank L. Perry, Mr. and Mrs. Frederick Sargent, Mr. and Mrs. Thomas I. Stacey, Mr. and Mrs. Benard E. Sunny, Mr. and Mrs. Walter H. Whiteside, Mr. James R. Wiley, Mr. James Wolff, all of Chicago.
Entertainment Committee—Louis A. Ferguson, chairman; Godfrey H. Atkin, H. Rae Hixson, James W. Johnson, Ernest A. Edkins, Oliver R. Hogue, John J. Schayer and William H. Ott, all of Chicago.
Hotel Committee—Homer E. Niesz, 139 Adams Street, Chicago.
Exhibition Committee—F. H. Gale, Schenectady, chairman; Walter Neumuller, New York, secretary; H. M. Post, Chicago, treasurer; J. C. McQuiston, Pittsburg; W. S. Heger, Milwaukee; Rodman Gilder, Ampere, N. J.; C. P. Frey, Newark, N. J.; Benjamin Wall, Brooklyn, N. Y.; James I. Ayer, Cambridge, Mass.; S. E. Doane, Cleveland, O.; Homer E. Niesz, Chicago, Ill.
Commercial Day Committee—C. W. Lee, New York, chairman; J. Robert Crouse, Cleveland; George Williams, New York; Frank B. Rae, Jr., New York; Howard K. Mohr, Philadelphia; John F. Gilchrist, Chicago.
Chief of Registration Bureau—Miss Edith M. Myers, New York.

The badge colors for the 1908 convention are as follows: Honorary, white; officers, red; member companies (Class A), purple; members (Class B), rose; associate member companies (Class D), golden brown; associate members (Class E), pink;

guest, pale blue; press, dark brown; ... committee, dark blue; reception committee, ... white and blue; entertainment committee, ... white and blue; hotel committee, yellow; ... committee, rose.

GENERAL INFORMATION.

Registration is the first duty of the visitor. The registration office and postoffice will be on the parlor floor of the Auditorium Hotel, corner of Michigan Avenue and Congress Street. The secretary's office will also be on the parlor floor of the hotel. Here also will be the headquarters of the hotel committee. The entertainment committee's Bureau of Information will also be here. From this bureau information relating to the convention or Chicago may be obtained; also tickets for the various entertainment features.

The exhibition hall is on the ninth floor of the Auditorium Hotel.

The assembly hall for the general meetings adjoins the exhibition hall.

Special meetings and parallel sessions are to be held in the banquet hall on the sixth floor of the Auditorium Hotel.

A special train will leave New York for Chicago via the Pennsylvania Railroad (foot of West Twenty-third Street) at 9:55 a. m., on Sunday, May 17th, arriving in Philadelphia at noon, Pittsburg at 7:30 p. m. and Chicago at 8:30 a. m., May 18th. George F. Porter, master of transportation, will be in charge.

The general offices of the Commonwealth Edison Company, the Chicago central-station company, are at 139 Adams Street; but passes to visit stations and sub-stations may be obtained at the Bureau of Information at the hotel during the convention.

The offices of the Board of Supervising Engineers, which has in charge the interesting and extensive rehabilitation of the street railways of Chicago, are at 181 La Salle Street.

Chicago's hydro-electric transmission plant is on the Drainage Canal, the power house being located at Lockport, Ill., 33 miles from the center of the city. It is in charge of the Sanitary District of Chicago, 125 Monroe Street. Santa Fe trains from Chicago stop at the power house.

An advance registration of 850 was reported from New York, ten days before the convention. The total registration at Washington last year was 1,675, the largest in the history of the association. This will probably be exceeded at Chicago this year.

AMUSEMENT ATTRACTIONS.

During the week beginning May 17th the attractions at the principal Chicago theaters will be as follows:

Illinois—Jackson, between Wabash and Michigan .... "Miss Hook of Holland"
Powers—Randolph, opposite City Hall .... "Witching Hour"
Grand—Clark, opposite Court House .... "Paid in Full"
Garrick—Randolph, near Dearborn .... "The Gay White Way"
Colonial—Randolph, between Dearborn and State .... "Merry Widow"
McVickers—Madison, between Dearborn and State .... "Brewster's Millions"
Majestic—Monroe, near Dearborn ...... Vaudeville
Chicago Opera House—Washington and Clark. .... William Hodge in "The Man from Home"
La Salle—Madison, between Clark and La Salle .... "Honeymoon Trail"
Studebaker—Michigan, near Van Buren .... Elsie Janis in "The Hoyden"
Whitney Opera House—17 Van Buren Street .... "The Three Twins"
Great Northern—Quincy, between Dearborn and State .... "Wine, Woman and Song"
Auditorium—Wabash Avenue and Congress .... "His Honor the Mayor"

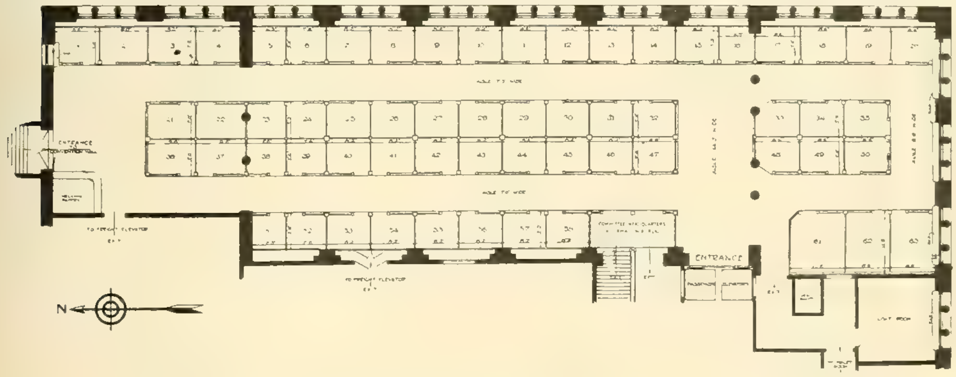
At the National League Baseball Park, Polk and Lincoln streets (West Side), the Chicagos (Cubs) will play, weather permitting, Brooklyn on May 18th and Boston on May 20th, 21st and 22d. On Thursday, May 21st, is scheduled the raising of the world's championship pennant, the Boston club, the only other survivor of the original National League, assisting. Games are called at 3:30 p. m. There are no games scheduled at the American League Baseball Park (White Sox) during convention week.

James I. Ayer, Cambridge, Ma... W. S. Heger, Milwaukee. J. C. McQuiston, Pittsburg. Homer E. Niesz, Chicago. Howard M. P...st, Chicago.

MEMBERS OF EXHIBITION COMMITTEE OF NATIONAL ELECTRIC LIGHT ASSOCIATION.

THE EXHIBITION.

The exhibition of electrical appliances will be held on the ninth floor of the Auditorium Hotel, and will be not only educational but brilliant and attractive. It will be worth coming a long way to see. Following is a list of the exhibitors, with the numbers of their booths, as shown on the accompanying floor plan:



PLAN OF BOOTHS AT EXHIBITION TO BE HELD AT CHICAGO ELECTRIC-LIGHT CONVENTION.

Allis-Chalmers Company, Milwaukee, 57, 58.
American District Steam Company, Lockport, N. Y., 22.
Central Electric Company, Chicago, 23, 24.
Condit Electrical Manufacturing Company, Boston, 11.
Crocker-Wheeler Company, Ampere, N. J., 43.
Dossert & Co., New York, 6.
Duncan Electric Manufacturing Company, Lafayette, Ind., 7.
Electrical Age, New York, 28.
Electric Appliance Company, Chicago, 20.
Electrical Review, New York, 42.
Electrical Record, New York, 55.
Electric Service Supplies Company, Chicago, 4.
Electrical World, New York, 36.
Federal Electric Company, Chicago, 54.
Fort Wayne Electric Works, Fort Wayne, Ind., 12.
General Electric Company, Schenectady, N. Y., 29, 30, 44, 45.
German-American Electric Company, New York, 2.
Gest, G. M., New York, 6.
Gregory Electric Company, Chicago, 5.
Illuminating Engineer, New York, 51.
Johns-Manville (H. W.) Company, New York, 15, 16.
Lee (C. W.) Company, New York, 56.
McJunkin (W. D.) Advertising Agency, Chicago, 17.
Minerallac Company, Chicago, 21.
National Electric Lamp Association, Cleveland, 25, 26, 40, 41.
Pettingell-Andrews Company, Boston, 38, 39.
Philadelphia Electric Manufacturing Company, Philadelphia, 10.
Pittsburg Transformer Company, Pittsburg, Pa., 1, 2.
Sangam Electric Company, Springfield, Ill., 19.
Simplex Electric Heating Company, Cambridge, Mass., 31, 32.
Triumph Electric Company, Cincinnati, 8.
Wagner Electric Manufacturing Company, St. Louis, 37.
Western Electric Company, Chicago, 46, 47.
Western Electrician, Chicago, 53.
Westinghouse Electric and Manufacturing Company, Pittsburg, 33, 48.

Booths will be of a uniform, artistic design. The color scheme is a combination of a peculiar shade of dark green and a white containing a tinge of green. The lettering of the sign-boards will be gold or aluminum. The names of the members of the exhibition committee are given in another column.

The Edison Medal.

An important change has been made in the conditions under which the Edison medal is hereafter to be awarded.

The Edison medal was founded by the Edison Medal Association, composed of old associates and friends of Mr. Edison, who subscribed a trust fund for that purpose, under an indenture dated February 11, 1904. The American Institute of Electrical Engineers engaged annually to award the medal "to such qualified student as shall have submitted to the Institute * * * the best thesis on record of research on theoretical or applied electricity or magnetism."

As no student entered in competition for the medal, the Institute, in the spring of 1907, decided to obtain, if possible, such change in the deed as to make the award dependent upon "meritorious achievement" in the electrical field. This has now been done. By the terms of the new deed, the Edison medal is no longer open to competition, but it is to be awarded "for 'meritorious achievement' in electrical science or electrical engineering or the electrical arts," thus placing the award on the high plane where the Institute and the Edison Medal Association deem it properly belongs. The award is limited to a resident of the United States and its dependencies, or of the Dominion of Canada. Charles L. Clarke, 120 Broadway, is chairman of the Edison medal committee.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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[illegible] of the National Electric Light [illegible] some imperative [illegible] convention to be held in [illegible] programme [illegible] read[illegible]ers of this journal can judge for themselves whether [illegible] vention will not be wisely spent. In fact, there can [illegible]

Central-station men and others qualified for membership will also receive a warm welcome, we are sure, even if not as yet members. Come to the convention, and it is likely that before the close you will, if in this class, see the importance of applying for membership.

The work of the association is of a high order, and it goes on the year around. The convention is the culmination, the clearing-house, of the year's development and ideas, as it were. No one interested in electrical subjects, either technically, industrially or commercially, can fail to find something of especial value to him in the programme of this convention. Such vital questions as public policy, increase of business and economy of operation are considered. The papers are prepared by experts, and members are expected to ask questions and to give their own views; the discussions, the interchange of opinions, constitute the most valuable feature of the meeting.

Western men especially, in view of the fact that this is the first western convention in three years, should turn out in large numbers, and give the association and Chicago their support.

Perhaps some of the members do not realize the amount of hard work that is put into the preparation for such a convention as this at the headquarters of the association, by the local central-station men and by the various committees. These faithful workers are fellow-craft. Electrical men generally should recognize the faithful performance of this well-executed task and reward it by their presence at the meeting.

Come to the convention. Come early—before the reception—and stay until the final adjournment. Electrical Chicago extends you a most cordial and hearty invitation.

BY A CURIOUS and interesting coincidence the National Electric Light Association comes to Chicago in 1908, as it did on the occasion of its last visit to this city in 1903, at a time when the local central-station company is building a great electric power house. Five years ago it was the Fisk Street station which was under construction; now it is the Quarry Street plant which is in process of erection. The new station lies just across the South Branch of the Chicago River from "Fisk Street," but it is an entirely distinct plant, with its own individual characteristics, although when completed the building, architecturally considered, will harmonize with its imposing neighbor.

Quarry Street station will have an ultimate capacity of 84,000 kilowatts in six 14,000-kilowatt turbo-generator units. One of these machines is to be installed this year, and another is to be placed in service in 1909. About one-half of the ultimate building is now under erection, and the present plans show two of the large units. A plan and cross-section of the Quarry Street station are given in this issue of the Western Electrician—the first publication of these interesting drawings. The first reference to this plant in an electrical journal was made in the Western Electrician of January 4, 1908. In the present issue the new power house is described in some detail.

In the five years that has elapsed since the visit of the National Electric Light Association in 1903, when the Fisk Street station was just rearing its massive steel structure toward the sky, a truly marvelous development has taken place in that power plant. Today is has a maximum capacity in 10 turbo-generator units of about 100,000 kilowatts. This fact is a flattering indorsement of the courage and foresight of its builders.

Chicago may well be proud of Fisk Street station. It is undoubtedly the most economically operated plant on either side of the Atlantic and also the lowest in interest and depreciation cost. Withal it is one of the most dignified and artistic of power houses, while its interior finish and upkeep are unsurpassed. It is a pleasure to add also that the credit for the remarkably low operating cost is to be given to a Chicago consulting engineer—Mr. Frederick Sargent—a fact to which Mr. Samuel Insull, the president of the Commonwealth Edison Company, bears ungrudging witness.

In other ways "Fisk Street" is the most notable power station in the United States, probably in the world. It was the first great steam-turbine power house, where, from the inception, not a reciprocating engine was installed, except to drive small auxiliary apparatus. It took nerve and grit to make the great investment represented by this very large generating plant and to lavish it on an untried machine. But the men who conceived the plant believed in the steam turbine and they launched forth boldly. Their courage and faith have been amply justified. Today the steam turbine has undisputed supremacy in large power-house design. If steam is to be employed, it is the turbine, not the piston engine, that is used for the generating units.

The boldness of the design of Fisk Street was shown by the fact that not only were steam turbines laid down exclusively, but they were in very large units. The colors were nailed to the mast. The first machines were of 5,000 kilowatts rated capacity each, and since then the tendency has been toward machines of constantly increasing size. Now there are 10 units in the plant, and the maximum capacity is perhaps a trifle in excess of 100,000 kilowatts. The ultimate capacity is not less than 168,000 kilowatts. By the progress of the art, this has been achieved with but slight changes in boiler, grate and stack equipment in a station originally designed for an ultimate maximum of 70,000 kilowatts.

Another novel feature—at least on such a large scale—was the switch house at Fisk Street. This is an entirely distinct structure, and in it the switching operations are mainly carried on, although comparatively small operating switch galleries—two of them—are in use in the turbine room of the main station. In Quarry Street the essential feature of the switch-house idea is retained, but here it is rather an extension of the main building, with a fire wall between, instead of an entirely distinct structure.

The arrangement at Quarry Street is clearly shown by the plan and cross-section drawings given in this issue, and the "layout" may be compared with the plan of Fisk Street, showing the latter's imposing dimensions, and with the exterior and interior photographic reproductions of that plant.

To a considerable extent "Quarry Street" may be regarded as an improved "Fisk Street," the designers having profited by actual experience with the older plant. Nevertheless, the design of the newer station is vigorous in its own individuality and adapted to its own requirements and to the land available. It is more than a copy of "Fisk Street" with improvements. But always, so far as can be foreseen now, the older plant will remain the larger one, while "Quarry Street," independent and distinct, will remain a worthy second. Perhaps—who can tell?—still other generating plants, possibly quite remote, will in the future make these now very up-to-date power houses hang their diminished heads, if the figure may be allowed.

A large portion of the space available in this issue of the Western Electrician is devoted to recounting recent central-station development in Chicago, particularly during the last five years, or since the visit of the National Electric Light Association in 1903. Visitors to the generating plants and sub-stations of the Commonwealth Edison Company during the convention of the same association in this city next week will find much to study; for it is not too much to say that nowhere have central-station problems been grappled more intelligently or more fearlessly than in this city.

That this is not boastful language is shown by the fact that in 1896 the number of kilowatt-hours sold by the Chicago Edison Company was about 10,000,000, while for the year ended March 31, 1908, the number of kilowatt-hours sold by the Commonwealth Edison Company, successor to the older company, was 290,000,000. The business of the company has more than doubled every three years.

Chicago has also been notable for voluntary reductions in the price of current to the consumer. What, then, is the lesson of the rapid development of the electric-light and power business in this city? It seems to be this—that good engineering accompanied by good selling on a scientific basis must eventually reduce the selling price of electricity the whole country over.

Reducing Motor Defects in Service.

The electric motor, as built under modern designs, will stand so much abuse that there is a tendency, even in installations where the equipment is well operated, for troubles to occur which might have been avoided with better inspection. One of the main causes of breakdown in electrical machinery is lack of cleanliness. It is nothing new to emphasize this, but as long as troubles occur from this cause, reference to them is [illegible]. A number of recent cases of breakdown from the accumulation of dirt or oil in the windings or on the commutator are worth citing.

In one instance a coating of oil and lint inside a three-horsepower shunt motor took fire, and burned the insulation off the fields. Neglect of cleaning was responsible for the damage sustained. In another case a deposit of oil, carbon dust and soot upon the insulating washer separating the commutator segments from the clamping ring caused a short-circuit between the armature and the grounded frame of the machine. Before the fuse blew three of the commutator segments were burned beyond repair, and several of the armature coils were disconnected from the commutator leads. In the case of a 15-horsepower motor wound for about 400 volts maximum, accumulation of carbon dust upon the insulating washer short-circuited some of the segments and destroyed one of the armature coils. The replacement of this coil necessitated the rewinding of the entire armature, for the insulation of the other coils was so impaired that the burned coil could not be lifted out without damaging them.

On account of the simplicity of the oiling arrangements in the modern motor, it sometimes occurs that serious damage is done the machines through long neglect of the lubrication conditions. In the case of a 20-horsepower motor of the 440-volt induction type, the bearing at the pulley end of the rotor shaft became overheated, and the white metal lining ran out. The end of the shaft dropped sufficiently to bring the rotor into contact with the core of the stator, and both rotor and stator windings were damaged and had to be rewound. The bearing had no oil gauge. Excessive wear of the shaft bearings tends to bring the armature and pole pieces together, with a general short-circuiting of the moving coils.

In one instance trouble was continually experienced from the blowing of fuses in the circuit of a semi-enclosed alternating-current motor. An insulation test showed that the stator windings were grounded. One end of the machine was saturated with oil and covered with dust, and the stator windings were burned in many places by arcs caused by temporary short-circuits. The stator had to be entirely rewound. The oil had come from the bearing at the pulley end of the rotor shaft. This bearing was partly inside the casing, and the mouth of its overflow pipe was placed too high. This, combined with an inefficient guard over the oil thrower and a shaft speed of 750 revolutions per minute, allowed the oil to creep along the shaft and be thrown upon the windings.

In another case, cited in the report of the British Engine, Boiler and Electrical Insurance Company, when the generator was stopped for the noon hour the spaces behind the commutator leads were found to be filled with black dust from the foundry in which the machine was working. The dust had so permeated the cotton covering of the conductors as to short-circuit the armature coils.

It is less easy to damage the rotor of an induction motor than the stator, for the difference in potential between the winding of the rotor and the frame is ordinarily low.

Failure to replace carbon brushes when they are badly worn down is the cause of many commutator troubles. In case the brush-holders are designed so that they can come in contact with the segments when the carbons are worn off, serious grooving of the commutator and resulting short-circuits are almost inevitable. Severe sparking, pitting and the wearing of deep circles in the bars follow as a matter of course.

Average Fares in Indiana.

The Indiana Bureau of Statistics have presented figures showing the average fare on the street and interurban lines in Indiana. On city lines the average fare for 1907 was 3.6 cents, this low figure being due to transfer tickets and reductions made on tickets sold in quantities. The average interurban fare was 16.6 cents, making it apparent that [illegible] long distance travel.

The Rise of the Electric Club.

[illegible] Chicago, but which would advance their commercial interests and enhance their knowledge of the electrical art.

Committees were appointed to look after the details of organization, and on February 12th an election of officers was held. Mr. C. A. S. Howlett of the Western Electric Company was elected president, to hold office for one year, the other officers being as follows: Vice-president, A. L. Millard, Westinghouse Electric and Manufacturing Company; secretary, S. M. McFedries, J. L. Schureman Company; treasurer, W. P. Crockett, W. P. Crockett Company. These officers, together with George Cutter, F. P. Vose, P. R. Boole, F. F. Skeel and J. T. Pomeroy, form the board of directors.

Meetings are held each Wednesday noon at the Grand Pacific Hotel, and, after luncheon, papers are read and discussions held on various subjects connected with the electrical industry. Among the papers which have been read were: "Hot Water and Steam Heating from Central Stations," by Mr. Jewett of the Wagner Electric and Manufacturing Company; "Electric Heating and Cooking," by Mr. Callahan of the General Electric Company; "Past Conditions in the Trade," by G. P. Nichols; "Electric Meters," by Mr. Bushnell of the Commonwealth Edison Company; "The Legal Aspect," by Mr. Vose of the Electrical Trades Association; "Credits," by Mr. Parsons of the Western Electric Company, and "Illumination," by Mr. Bonham of the Sterling Electric Manufacturing Company.

The attendance at the meetings and the growth of membership testify to the interest taken in the discussion of these subjects. At the initial meeting there were only 16 present, whereas at this time there are about 260 members, and the main dining room of the hotel is required for the weekly meetings. Applications are still coming in and permanent quarters for the club are contemplated.

It is planned, also, to give entertainments of lighter nature occasionally, and to this end a "smoker" was successfully given last month. The entertainment committee has another affair in preparation, which is to be given during the month of May.

Among the persons who will read papers at future meetings are: Louis A. Ferguson, Commonwealth Edison Company; H. W. Young, Central Electric Company; E. I. Sessions, General Electric Company; A. Frantzen, Arthur Frantzen Company; F. J. Postel, Postel & Linn; F. L. Perry, Western Electrician.

Franklin and Kelvin.

At the British Institution of Electrical Engineers on May 1st Mr. H. F. Parshall presented that body with a bust of Franklin on behalf of the American Institute of Electrical Engineers. In a few brief remarks he referred to Franklin as the greatest scientist America had ever seen, and although Americans did not place him on the same plane as Kelvin, yet he thought the two countries could regard them as the greatest scientists of the world, with Kelvin in a class by himself. The bust, which is in bronze, was accepted by the president of the Institution of Electrical Engineers, Colonel Crompton, who recalled the great hospitality shown to the British Institution by the American Institute at the time of the St. Louis Congress.

Following on the presentation of this bust, Professor Silvanus P. Thompson delivered the first "Kelvin" lecture. As a memorial to Lord Kelvin, it has been decided to found an annual lecture to be named the "Kelvin" lecture, and Professor Thompson, who took as his subject the life and work of the great man, opened the series in a most fitting manner. Dr. Thompson has special and peculiar gifts in portraying the lives of great scientists, as witness his life of Faraday, and the lecture needed to be listened to, or at any rate to be read in full, to be thoroughly appreciated. Almost every detail of Lord Kelvin's scientific life was set forth with anecdotes and incidents which only a close and personal friend could have access to.

Electric Display for "Fleet Week" in San Francisco.

[illegible] for individual lighting in connection with store [illegible]

[illegible] handle the throngs of sightseers, including many thousands of transients. Plans were made to operate 500 electric cars daily during "Fleet Week," an [illegible] 7th more cars were running in San Francisco than before the fire. On the peak load the power required for the operation of all the cars was about 20,000 kilowatts. This heavy draft upon the power plants was met successfully by the Pacific Gas and Electric Company and the City Electric Company, from both of which the United Railroads purchases current in addition to operating its own generating station at North Beach.

The largest electrical feature displayed during the festivities in honor of the fleet was the big electric sign, with letters each 50 feet in height, spelling out the word "Welcome." The large wooden framework occupied a position near the summit of historic Telegraph Hill and could be seen from all of the ships and from the cities across the bay. It contained more than 3,000 incandescent lights.

A number of prominent buildings were elaborately decorated and illuminated with electric lights. The Hibernia Bank Building, which had a large Irish flag displayed in front, together with very artistic draping effects done with the American colors, was most handsomely outlined in electric lights. The dome was worked out in considerable detail. The damaged dome of the City Hall was again covered with incandescent lamps, looking almost as well as in illuminations in days before the fire. The decorations of the Union Ferry Depot were very elaborate. An immense shield was worked out in red, white and blue lights on the Market Street front of the tower, while streamers covered with electric lights ran from the upper section to the roof of the main building. The grand nave of this building was beautifully decorated with vari-colored incandescent lamps, furnished by the Metropolitan Electric Supply and Construction Company.

The front of the 12-story St. Francis Hotel was outlined in red and white lights and the arcades of the three wings were covered with lights so as to show every detail. One of the most beautiful store-front decorations was that of Hale Bros. A great shield was done in the national colors with electric lights in addition to other artistic lighting effects. The supply of power was kept up remarkably well, although the generators were heavily overloaded, as stated.

The Pacific Gas and Electric Company took an unusually large amount of power from its hydro-electric plants in the mountains to supplement the output of its San Francisco plants. It is said that on many of its outside power circuits in the interior of the state the operation of electric motors was suspended so as to permit of transmitting more current to San Francisco for a few days.

Programme of Armour Institute Electrical Meetings.

The students' branch of the American Institute of Electrical Engineers at Armour Institute held a meeting May 7th, at which Mr. H. R. Badger read a paper on "Hydro-electric Power-plant Design." A special meeting was arranged for May 14th to enable Mr. C. R. Morey to present his paper on "Lightning Protective Apparatus." On May 21st Lieut. W. F. Sims, Illinois Naval Reserves, will speak on "Some Features of the Electrical and Mechanical Equipment of the United States Navy." At the last meeting in May, on the 28th, Prof. J. E. Snow will discuss "Machine-tool Driving."

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker.

Part VII.

The Test Room (*Continued*).

Primary Laboratory Standards. The laboratory equipment of a central-station company desiring to check its own instruments may include standard wattmeters and potentiometers, which, in connection with a 150-cell storage battery of small capacity, permit precise measurement of potentials up to 300 volts; of standard ammeters with a large-capacity storage battery or other source of heavy currents, permitting equally accurate measurement of current; and of a standard chronometer or clock.

Primary standards should be compared with the standards of independent laboratories, to avoid deviation from the standards certified by the United States Bureau of Standards at Washington, D. C.

The fundamental standards are standard cells, such as the Clark mercury-zinc cell, which is made in various forms, and standard resistances. From these elements potentiometers and resistance boxes have been designed for effecting potential, current and power measurements with any desired precision by the use of a sensitive galvanometer.

For the calibration of secondary standards in the laboratory there may be employed: A potentiometer reading to 1.5 volts in steps of 0.00001 volt, with D'Arsonval galvanometer, and ratio resistance boxes giving ranges of 15, 150, 300 and 600 volts; standard resistances ranging in capacity from 1.0 to 0.0001 ohm; high-resistance standards ranging from 1,000 to 100,000 ohms, and a megohm resistance; electro-dynamometer and shunt box, adapted to measure alternating and direct currents up to 50 amperes, potentials up to 600 volts, and power up to 25 kilowatts.

The potentiometer method gives far greater accuracy than is attainable in deflection instruments, inasmuch as it consists in the obtaining of a balance against a standard electromotive force, through a standard resistance, neither of which is subject to change under laboratory conditions. For precision measurements of electromotive force in the calibration of voltmeters, for example, the potentiometer, as a null instrument, has the advantage of giving any desired precision, when a sufficiently sensitive galvanometer is used, with the disadvantages of requiring a very steady voltage and much time to make a test. Moreover, a good potentiometer is an expensive and bulky instrument. These features have operated against the wide utilization of the potentiometer in commercial work. Deflection instruments, with their practical advantages of being quickly read and of requiring no special setting up, have been more in vogue in spite of their limited attainable accuracy, and, in instruments of the moving-coil type, their liability to error from stray fields, change in strength of magnets and springs, etc.

The above may be summarized by the statement that the potentiometer method is the most accurate, but that the deflection-instrument method has hitherto been the more expedient.

A "deflection potentiometer," in which the principle of the potentiometer method is utilized to measure the bulk of the electrical quantity, in conjunction with a suitable deflection instrument to measure the small remainder, is described by Mr. H. B. Brooks, in Bulletin of the National Bureau of Standards, vol. 2, p. 225, 1906, entitled "A New Potentiometer for the Measurement of Electromotive Force and Current." A later form of the instrument is described in an article entitled "A Deflection Potentiometer for Voltmeter Testing," on page 96 of the Electrical World for January 11, 1908. The instrument is semi-portable, and makes use of a dead-beat pivoted moving-coil galvanometer, a standard cell for checking the working current previous to making a test, and a small three-cell storage battery for furnishing the working current. By its use the checking of commercial voltmeters to a high degree of precision is accomplished as rapidly as could be desired, the only limit being the ability of the tester to control [illegible]

Tests may be made even on commercial circuits, as a range of several volts is covered by the galvanometer, and simultaneous readings of the standard instrument and the voltmeter under test may be taken very quickly.

The same type of instrument may be designed to measure the drop at the terminals of a standard shunt, and thus may be used for checking direct-current ammeters.

A method of using two potentiometers, for measuring the current and potential, respectively, in calibrating wattmeters, and in which the two galvanometers reflect their light-spots on one scale, side by side, so that a single observer controls the calibration, is referred to in Special Publication 7052 of the Westinghouse Electric and Manufacturing Company—"The Maintenance and Calibration of Service Meters," by William Bradshaw.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Books on Electrical Engineering.

H. C. P., Chicago: Please tell me what is the best book for learning electrical engineering and its cost.

Answer.

Such a large number of books on this subject have been published that it is inadvisable to recommend any one as the best without knowing what preparation in mathematics and general science the student has had and how deeply he wishes to study the subject. Books on electrical subjects are written for so many classes of readers and from so many points of view that it is necessary to know whether an elementary, popular, advanced student's or engineer's technical book is wanted. These distinctions also make a decided difference in the size and cost of the book.

Thawing Frozen Water Pipes by Electricity.

W. A. McC., Lake City, Colo.: Can frozen water pipes be thawed out by direct current, and how?

Answer.

This subject was much discussed some years ago and many articles on it have appeared in the Western Electrician from time to time. One of the earliest efforts was with alternating current, described by Francis H. Soden of Chicago on March 4, 1899. About the same time Profs. D. C. Jackson and R. W. Wood of the University of Wisconsin, developed a similar method, and for many reasons this is preferred to direct current.

However, direct current can be employed. It must be at a low voltage and with a heavy current, for it is the heating effect of the current that is depended on. The actual values are dependent on the size and length of the pipe. In one case 10 volts and 1,800 amperes was used. Heavy cables must be connected to the pipe as nearly as possible to the portion affected, so that the current passes through the frozen part. Good connections with the pipe are necessary.

Other articles on this subject may be found in the Western Electrician of March 26, April 2 and December 24, 1904.

The City Council of Liberty, Ind., has decided not to construct a municipal lighting plant and is inviting private interests to erect a plant.

Nebraska Electrical Association.

The first annual meeting of the Nebraska Electrical Association, held in Omaha, May 6th and 7th, was a success in every respect. The meetings were held at the Omaha Auditorium in a place provided by the management of the Omaha Electrical Trades Association, which gave its first electrical show at the Auditorium the week of May 4th.

The first session of the Nebraska Electrical Association was opened on Wednesday morning by the president, T. H. Fritts, of Grand Island. About 100 were present. Following the disposal of routine business an invitation was read from the Omaha Electric Light and Power Company asking the members to visit the company's power plant, which was accepted.

President Fritt's Address.

President Fritts in the annual address brought out some valuable suggestions. He spoke principally on the subjects of municipal ownership, accounting and inspection. He referred to the erroneous popular belief that municipalities can better manage electric-lighting plants than private corporations. Yet, under the systems of accounting in use in most municipalities it is at times many years before they learn the true conditions of their affairs and realize that their cost of operation and maintenance is not clearly brought out to them. Municipalities should be taught that a strict accounting is one of the first essentials to an intelligent handling of their plant. With the items of cost of plant and depreciation, loss of taxes should also be considered in estimating the cost of production, and not until this is done can we hope to successfully combat the dangers that are always before us. Mr. Fritts suggested a standing committee to lend whatever aid is possible to members who may have the municipal-ownership agitation to combat with.

On the subject of accounting the president urged intelligent management. A false impression prevails that the percentage of net profit in the lighting business is unusually large. This must be overcome by proper accounting, which will show that there are few classes of business in which the item of depreciation is so great as in the central station. Therefore a good amount should be set aside to meet this item. A uniform system of accounting is desirable.

It is to be regretted that many have not exercised the wisdom and foresight with regard to wiring installations that prudence and good business judgment have demanded. Doubtless many complaints and a great many reports from dissatisfied customers could be traced to careless or inefficient wiring. This should not be so. The insurance interests of the country have awakened to the fact and are very much alive to the necessities for more rigid inspections. "We must ourselves take cognizance of the conditions and submit, both for the protection of the public and for our own best interests, to some inspections." Mr. Fritts believes that a proposition looking to a state inspection or to a general inspection, with the expense borne in part by the insurance companies, will be much better than local inspections. If local inspections are indulged in it is most likely that the water commissioner or some inferior officer of the municipality will be chosen for the work, and it is unreasonable to expect intelligent and thorough work in this line from men who have not given the business of electric lighting any considerable thought or attention.

President Fritts invited a thorough discussion on the tungsten lamp in order properly to meet the new conditions brought about by the introduction of this high-efficiency lamp. Mr. Fritts closed by commending the good work of the officers and pointing out the intelligent results which the association has produced in the first year of its existence.

Following the president's address a spirited discussion was aroused by a resolution to admit managers of municipal plants to membership in the association. It was thought best to look into the matter more thoroughly, and S. J. Duncan, E. A. Bullock and W. B. Stark were appointed to investigate and advise the association.

The morning session closed with the appointment

MEMBERS OF THE NEBRASKA ELECTRICAL ASSOCIATION AT OMAHA.

of committees, the nominating committee consisting of Messrs. Schwingel of [illegible], Schwetzer of Omaha, Watson of Beatrice, Sullivan of Omaha and Roberts of York.

DUTIES OF THE ELECTRICAL INSPECTOR.

At the afternoon session Waldemar Michaelson, city electrician of Omaha, read an interesting paper on the duties of the electrical inspector. He said that if it were not for the electrical inspector, electricity would not have gained the reputation it now enjoys, nor would its use be so extensive. Mr. Michaelsen showed how nothing but good could come to both the consumer and the central station by rigid observance of the rules of the Code. The manager who disregards the recommendations of the engineer and inspector in order to save money and increase earnings is rapidly passing away, as experience is proving that money spent in complying with the Code is real economy. E. A. Bullock of Norfolk, H. W. Holdredge of Omaha and V. W. Bergenthal discussed the paper.

OTHER PAPERS.

V. W. Bergenthal of St. Louis presented the subject of "The Motor Problem from the Viewpoint of the Small Central Station." On Thursday morning E. A. Bullock of the Norfolk Electric Light and Power Company and W. S. Boyd of the Fire Underwriters, Chicago, engaged in a discussion of insurance and the moral as well as fire hazard. Others took part in the discussion, after which the matter of inspection was left to a committee to report at the next meeting. The committee consists of T. H. Fritts of Grand Island, E. J. Sullivan of Omaha and E. V. Capps of Blair.

The papers on "Electric Law" and "Electric Rates" were read by title, followed by a lengthy discussion of rates led by President Fritts, I. B. Zimman and E. V. Capps.

J. R. Cravath of Chicago read a paper on "How to Meet Gas and Gasoline Competition." He gave some suggestions along the line of good illumination and how to get the best results. The Question Box brought out many points of interest.

ELECTION OF OFFICERS.

The election of officers was held on Thursday and resulted as follows:

President—E. A. Bullock, Norfolk.
Vice-president—S. J. Duncan, Kearney.
Secretary—William Bradford, Lincoln.
Treasurer—[illegible]
Executive committee—[illegible] Grand Island; E. P. [illegible], Nebraska City; J. M. [illegible], York.

Omaha Electrical Show.

[illegible] the Nebraska Electrical [illegible] the Omaha Auditorium [illegible] successful. The lighting decorations were brilliant and well designed; the "electric cottage" attracted much attention, there were [illegible] demonstrations by Miss Lyons, and a vaudeville performance "helped some." The annual convention of the Nebraska Electrical Association was held during the exhibition, on May 6th and 7th, and is reported elsewhere in this issue.

Manager J. M. Gillan declares that the Chicago show only exceeded that at Omaha in point of size.

The Sons of Jove had a "rejuvenation" on Thursday night, May 7th. Saturday was Children's Day, when children were admitted for 15 cents. It is said that the total attendance for the week was nearly 20,000. It is entirely probable that the show will be held annually hereafter.

The Holtzer-Cabot Electric Company of Boston exhibited a line of interior telephones, annunciators, waterproof telephones and bells and small motors. The company was represented by A. E. Klunder of the Chicago office.

The Nebraska Electric Company of Omaha had one of the most interesting exhibits of the show, including Excello flaming arc lamps, tungsten lamps, Holophane shades, Fort Wayne motors, sewing machines operated by electricity, and many other electrical specialties. Considering the fact that this company started in business only five years ago, it has made a creditable record indeed. E. L. Sullivan is president and treasurer of the company.

The Burgess-Granden Company of Omaha made a creditable display of electric-light fixtures, art-glass canopies, etc.

The Holophane company, represented by Morgan [illegible]

The Chicago Fuse Wire and Manufacturing [illegible] tional switch boxes and conduit boxes.

[illegible] tos goods in more than 57 varieties. J. H. Brown, Jr., was in charge of the exhibit.

The Crane Company's exhibit, in charge of Jack [illegible] The heavy electrically operated emergency gate valve was of special interest.

Joseph R. Lehmer of Omaha exhibited the products of the Westinghouse Electric and Manufacturing Company, the Westinghouse Lamp Company, John A. Roebling's Sons Company, H. W. Johns-Manville Company and Mathias Klein & Sons Company. A small installation plant, consisting of an Ideal engine and a Westinghouse generator, was shown. W. E. McFadden, C. A. Fried and S. M. Kempton were in charge of the Lehmer exhibits.

The Western Electrician booth was the headquarters for the Nebraska Electrical Association.

Westinghouse representatives included W. R. Pinckard, Chicago office, Westinghouse Electric and Manufacturing Company; A. N. Brown, Westinghouse Lamp Company; S. G. Peticolas, Omaha representative; J. M. Shilling of the Chicago office.

The General Electric Company was in charge of the kitchen in the "electric cottage" of the Omaha Electric Light and Power Company. Miss Lyons demonstrated, as has been stated. Other "G. E." representatives were E. L. Callahan, R. E. Keller and G. A. Seabury of the Chicago office, and C. A. Mann, Nebraska representative.

Among those at the show were Messrs. George A. Saylor, Johns-Manville Company, Milwaukee; H. E. Watson, Benjamin Electric Manufacturing Company; Conover and Crawford of the John A. Roebling's Sons Company; H. A. Rhea, International Steam Pump Company; G. W. Armstrong, Excello Arc Lamp Company, Chicago; William Bradford, Lincoln Gas and Electric Light Company, Lincoln, Neb.; W. E. Butler, David City (Neb.) Electrical Manufacturing Company; L. D. Mathes, Union Electric Company, Dubuque, Iowa; Arthur O. Einstein, Crescent Company, Chicago; Frank S. Wiemeyer, Fort Wayne Electric Works, Des Moines; F. J. Kysela, National Carbon Company, Cleveland, Ohio; F. E. Wilson, Franklin Electric Manufacturing Company, Hartford, Conn.; H. D. Austin, Signal Corps, U. S. A., Omaha; Sydney H. Finney, Woolley Electric Company, Chicago; B. L. Smith, Nelson Light, Power and Heating Company, Nelson, Neb.

Western Electrician. Standard Electric Company.
J. R. Lehmer's Collective Exhibits. Nebraska Electric Company.
Another View of the Lehmer Booth. Electric Cottage of Omaha Electric Light and Power Company.

VIEWS AT THE OMAHA ELECTRICAL SHOW.

Dr. S. S. Wheeler on "Engineering Honor."

Dr. Schuyler Skaats Wheeler, past-president of the American Institute of Electrical Engineers and president of Crocker-Wheeler Company, addressed the Engineering Society of Columbia University on May 4th on the subject of "Engineering Honor." As an undergraduate at Columbia, in the class of '83, he, with Prof. F. B. Crocker, had addressed the same society on technical subjects.

The speaker referred to the code which he proposed in his presidential address before the American Institute of Electrical Engineers. He said that Francis Bacon had written a brief but comprehensive treatise on this subject in the preface to his "Maxims of the Law," as follows: "I hold every man a debtor to his profession; from the which as men of course do seek to receive continence and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto."

Dr. Wheeler mentioned the three great duties of the engineer in the order of their importance; first, the engineer's duty to his client; second, to the public, and, third, to his engineering society. He condemned strongly the publication of false scientific and false engineering statements in the newspapers, and he declared that discoveries and inventions should be announced not in the daily papers, but through the technical societies or the technical press.

Steam-turbine Development.[1]

By J. C. Thorpe.

It was without a particular intention of presenting new thoughts that this paper was prepared, but rather of gathering together from various sources some of the facts developed during recent years and compiling them in convenient form for consideration.

In 1885 patents were issued in several countries, covering the invention of a compound balanced reaction turbine, to Hon. C. A. Parsons, whose name from this date has been inseparably linked with steam-turbine development. His first invention showed Parsons' conception of the importance of the principles of compounding and of lateral balancing of horizontal machines. Among other prominent features of this machine still approved and applied in the most modern design, are elasticity of bearings and forced lubrication. It may be said that Parsons was the first inventor to place the steam turbine on a commercial basis.

In 1889 De Laval, whose name is closely linked with that of Parsons in steam-turbine development, secured his patents on the present expanding nozzle used with the De Laval machines. A patent on the expanding nozzle, as applied to injectors, had

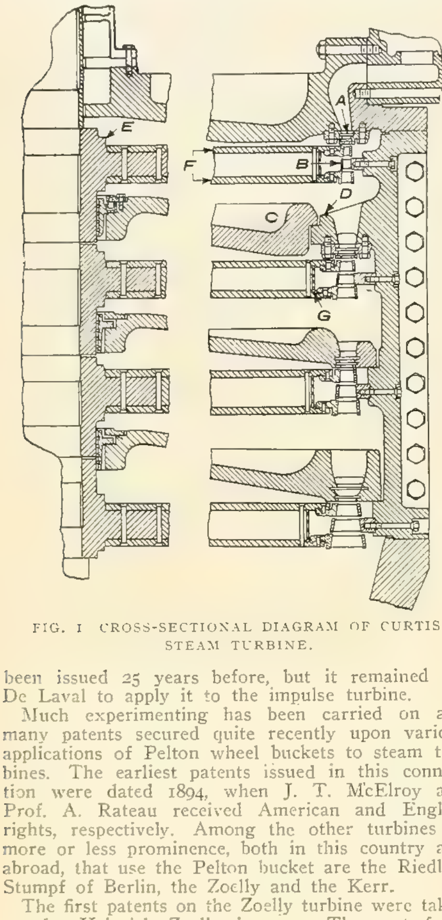


FIG. 1 CROSS-SECTIONAL DIAGRAM OF CURTIS STEAM TURBINE.

been issued 25 years before, but it remained for De Laval to apply it to the impulse turbine.

Much experimenting has been carried on and many patents secured quite recently upon various applications of Pelton wheel buckets to steam turbines. The earliest patents issued in this connection were dated 1894, when J. T. McElroy and Prof. A. Rateau received American and English rights, respectively. Among the other turbines of more or less prominence, both in this country and abroad, that use the Pelton bucket are the Riedler-Stumpf of Berlin, the Zoelly and the Kerr.

The first patents on the Zoelly turbine were taken out by Heinrich Zoelly in 1900. They set forth in particular the construction of a multi-stage turbine, with one rotor only in each stage and a particular construction of the wheel disks. The arms, if they may be called such, were machined for a considerable part of their length and ended in the Pelton buckets.

In 1896 Mr. C. G. Curtis took out a group of patents covering the important principles of construction of the Curtis turbine, manufactured by the General Electric Company of Schenectady, N. Y. The most significant feature of Mr. Curtis' claims was the application of the system of diverging nozzles with the compound wheel. Other inventors had applied the results of expansion that could take place only in a diverging nozzle, but no invention had been previously made of the apparatus itself. In Fig. 1 is shown the present preferred arrangement of nozzle and moving and stationary or intermediate blades.

In the preceding discussion the more important inventions that have influenced turbine development have been considered. That the principal difficulties [illegible] recognized [illegible] designers have endeavored to reduce the energy losses to a [illegible] present day designers who have brought the steam turbine [illegible] in the list of prime movers. The energy losses, mentioned, [illegible]

1. Friction between the steam and the metallic surfaces, both stationary and moving, 10 per cent.
2. Friction due to eddy currents, five per cent.
3. Resistance to the rotation of moving parts in the atmosphere of steam, called "windage," six per cent.
4. Mechanical friction in journal bearings, glands, stuffing boxes, etc., five per cent.
5. Leakage through clearance spaces, glands, etc., three per cent.
6. Radiation loss, } four per cent.
7. Residual velocity in exhaust, }

The constant striving to minimize these losses has resulted in improved methods of governing, special devices for cutting, shaping and spacing the turbine blades, exhaustive experimentation relating to the flow of steam through nozzles and orifices, the development of high-pressure lubricating systems and high-temperature packing, and in the development of remarkably efficient condensing equipment, particularly in units of large capacity.

Steam Turbine Performance.

A consideration of some particular installations with the results of steam economy tests will indicate the measure of success that has attended the recent development of steam turbine practice.

In 1902, after very careful consideration of the steam turbine problem, the then Commonwealth Electric Company of Chicago purchased the first 5,000-kilowatt machine that was built. Just previous to this the Westinghouse company had taken the contract to build a 1,500-kilowatt unit, which was installed in the plant of the Hartford Electric Light Company of Hartford, Conn. It is worthy to note that the turbine unit No. 1 in the Fisk Street station of the present Commonwealth Edison Company was the result of the first effort that had ever been made in this country to build a machine of this type larger than 600 kilowatts. The 600-kilowatt turbine mentioned was a two-stage horizontal Curtis machine, installed in 1901 in the shops of the General Electric Company at Schenectady, N. Y. It is a compliment to the engineers and management of the General Electric Company, who built and installed this first larger unit, that they planned and built so well and confidently at that time. We doubt not that, in the light of more recent designs, this first large turbine to be installed in this country fails to nourish the pride of its designer, and yet all must agree that the undertaking at that time was very meritorious.

The writer has been privileged during the past two years to conduct tests on three of the units in the Fisk Street station, Commonwealth Edison Company.

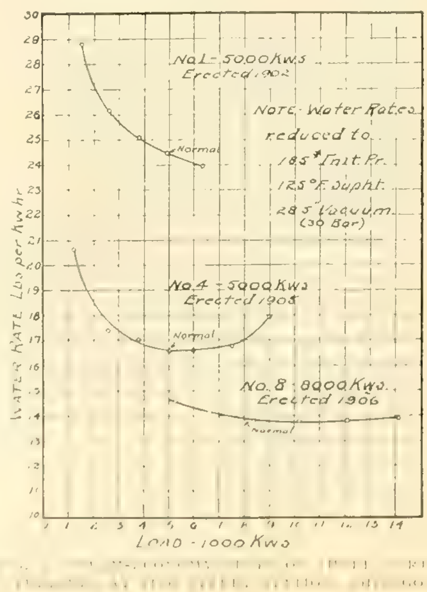
A brief summary of the results of these tests is presented in the following table:

Comparative Results—Best Performance on Operating Conditions.

Unit Number	1	4	8
Nominal rating of machine, kws.	5000	5000	8000
Load—Gross output, kws.	6137	5970	10156
Ditto, per cent. normal rating	1.25	1.20	1.25
Water Rate—Observed kw.-hr.	23.85	16.56	12.94
Ditto, corrected for "Contract Conditions"	23.94	16.72	13.07
Water Rate—Observed e. h. p.-hr.	17.89	12.42	9.71
Ditto, corrected for "Contract Conditions"	17.96	12.54	9.80
Initial Pressure, pounds	176.6	174.0	176.0
Vacuum observed, inches	28.10	28.0	29.17
Vacuum, 30-in. barometer, inches	28.52	28.30	29.50
Superheat—Degrees Fahrenheit	139.0	184.0	147.0
First stage pressure, lb. gauge	5.66	34.8	46.7
Normal speed, r. p. m.	500	500	750

A considerable condenser leakage necessitated a correction in the steam flow of turbine No. 1.

The accompanying curves, Fig. 2, present the relative steam economies of these three units in a very interesting manner. It will be seen that the scale of the vertical ordinate, representing "Water Rate," is continuous, thus giving a direct comparison of the units, all values of the steam economy



[illegible]

having been reduced to the basis indicated. Another notable feature is the flatness of the load curve for unit No. 8. It is noticeable in No. 4, but less markedly, and the tendency to give a wide range of economy with a considerable range of load is hardly perceptible in the first unit. It is difficult to say what the results would have been in the latter case had the load been increased to 75 per cent. overload, as in the case of No. 8. These curves serve better than words to illustrate the remarkable development in the design and operation of large turbine units of this type during the past five years.

The curve in Fig. 3 was constructed from the load curves of four Curtis turbines of 1,000, 2,250,

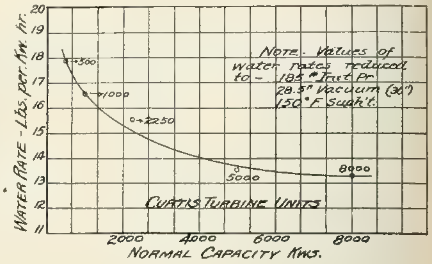


FIG. 3. PERFORMANCE OF VARIOUS SIZES OF CURTIS TURBINES.

5,000 and 8,000 kilowatts rated normal capacity, using the steam economy for the points of normal loading and all reduced to a common basis, namely, 185 pounds (gauge) initial pressure, 28.5 inches vacuum (30 inches bar.), and 150° F. superheat. This curve illustrates the well-known fact that the ratio of the energy losses to normal capacity decreases with the increasing size of units, just as the same ratio varies with the load on a given unit.

Corrections on these curves were based upon the following values, derived from actual tests, when all the conditions of operation, except those under trial, were maintained as nearly constant as practicable:

One-inch vacuum, between 26 inches and 30 inches = 5 per cent. effect upon water rate.

Fourteen degrees F. superheat = 1 per cent. effect upon water rate.

Ten pounds of boiler pressure between 150 and 185 pounds = 0.5 per cent. effect upon water rate.

Difference between 185 and 200 pounds boiler pressure is negligible.

The following corrections for departure from contract conditions during a test of a 7,500-kilowatt Westinghouse-Parsons turbine in the plant of the New York Edison Company were made:

Pressure, 2½ pounds high = correction, 0.25 per cent. in water rate.

Vacuum, 0.69 inch low = correction, 1.84 per cent. in water rate.

Superheat, 4.25 degrees low = correction, 0.29 per cent. in water rate.

It will be noticed that the influence of the variation in steam pressure is apparently much greater with the Parsons type of machine and the influence of variations in vacua much less, than in the per-

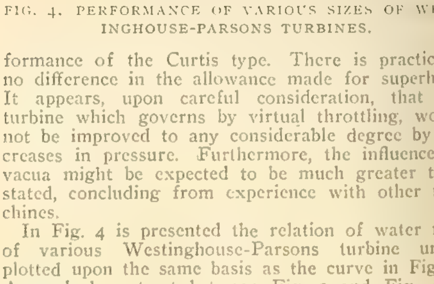


FIG. 4. PERFORMANCE OF VARIOUS SIZES OF WESTINGHOUSE-PARSONS TURBINES.

formance of the Curtis type. There is practically no difference in the allowance made for superheat. It appears, upon careful consideration, that the turbine which governs by virtual throttling, would not be improved to any considerable degree by increases in pressure. Furthermore, the influence of vacua might be expected to be much greater than stated, concluding from experience with other machines.

In Fig. 4 is presented the relation of water rate of various Westinghouse-Parsons turbine units, plotted upon the same basis as the curve in Fig. 3. A marked contrast between Fig. 3 and Fig. 4 is immediately noted; a difference in water rate of 3½ pounds existing between the 1,000 and the 8,000-kilowatt units of the Curtis pattern, and but 0.5 pound difference over the same range of capacities in the Westinghouse-Parsons machines. This may be understood after a consideration of the constructive features of the two patterns of turbines. In the Westinghouse-Parsons pattern, the larger units are but magnified copies, if you please, of the smaller sizes, and thus the energy losses bear the same relation to the capacity in any sized unit. On the other hand, the smaller Curtis turbine units

[illegible] ... units are involved, or the agreement of actual performance with guarantee [illegible] ... should always be determined which will present the variation in economy, due to changing conditions of vacua, superheat, pressure, etc.

For some reasons it would be desirable to present performance and load curves for many other turbines that are now playing an important part in the design and operation of power plants. Numerous comparisons, however, have indicated that the curves here presented for the Curtis and Westinghouse-Parsons machines, representing, as they do, the two chief types of turbines, are characteristic, both in form and in the absolute values given, of all steam turbines of their respective types.

Before passing from the consideration of steam economy, it will be well to consider examples of the numerous smaller machines that are attracting attention. Among the turbines of this class that have appeared quite recently are the Kerr, the product of the Kerr Steam Turbine Company of Wellsville, N. Y.; the Sturtevant, recently perfected, and now being vigorously supported by the B. F. Sturtevant Company, and the Terry, built by the Terry Steam Turbine Company of Hartford, Conn. These small machines are all of the multistage impulse type, the Kerr applying the principle of the Pelton wheel and all of the others mentioned being modifications of the Riedler-Stumpf pattern.

These small machines are designed for relatively small capacities of from 15 to 200 brake horsepower, and usually for some special application, such as driving direct-current electric generators, blowers, centrifugal pumps, etc., and where close regulation is desirable at comparatively high speeds. In general, they are designed to operate non-condensing, with saturated steam, and under such conditions give practically the same steam economy as a well-designed high-speed reciprocating engine of similar capacity.

Low-pressure Turbines.

A number of plants have been installed more or less recently that have employed low-pressure turbines as prime movers, which are operating on the exhaust steam from reciprocating engines in the same station. By this means great economy is effected in the use of the steam, and a saving of practically 65 per cent. may be effected by the use of a high-vacua condensing equipment. Practically all of the builders of turbines of large capacity have developed a low-pressure turbine, and these are playing a prominent part in the design of power-plant extensions. One of the prominent installations of low-pressure turbines is in the power station of the Philadelphia Rapid Transit Company. This machine is an 800-kilowatt Curtis turbine unit operating on the exhaust from Corliss engines and utilizing a vacuum of 28 inches. The guarantee provides that the steam consumption per kilowatt-hour shall not exceed 36 pounds at full load, and 40 pounds at half load. Tests that have been made indicate a water rate well within the guarantee. Tests made in the shops of the Westinghouse company upon a 1,250-kilowatt low-pressure unit have resulted in a water rate of 30 pounds per brake-horsepower-hour, this being the equivalent of approximately 38 pounds per kilowatt-hour.

Heat Efficiencies.

Willans & Robinson, Ltd., of England, builders of a popular and efficient type of reciprocating engine, have been experimenting for some years upon improvements in the Parsons type of turbine. Results have been secured that are very satisfactory to the builders, and they are now doing a large turbine business. A contract recently entered into by this company for the construction and erection of a 3,000-kilowatt unit contained a performance guarantee clause, stipulating a water rate of 12.9 pounds per kilowatt-hour. No data were presented with reference to the conditions of operation, but by reference to the curves from which Fig. 3 is deduced it can be seen that this is equal to the best performance of the 8,000-kilowatt Curtis turbine.

Now, just what does it mean for a turbine to develop a kilowatt at the switchboard on a steam consumption of 12.9 pounds per hour? This is the equivalent of 9.54 pounds per electrical horsepower, or with a generator efficiency of 96 per cent. it is the equivalent of 9.17 pounds of steam per brake-horsepower-hour; further, assuming a mechanical efficiency of 94 per cent. for the prime mover, it is the equivalent of 8.62 pounds per indicated horsepower-hour, certainly a commendable performance. According to the British standard, as recommended in the report of the committee of the American Society of Mechanical Engineers on Standard Code for steam-engine tests, this performance gives a thermal efficiency of 21.4 per cent., closely approaching the best performance of internal-combustion engines. The "potential efficiency" of heat [illegible] ... the official trial of a 1,000-indicated-horsepower double-acting, twin-compound Schmidt engine, operating on 155 pounds initial steam pressure, 25.4-inch vacuum and 330 degrees F., superheat, gave [illegible] ... sents the best modern practice.

Thus it will be seen that we are fast approaching the limit of economy in the prime mover itself, and future developments must be looked for in the steam generator. Greater economy must be secured in the performance of the boilers. It is significant that practically the same rated boiler capacity was installed for the first 5,000-kilowatt unit in the Fisk Street station of the Commonwealth Edison Company of Chicago as, three years later, was installed to operate the 8,000-kilowatt units. This points to developments in boiler practice as well as to remarkable advances in the large turbo units.

Boiler Economy.

In most plants the steam-driven auxiliaries do not furnish enough exhaust steam to heat the feed water above 120° F. The possibility of increasing economy by using hot feed water has been taken advantage of in some cases by the installation of economizers, though their ultimate practicability still remains a much-discussed question. Other engineers have taken steam from the second or third stage of the turbines to increase the feed-water temperature, and this without suffering a deleterious effect in economy.

In a recent article before the American Institute of Electrical Engineers, Mr. J. T. Findlay presented a very interesting discussion of experiments with double-stoker boilers in the power plant of the Interborough Rapid Transit Company of New York city, made under the general supervision of Mr. H. G. Stott, superintendent of motive power of the Interborough company. These boilers were 500-horsepower units, set with two Roney stokers, one as in the standard setting and the other at the rear at a somewhat lower level. The horizontal baffling was so arranged that the gases from both stokers intermixed and traversed the same passes over the heating surface. This increase in volume of gases, with the resultant higher velocity, effected an increase in capacity of 80 per cent., with no appreciable difference in overall efficiency.

This suggests what is very much discussed, namely, the possibility of securing a greater amount of work from our boilers. It leads to the prediction that we are rapidly approaching the point when we will be able to rate water-tube boilers on a basis of five square feet of heating surface per horsepower instead of 10, as now used. Experiments such as are now being made, of which the one cited is a good example, foreshadow the design and operation of larger boiler units, the reconsideration of generally accepted theories regarding heat transmission through boiler-heating surface, and the redesign of boiler settings that have been standard for years. There must be a constant striving for better evaporative performance; for a decrease in the radiation and unaccounted-for losses in boiler practice, if this factor in power-plant development is to keep pace with the modern prime movers.

Rating of Steam Turbines.

An inspection of the performance curves suggests a very significant fact pertaining to the rating of steam turbines. The maximum steam economy is obtained at loads varying from 115 to 130 per cent. of the rated capacity of the units, and no considerable increase in water rate occurs at 150 per cent. of the normal rating. This is in direct contrast to the conditions which obtain in reciprocating-engine practice, where increasing the load above the normal rating or point of maximum economy, brings about a marked increase in the water rate. The reciprocating units are designed to sustain a certain overload for a period of time, usually 50 per cent. for two hours, but it is obvious that this maximum capacity should not form the basis for normal rating. In the light of these facts, a change is being effected in the system of rating turbines, and it will not be long until such rating will be based upon the continuous maximum operating capacity instead of upon a normal load basis of the turbines, and generators will be installed capable of such continuous operation. It will be seen that this will not present a radical departure from the practice which now obtains with reference to some prime movers, such as gas engines or water turbines, where the best performance occurs at points of maximum capacity, and where guarantees of performance seldom contemplate any considerable overload capacity.

The General Electric Company is taking a prominent part in effecting the changes in the rating [illegible] ... a number of instances. In the vertical machines [illegible] ... by the draft of the rotating element. It can be seen that the problem presented is more complex in [illegible] ... type of generator has become quite popular. This form of construction permits the application of a very effectual closed forced or induced-draft system with the blower on the generator. In some cases this is supplemented by an independently driven blower to reduce the heating effect during periods when unavoidably heavy overloads occur. This careful attention to generator ventilation insures greater safety and makes possible the attainment of an overload margin hitherto quite impracticable and unsafe.

Conclusion.

A number of matters pertaining to recent steam-turbine development have been discussed. There are many others that might be profitably considered at this time, such as improvements and inventions pertaining to system of governing, methods adopted for securing blades to the stationary and rotary elements to prevent dangerous stripping, new devices for balancing end thrust in horizontal machines, the design and operation of large condensing units, etc. All of these are of importance and constitute the distinguishing features in particular machines, but lack of space prevents a discussion of them at this time.

In conclusion, it should not be said or inferred that the steam turbine is supplanting the steam engine in the broad field of the latter's usefulness, nor that the days of the "old reliable" are numbered. Certain it is, however, that for electric generation for all purposes, particularly in large units, the steam turbine of the past decade has proven its superiority.

Two Tributes to Mr. Kreidler.

It is with sincere sorrow that we record the death of Mr. William Ainsley Kreidler, founder and principal proprietor of the Western Electrician. * * * In 1887 he established the Western Electrician, a journal that has always been a warm friend of our association, and to which we are greatly indebted for hearty support at all times and for many kindly courtesies. Mr. Kreidler was also identified with many other interests, both business and social, and will be greatly missed by his many friends and associates.—From the April Bulletin of the National Electric Light Association.

Having an idea that there was a field in the West for an electrical journal, he founded the Western Electrician, with which he was identified, and its ruling spirit, until his death. Owing to his untiring energy and ability, the paper presented the unusual instance of being a financial success from its inception, and under his skilful guidance became an acknowledged authority in the discussion of matter within its province. He had the faculty of organization and gathered about him a competent staff of assistants, under whose management the paper will be conducted in the future, and the fabric which his genius created will continue in its course, a monument to his methods and policy.

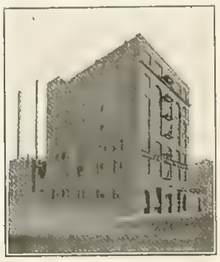
Successful in his chosen profession, Mr. Kreidler showed his ability in other directions and embarked in other enterprises, always with satisfactory results, and was an example of the progress of the careful and shrewd man of business. In the midst of business cares he found time for the exercise of his inventive genius, and as a result of his efforts in that direction had taken out one or more patents. He also was a considerable student of literature and the natural sciences, and, in brief, an instance of the combination of the business man, the scholar and inventor.—From the May Proceedings of the American Institute of Electrical Engineers.

At a meeting of the Eleventh District of the Indiana Independent Telephone Association in Seymour, William F. Qualls of the Decatur County Independent Telephone Company read a paper on "Unprofitable Business," dealing expressly with free service between exchanges and unlimited use of subscribers' equipment by non-subscribers. The clearing-house proposition was also discussed.

The Wagner Electric Manufacturing Company.

By Thos. T. Richards.

In 1890 two young electrical engineers, Mr. H. A. Wagner and Mr. Ferd. Schwedtmann, appreciating the fact that at that time there was no satisfactory alternating-current fan motor on the market, began in a small shop, in a very small way, the manufacture of desk fans. Strict attention to business and a careful conservation of their energies, and good fortune in getting the repair work of a large central station, attracted other



Original Store and Factory of 1890. The Plant in 1900.

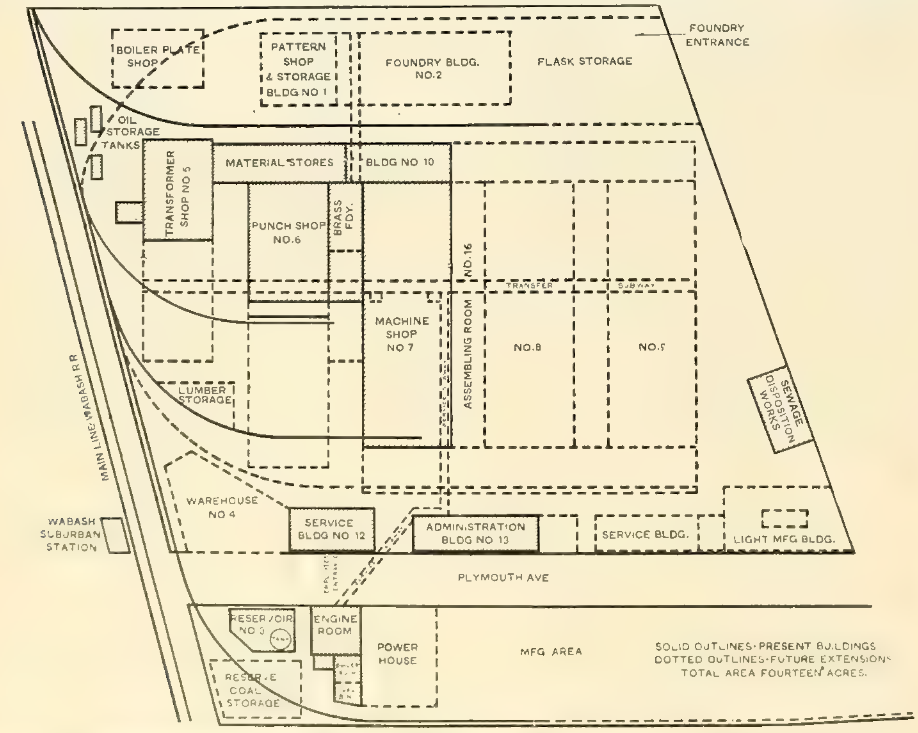
WAGNER ELECTRIC MANUFACTURING COMPANY.

capital toward them. These two young men conducted their fan business in a small store, a picture of which is shown herewith.

After having been in business a year, it very soon became apparent that additional capital was desirable. This was forthcoming, and the Wagner Electric Manufacturing Company was incorporated in 1891.

It was fortunate for these two young men that the central station whose repair work they were handling was one of the foremost in developing alternating-current distribution. It was repairing the transformers of this company that first showed the Wagner company the faults of other transformers and how to remedy them. The Wagner company made its repaired transformers even better than the new article, and its research and development in this line of apparatus led it into new forms of construction. This naturally led to transformers of the company's own design, and the introduction of the transformer department necessitated increasing the plant 200 per cent.

The company was very successful. The results of the work in the experimental department began



GENERAL PLAN OF HILLSIDE WORKS OF WAGNER ELECTRIC MANUFACTURING COMPANY.

[illegible] the introduction of the [illegible] single-phase motor ever put upon the market. The success with which this motor [illegible] the further addition [illegible] 1900, had reached the respectable dimensions shown in the picture.

In 1896 several central-station clients of the company enlisted its assistance in remodeling and improving their alternating-current switchboard meters. This practically forced the Wagner company to design a line of such devices, and this line rapidly [illegible]

[illegible]

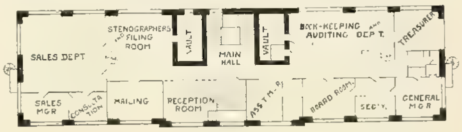
with the adjacent ground, which was used for storage purposes, was outgrown three years ago, when a careful search was made throughout the city of St. Louis and the surrounding country for a favorable factory site which would be suitable for the erection of an entirely new and modern plant.

New Hillside Plant.

The company's new plant is located at Hillside Station, and is about 800 feet west of the city limits. The site comprises about 14 acres and is admirably located as regards sunlight and fresh air, and has unsurpassed shipping facilities. In addition to this, it is located almost within a very excellent residence neighborhood. A careful study was given to the first layout of the plant. The final plan which was adopted is shown in the general-plan drawing given herewith. It is believed that it will result in a minimum cost of manufacture, together with opportunity for almost indefinite expansion.

Materials are received at the north end of the plant and stored in the material warehouse called the Rough Stores Building. All castings from the foundry will either be stored in this rough stores building, or will pass through it en route to the workshops.

Individual factory buildings are located at right angles to the rough stores building, the material for each building being carried in the stores building at such particular place as will insure its being loaded directly onto trucks running into the individual factory buildings. These factory buildings



FIRST-FLOOR PLAN, ADMINISTRATION BUILDING, HILLSIDE WORKS.

have been laid out as units in themselves, no partially completed product being transferred from one building to another for completion.

The entire layout is arranged so that as the business expands, new factory units can be added and the work reclassed according to the type and size of same. It will be noticed that buildings Nos. 5 and 6 are arranged for easy expansion, which expansion will simply complete the general working plan as originally laid out. Buildings Nos. 7 and 8, when extended, will be connected by a transverse extension, which will probably be used as an erecting shop.

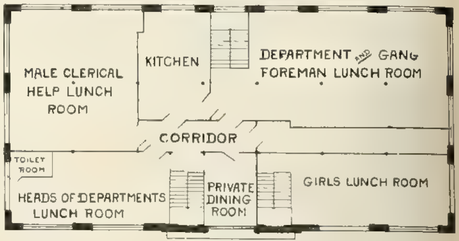
All of the buildings are served with traveling cranes operated with Wagner three-phase motors, and are further fitted with hand cranes and air hoists, to further the expeditious handling of material and finished product.

A particular feature in the layout of this plant which is producing great results is the system of subways which connects the various buildings and departments. The system of subways run as indicated in the general plan, and is served by elevators located at various points throughout the plant, the material being dropped down from the factory floor to the subway, there transferred to any department necessary and raised by an elevator to the particular spot where it is wanted. This prevents the great mass of crowding and trucking through the aisles, which is generally observed in large plants, and thus obviates the distraction of the workman's attention from his individual task.

The buildings, as shown on the plan, are as follows:

Power plant. One story, 90 by 100 feet.

No. 5—Transformer shop. Present portion 80 by 120 feet, having open erection bay on the west side



SECOND-STORY PLAN, SERVICE BUILDING, HILLSIDE WORKS.

throughout its length, with traveling-crane service, and 40-foot gallery on the east side.

No. 6—Punch shop. Present length 90 by 144 feet, two stories; sawtooth-roof construction.

No. 7—Motor shop. One hundred by 312 feet, having open central bay 50 feet wide, with traveling crane throughout its length, and side galleries 25 feet in width; sawtooth-roof construction.

No. 10—Half of rough stores building. Present length 40 by 272 feet, two stories.

No. 12—Service building. Fifty by 100 feet, two stories and basement.

No. 13—Office building. Forty by 150 feet, three stories and basement; fireproof throughout.

All of these buildings have been designed for maximum light and free ventilation, and it is believed that no artificial light will be necessary throughout the entire plant.

The heating system is hot water under forced circulation, with temperature controlled by engineer at the power plant. This heating installation is very complete, and is guaranteed by the manufacturer, the Evans-Almirall Company, to keep the buildings at 70 degrees.

An independent system of drinking-water pipes is carried throughout the plant, and drinking water is supplied under a continuous circulation at a temperature of 60 degrees, this being maintained by a refrigerating machine driven by a Wagner single-phase motor. The temperature regulation of this machine is entirely automatic. Drinking fountains are located at sufficiently frequent and convenient points throughout all buildings to bring a supply to within 50 feet of every employe, the water coming up in a cup provided with a drain so that a workman may obtain a drink from a stream of water under pressure, without fear of contamination, as no cups are used, the stream of water only being brought in contact with the lips.

Two drainage systems are provided. All surface water is carried direct into a branch of the River Des Peres, which runs along the east side of the factory tract. All sewage from the plant is carried through a septic tank, which is shown on the plan, for reduction and purification, and thereafter discharged into a branch of the River Des Peres.

The equipment for fire protection includes a 75,000-gallon steel tank, 100 feet in the air, located immediately over a 150,000-gallon surface storage reservoir, this reservoir being located adjacent to the power plant. Other fire-fighting equipment is am-

TRANSFORMER SHOP, SHOWING GALLERY CONSTRUCTION.

ple. A fire department has been organized and drilled for service should a fire break out at any time during factory hours. In addition to [illegible] twin plug stations, the entire factory is equipped with an interior system of water pipes with sprinkler

[illegible] Main Machine Shop, Looking North.
General View, Looking East from Railroad Tracks.
HILLSIDE WORKS OF WAGNER ELECTRIC MANUFACTURING COMPANY

heads. The outside water supply to the fire pump consists of an eight-inch connection with service pipes of the St. Louis County Water Company.

Welfare Work.

Believing that the best work could be obtained from factory employes if they had pleasant surroundings, a radical departure from previous practice was made at the new plant in providing a service building. This consists of a three-story brick building, in the basement of which are located the lockers of all employes working in the factory, and a limited number of toilets (the main toilets being scattered through the buildings). The factory employes pass through the service building in entering the plant, making such change as they wish in their clothing, each employe having at his disposal a steel locker, for which he alone has the key. Heating pipes are carried underneath these lockers, for the purpose of drying out such clothing as may be damp when coming to work.

The employes are required to use the service building for lunch purposes, as ample lunch facilities have been provided on the second floor, each department being assigned tables, where the employes may eat their lunches at their leisure. The company provides a light lunch, which is sold to the employes at cost, the purchase of which, however, is entirely optional. In the center of this room is a serving counter, from which milk, coffee, sandwiches, pies, etc., are served, the company furnishing all the china and tableware used in the service of the lunches.

It was deemed advisable to install the lunch feature of the service building for the double purpose of shortening the noon rest hour to 30 minutes, permitting the men to get off duty 30 minutes earlier in the evening; to forestall the rapid encroachment of the lunch saloon, and also to avoid the accumulation of lunch refuse in the factory proper. This arrangement has succeeded admirably and meets with the hearty indorsement of the factory hands.

General Details.

The view looking down building No. 7, which is the main machine shop, shows the interior construction, and it will be noted that this building carries a gallery on each side. This building is 100 by 312 feet, the galleries being 25 feet in the clear. The building, as shown by the birdseye view, has a sawtooth roof, the vertical panels facing the north. The building is served through its entire length by a 10-ton crane, operated by three-phase Wagner motors. The space underneath the galleries and the galleries proper are served by 28 hand cranes, each one of which serves a limited area. This shop is equipped with the most up-to-date machinery known to the trade.

An interior view of a corner of the transformer shop building is shown. Noteworthy is the heavy steel construction, together with loading platform, so that the overhead crane may serve the gallery. The heavy and large transformers are built on the main floor of the building, the final [illegible] and [illegible] being conducted in the gallery.

The instrument [illegible] on the second floor [illegible] over the [illegible].

The subway [illegible] serving the elevators. There are frequent switch-overs, so that trucks may be sent from one track to the other as the occasion demands. This subway also serves to carry the various power and lighting feeders, together with the refrigerator and water supply. This subway is entirely of the concrete form of construction.

The power plant includes one 250-kilowatt, three-phase, 440-volt, 60-cycle, alternating-current generator, direct-connected to a tandem compound Corliss engine; and, for testing purposes, one 100-kilowatt, 133-cycle, single-phase, 110-volt alternator, and one 50-kilowatt, 500-volt, direct-current generator. The output is entirely controlled by Wagner switchboard indicating instruments, and measured by Sangamo integrating meters. The boiler-plant equipment consists of two Heine boilers with American chain grate driven by Wagner single-phase motors.

S. M. Dodd, President. W. Robbins, Assistant General Manager. W. S. Thomas, Treasurer. V. W. Bergenthal, Assistant Manager of Sales. W. A. Layman, Vice-president and General Manager.
A. H. Timmerman, Chief Engineer. C. B. Lord, Superintendent.
WAGNER ELECTRIC MANUFACTURING COMPANY.

Personnel.

As the apparatus of the company steadily underwent complete evolution, so also did the active personnel of the staff. It is a notable fact that the board of directors of the company is today probably the most representative of any corporation in the city of St. Louis, as shown in the following list:

Mr. S. M. Dodd, capitalist, president of the Wagner Electric Manufacturing Company, member of the boards of the National Bank of Commerce, [illegible]

[illegible]

[illegible] of numerous large corporations, and president of [illegible]

Mr. Albert Blair, secretary and counsel of the Wagner Electric Manufacturing Company; director [illegible]

Mr. W. A. Layman, vice-president and general manager.

The president of the company, Mr. Dodd, who has piloted the financial interests of the corporation through its various stages of development, is one of St. Louis' pioneer [illegible]. His name has been identified with all the foremost commercial movements of the city for 50 years. Mr. Dodd organized the first large alternating central-station company in the West, the Missouri Edison Company of St. Louis, for years the foremost example, west of New York, of central-station distribution by alternating currents. The business of the Missouri Edison Company first directed his attention to the manufacturing of electrical devices.

The engineering and administrative staff has undergone gradual evolution. The directory heads have changed from time to time, until today the active organization rests largely upon men who have been developed in the company's own plant, all of whom are well known in electrical fields.

Mr. W. A. Layman, vice-president and general manager, is a graduate of the Rose Polytechnic Institute, having been graduated in 1892, taking a degree of B. S. In 1894 he was given the degree of M. S., and in 1896 E. E. Mr. Layman is a full member of the American Institute of Electrical Engineers and past-president of the Engineering Club of St. Louis. He began his work with the Wagner company in September, 1892, as draftsman, serving successfully as the head of the engineering department, assistant superintendent, assistant manager, and as general manager of all departments since 1902. Mr. Layman was elected vice-president of the organization in 1908.

Mr. W. Robbins, assistant general manager, is a graduate of the University of Michigan, class of 1896, having taken the electrical engineering course. Immediately after his graduation he entered the organization of the Western Electric Company of Chicago, serving in almost every capacity from salesman to superintendent of construction. He left that company in July, 1906, to associate himself with the Wagner company.

Mr. W. S. Thomas, treasurer, is a graduate of the Illinois State University, having had 14 years' experience as the manager and financial head of one of the largest wholesale coffee establishments in the West. Mr. Thomas' connection with the Wagner company dates from December, 1907.

Mr. A. H. Timmerman, chief engineer, is a graduate of the College of the City of New York (B. S., 1891), afterward graduating from Cornell University in 1892, taking degree of M. M. E. in 1893. Mr. Timmerman was instructor of physics and electrical engineering in 1893-94 in the Washington University of St. Louis, and was professor of physics and electrical engineering in the School of Mines and Metallurgy, University of Missouri, Rolla, Mo., from 1894 to 1899. In 1899 Mr. Timmerman entered the organization of the Wagner company as electrical engineer, being made assistant superintendent in 1900 and superintendent in 1902.

Mr. Timmerma succeeded to the position of chief engineer in 1908.

Mr. C. B. Lord, superintendent, was associated for seven years with the General Electric Company, as general foreman of the train-control department and test department. After leaving the General Electric Company Mr. Lord served as assistant superintendent with the Victor Talking Machine Company of Camden, N. J., associating himself with the Wagner company December, 1906.

Mr. V. W. Bergenthal, assistant manager of sales, is a graduate of the University of Wisconsin (1897, B. S. E.), having taken a post-graduate course in 1898 with a degree of E. E. Mr. Bergenthal was associated with the Stanley-G. I. Electric Manufacturing Company for five years, in various departments. Mr. Bergenthal associated himself with the Wagner company in November, 1904.

Porcelain Pot-heads of Recent Design.

The G. & W. Electric Specialty Company of 128 West Jackson Boulevard, Chicago, has recently placed on the market some new porcelain pot-heads for making connections between high-voltage overhead lines and lead cables, which are of considerable interest.

Fig. 1 is a cross-section of a single-conductor detachable pot-head. It is contended that the use of the porcelain sleeve results in a much higher degree of insulation than is possible with the lead sleeve, and the porcelain cup serves to protect the compound in the sleeve from the action of the elements. The device is recommended as suitable for use on voltages of 2,000 to 20,000. The detachable feature is also of value. It is not necessary to cut connections at the risk of having them left unsoldered by the repair man. If trouble is suspected, the "trouble" man merely removes the cap from the tube until he has tested. If no trouble is found the cap is replaced and the entire installation is left in good working order. It is said that the slip contact in this type of pot-head will carry 150 amperes without undue heating; also that the pot-head can be submerged in water when set in a vertical position.

When the disconnecting feature is not required, and a cheaper pot-head is desired, the device is supplied without the metal connecting parts. The [illegible] (See Fig. 2.) The two conductors are then joined together, the tube drawn over the joint, taped at the bottom, filled with compound to one-half inch of the top and then fastened to its support. The cap is then pulled down and set on the tube and compounded and taped at the top. This form of pot- [illegible] line work where disconnecting is not necessary.

[illegible]

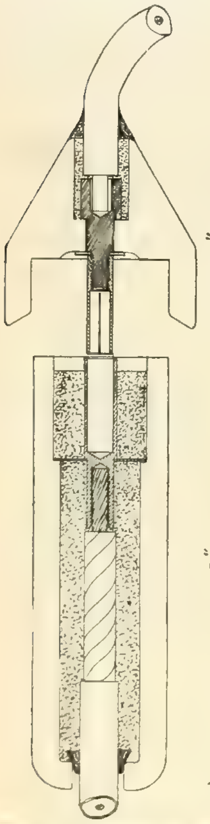


Fig. 1. Cross-section of Single-conductor Detachable Type.

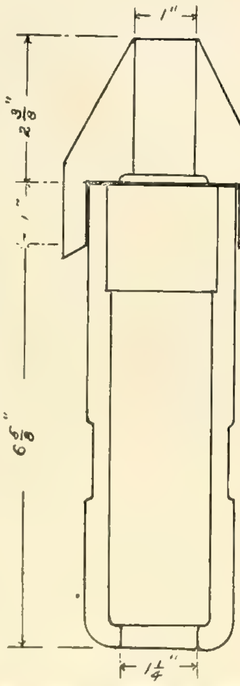


Fig. 2. Diagram of Single-conductor Type without Disconnecting Feature.

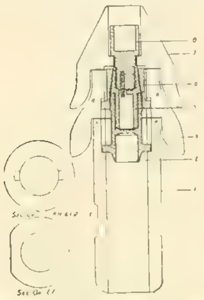


Fig. 3. Cross-section of Detachable Type for Heavy Current.

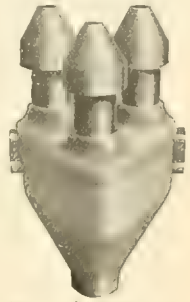


Fig. 4. Three-conductor Type.

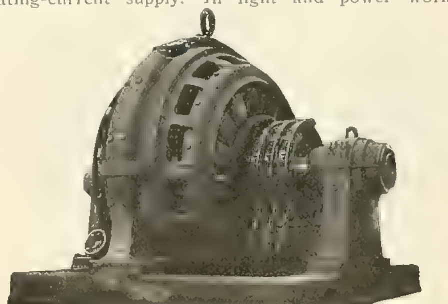
PORCELAIN POT HEADS OF RECENT DESIGN.

of turning a threaded taper collar which draws the two metal members together through the medium of the taper-headed plug and the externally threaded socket, thus insuring a tight-fitting joint. The standard size is designed to carry 650 amperes. This type of head is recommended when the disconnecting feature is required for loads above 150 amperes. It is well adapted for street-railway work.

The three-conductor type is shown in Fig. 4. It is made detachable or without the disconnecting feature. The required number of single-conductor heads are mounted in a cast-iron lid, completely sealed in. The iron lid is so formed as to fit over the top of an iron pot or hopper approximately 10 inches high. The opening through which the three-conductor cable enters the hopper is approximately three inches in diameter in the standard pot-head, and this size is supplied for all sizes of cable up to 3 inches. For considerably smaller cables an iron bushing is provided. Larger sizes are made to order. The manufacturer says that this form of pot-head, when properly installed, will give satisfaction on potentials as high as any underground cable now manufactured will withstand; that is, about 20,000 volts. These types of pot-heads have been in use for over two years.

A New Westinghouse Rotary Converter.

The direct-current voltage delivered by a rotary converter usually bears a fixed ratio to the alternating-current supply. In light and power work



Alternating-current Side, Showing Synchronous Regulator.
NEW WESTINGHOUSE ROTARY.

it is essential that the potential on the direct-current feeders be maintained constant without regard to the variations in the alternating-current voltage, and several methods have been devised for regulating the potential. Rotary converters are often compound wound, and this, when accompanied by a suitable reactance on the alternating-current side, has been the only automatic method of voltage regulation which did not entail considerable auxiliary wiring. Potential and induction regulators are used in many installations. Although these devices can be fitted up to control the voltage automatically, they not only occupy considerable space, but at the same time add a large amount to the auxiliary wiring required.

The Westinghouse rotary converter with synchronous voltage regulator is designed to supply, in one compact, simple and efficient machine, an entirely self-contained piece of apparatus which will accomplish all that has heretofore been done by the use of the potential or induction regulator. These machines can be designed for either automatic or non-automatic control of the direct-current voltage. A number of Westinghouse rotary converters with synchronous voltage regulation are now in service on the lines of the New York Edison Company, where they have proved successful. In designing these machines it was necessary to build them so that they could be installed in existing sub-stations in the same space that had been occupied by rotary converters of an earlier design. This requirement was complied with.

The machine illustrated is of 1,000 kilowatts nominal capacity, and is designed to deliver direct current at 225 to 300 volts potential when receiving alternating current at 166 volts potential, six-phase, 25 cycles. It has 16 poles and operates at 187.5 revolutions per minute. The rotary converter, with synchronous regulator, consists of a rotary converter [illegible] combined with a small alternating-current generator, the field and poles of the latter being supported by a bracket from the frame of the rotary-converter field. The alternating-current regulating armature is carried on the same shaft with and between the armature of the rotary converter and the slip rings, and therefore requires no separate collector or brush-holder mechanism. The field coils are excited by current from the sub-station bus-bars.

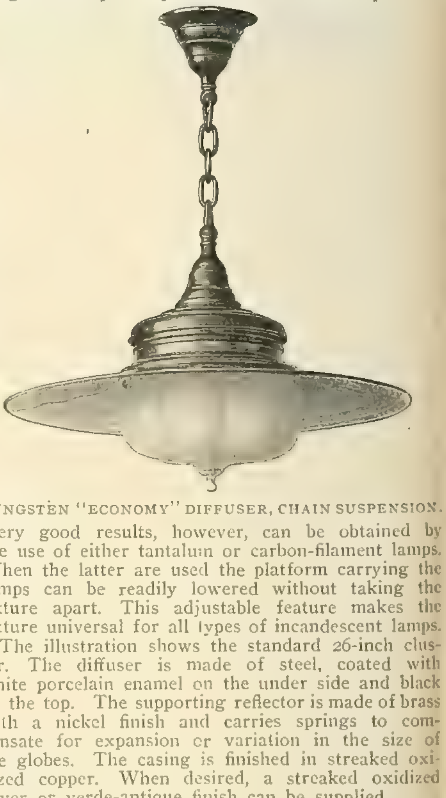
The direct-current voltage can be either raised or lowered by altering or reversing the field excitation of the alternating-current-generator portion of the machine in a similar manner to that adopted in controlling the voltage of an alternating-current generator. The sole difference lies in the fact that the synchronous regulator is designed so that the normal direct-current voltage is delivered with normal voltage on the alternating-current side without any excitation of the regulator field. The direct-current voltage is increased or decreased by altering the strength or the polarity of the regulator field exciting current.

The advantage of this method of controlling the direct-current potential lies in the wide range of accurate control which can be secured without affecting the power factor of the circuit and the compactness of the arrangement. The value of the close control of the direct-current voltage is apparent.

A New Tungsten Diffusing Cluster.

To fill the demand for a large lighting unit of approximately the same power as the enclosed arc lamp, the General Electric Company has perfected the tungsten "Economy" diffusing cluster. This unit provides, in addition, a light of variable intensity, with a wide range of voltage adjustments, without mechanical change.

The diffuser is designed primarily to carry six tungsten lamps suspended in a vertical position.



TUNGSTEN "ECONOMY" DIFFUSER, CHAIN SUSPENSION.

Very good results, however, can be obtained by the use of either tantalum or carbon-filament lamps. When the latter are used the platform carrying the lamps can be readily lowered without taking the fixture apart. This adjustable feature makes the fixture universal for all types of incandescent lamps.

The illustration shows the standard 26-inch cluster. The diffuser is made of steel, coated with white porcelain enamel on the under side and black on the top. The supporting reflector is made of brass with a nickel finish and carries springs to compensate for expansion or variation in the size of the globes. The casing is finished in streaked oxidized copper. When desired, a streaked oxidized silver or verde-antique finish can be supplied.

The 39-inch or mill-type diffuser is identically the same as the 26-inch, except that the diffuser is larger, and instead of being finished in porcelain enamel is coated with white-zinc enamel. For store lighting, the 26-inch diffuser is recommended, and for mill and factory work the 39-inch gives more satisfactory results as regards distribution and diffusion.

It has been found from experience that the 39-inch tungsten Economy diffusing cluster gives excellent results for mill lighting when equipped with three 100-watt tungsten lamps. This permits, for the same energy, somewhat closer spacing than arc lamps.

The shade is made of clear glass, frosted on the inside, and, as may be seen from the illustration, is curved to take the same general shape of the lamps. Placing the frosting on the inside of the shade gives a lower intrinsic brilliancy than is obtained by the same grade of frosting placed on the lamps, and does not reduce the life of the lamps. The six-lobe shade is standard for all lamp combinations, and the curvature of the shade minimizes the spotted effect so apparent when part of the lamps are extinguished in a fixture having a spherical globe.

By using various combinations of 40, 60 and 100-watt lamps, the cluster can be made to operate at 120, 180, 240, 300, 360, 420 and 480 watts.

Purpose of Electric and Gasoline Car Dissimilar.

"There is a tendency in some localities to compare the electric pleasure vehicle and the gasoline pleasure vehicle as possible alternative purchases," says General Manager Hayden Eames of the Studebaker Company. "Their purposes are not alike. For long runs, for touring and when it is desirable to travel at a high rate of speed or [illegible] the gasoline car is the ideal method of conveyance. The electric pleasure vehicle, however, is unsuited for touring in the manner in which it can be done with a gasoline car. The strictly pleasure use of the electric vehicle, as distinguished from its business uses, is practically restricted to park driving or for service to and from country clubs or suburban homes. Its pre-eminence lies in those applications in which convenience and low maintenance costs are either or both the principal consideration.

"The electric pleasure conveyance is the most convenient conveyance in existence. It has all the conveniences of the bicycle, with none of its discomforts; all the advantages of the horse phaeton or buggy with absolutely none of its disadvantages, and, with the use of a rectifier for private charging, its maintenance is in the majority of cases cheaper than the horse vehicle, making it the most economical individual passenger conveyance in existence today.

"The electric carriage may be left at the curb as long as you like without having to consider the chauffeur or worry about the discomfort of your horse, should the weather be inclement. Returning to the car, you step in, start off quickly and quietly. There is no concern about the mechanism, and the control is so simple and effective that with electric vehicles accidents are almost unheard of.

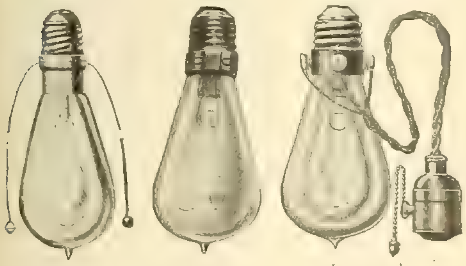
"As the many advantages of the electric become better known, we may expect to see fewer five and seven-passenger cars of from 30 to 60 horsepower, conveying one or two people about our streets, and the (not now unusual) sight of a chauffeur taking a little girl to school or to the beach in a 50 or 60-horsepower touring car will soon become a forgotten memory of the misapplication of the self-propelling pleasure vehicle.

"Circumstances or inclination usually impel people to travel in pairs, and as a popular and economical two-passenger conveyance for a family in average circumstances, for a business or professional man, or as an auxiliary to the gasoline touring car of greater radius and larger seating capacity, the electric vehicle is the ideal conveyance for a very large number of people who reside in city or suburban communities."

New Types of Turn-down Lamps.

Incandescent lamps that can be turned down as easily as a gas light have proved themselves extremely popular, especially in residences. The advantage of leaving a small light in vestibules, hallways and bathrooms is at once apparent and extends even to the living rooms of the house. Some new types of lamps for this purpose have been put on the market by the Economical Electric Lamp Company of 96 Warren Street, New York city.

These lamps have two filaments, the regular one and the miniature filament, either of which can be switched on at will. This construction is more



Pull-string. Turn bulb. Long-cord.

NEW TYPES OF TURN-DOWN LAMPS.

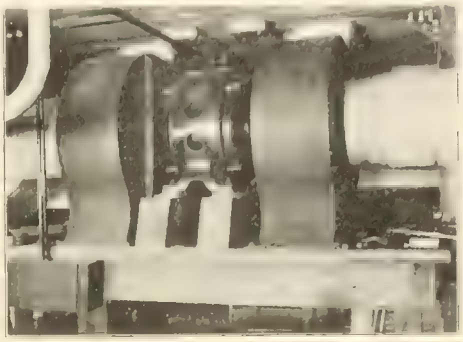
economical of current than the resistance type of turn-down lamp. Four styles of Economical lamps are made. No. 1 is of the pull-string type. No. 2 is turn-bulb lamp. In No. 6, known as the new long-cord lamp, there is a triple-strand lamp cord, heavily insulated, at the end of which is a strong, neat pull-chain switch to control the lamp. There are no contacts which may become exposed and hence no possible chance of getting a shock. In case the lamp is broken or becomes dim the cost of renewal is nominal, as it is necessary to secure only a new lamp, the cord and switch being detachable and may be used for years. Cord can be had in any length desired. A lamp known as No. 7 has been added to the list. This lamp can be controlled so as to give 16 candlepower or one candlepower, or it can be put out entirely. The accompanying cuts show the first three of these lamps.

The first electric car of the Maryland Electric Railways Company to run between Baltimore and Annapolis has been put in service.

Motor Drive in the Manufacture of Office Furniture.

[illegible] handling material, in its power drives, and particu[illegible] department.

[illegible]



FORTY-HORSEPOWER INDUCTION MOTOR DRIVING DOUBLE EXHAUST FAN IN OFFICE FURNITURE FACTORY.

pieces are cut to the proper length and width and stacked on trucks. The route followed by the stock then depends upon the operations to be performed upon it, but the progress is a continuous one in all cases. Everything in the factory is electrically driven.

The main building is equipped with an extensive blower system operated by two 40-horsepower Allis-Chalmers motors. The shavings and sawdust made by the various machines are removed by two sets of exhaust pipes carried direct to the power house and automatically fed to the boiler fires.

Elevators carry finished parts to the third floor, where the benchmen put these parts together into panels, tops, drawers and pigeon holes. Then they are carried to the fourth floor and assembled into complete desks, ready for finishing.

The export work, which is shipped in knock-down form and finished abroad, is boxed or crated and shipped in that condition on account of the fact that partially finished work enters most countries duty free. An additional reason is that the desks can be shipped in much smaller compass in this way and the assembling done practically as cheaply as in this country.

The power-house equipment contains three 450-horsepower boilers supplying steam to a 250-horsepower high-speed engine direct coupled to a 150-kilowatt Allis-Chalmers generator wound for three-phase, 240 volts and a speed of 225 revolutions per minute, and a smaller engine, 150 horsepower, of the same type, direct connected to a 75-kilowatt Allis-Chalmers generator of characteristics similar to those of the larger machine. A 12½-kilowatt, 120-volt Allis-Chalmers belted exciter is driven from the shaft of the 150-kilowatt generator, while a 12½-kilowatt Allis-Chalmers engine-type exciter is installed for auxiliary purposes and also used for running the watchman's lights at night and for the office lighting when used.

The power derived is applied to over 90 Allis-Chalmers induction motors which drive every machine in the plant, either directly mounted upon it or belted to it from ceiling, side wall or floor. These motors range each from 2 to 40 horsepower and aggregate over 500 horsepower in all.

The greatest possible amount of care has been taken all over the factory to provide safety devices for the protection of the employes. The saws are all provided with guards and the surfacers, shapers, stickers, etc., are likewise protected.

Fire protection has been carefully planned for. The sprinkler system is used throughout every building and a fire pump has been installed with a capacity of 1,000 gallons per minute from a storage tank holding 100,000 gallons, from which water is available from hydrants in all portions of the plant.

Over 50 styles of office desks, tables and typewriter cabinets are made in the plant described, all of which are sold direct to dealers. Officers and directors of the company are: Mr. H. G. Munger, president; Mr. R. E. Steele, vice-president; Mr. F. S. Munger, secretary; Mr. G. W. Searles, treasurer, and Mr. G. P. Simmons of Utica, director.

The Chicago City Railway Company has constructed a new-style double-truck sprinkling car of its own design, which is serviceable and efficient. The car consists of a steel tank having a capacity of 4,000 gallons, mounted on a steel frame and equipped with four 40-horsepower motors. The car cost about $5,000. It has been placed in service on the Cottage Grove Avenue line, and the company probably will build 12 more cars of the same pattern.

Steel Bands for Mechanical Power Transmission.

[illegible] leather band, and, as it can be very tightly adjusted, the distance between the engine and the [illegible] case with the leather belting, where the transmission of power is dependent upon the weight of the [illegible] much reduced, experiments having shown that this [illegible] and repeated experiments have shown that the entire loss of power is very small, and as far as can be ascertained will not exceed one per cent. Further, owing to the lightness of weight of the steel belting, it is claimed, the influence of the centrifugal [illegible] much increased velocity."

OBITUARY.

John A. Erner, president of the Erner Electric Company of Cleveland, Ohio, died on May 6th at his home in East Cleveland. Mr. Erner had been ailing for several months. His father died three weeks ago, and the shock is believed to have hastened the son's death. Mr. Erner was one of the progressive business men of Cleveland, and was prominent among the electrical supply men. Outside of business he took a great interest in society.

L. L. Luft, manager of the Urbana (Ohio) Electric Light Company, died at Wilmington, Ohio, on May 5th, of tuberculosis, at the age of 42. Mr. Luft had been engaged in the electric-light business for over 20 years. He was superintendent of the Xenia (Ohio) Gas and Electric Company for 14 years, of the London (Ohio) plant for four years, and two years ago went to Urbana. A man of sterling character, always eager to advance in his business, Mr. Luft is mourned sincerely by all who knew him. A widow and one child—a daughter—survive him.

Southwestern Electrical and Gas Association.

A successful convention of the Southwestern Electrical and Gas Association was held at El Paso, Tex., on May 7th, 8th and 9th. The following-named officers were elected: President, R. B. Stichter, Dallas; first vice-president, W. B. Tuttle; second vice-president, W. B. Head; third vice-president, J. E. Carroll; secretary, J. A. Myler; treasurer, A. E. Judge; executive committee, H. T. Edgar of Fort Worth, H. M. Moore of Austin, E. L. Wells of Taylor, Fred M. Lege, Jr., of Galveston, A. E. Judge of Tyler.

A report of the convention will be given next week.

An Unexpected Forest Preservation.

The wood business, for fuel, which for 15 years has been an important industry in the Blue Mountains of Umatilla County, Oregon, is said to be nearly at a standstill. This, according to a large wood contractor of Pendleton, Ore., is largely due to hydro-electric plants which have taken the place of boilers which used wood for fuel to a large extent. The cities of Pendleton and Walla Walla have denuded nearly 10,000 acres of mountain land for fuel. An average acre of mountain land produces 25 cords of wood. The timber is not heavy. When the timber is removed from a tract, the land is sold—sometimes before the timber is touched usually at $1 per acre, for sheep range.

The Nile and the American Nile.

A comparison of the flow of the Nile and the Colorado River of the West, which has sometimes been termed the American Nile, is given in a publication recently issued by the United States Geological Survey. The maximum flow of the Colorado is about 110,000 second-feet; that of the Nile is about 353,000 second-feet; while the minimum flow of the Colorado is about 2,500 second-feet and that of the Nile about 14,500 second-feet.

A report has been received from an American consul in South Africa in which he states that an inquiry has been received at his office from a local business man for the addresses of dealers in electric-railway supplies, such as overhead wires, cars, steel and iron rails, etc. The business man in question also desires the names of contractors engaged in electric-railway construction. Address the Bureau of Manufactures, Washington, D. C., referring to File No. 2226.

CORRESPONDENCE.

Continental Europe.

Paris, April 27.—A concourse of storage and primary batteries was held some time ago at Paris by the Workman's Accident Association, and its object was to find out what commercial types of batteries would give the highest output in relation to the size, and would also present the minimum amount of danger for the workmen who are charged with mounting such batteries and keeping them in order. A number of the leading manufacturers presented types of batteries which had been designed to meet the above conditions, and of these there were tested seven types of storage battery and 12 types of primary battery, presented by seven makers. The primary batteries were tested by working them upon fixed resistances until the voltage fell to 0.5 volt. According to the report presented by the association, the Leclanché battery is the only one which fulfills the conditions as to absence of harmful effects as well as advantages from an electrical viewpoint. Next comes the Roussel and Tournaire battery, which is of the dry-pile type. As to the storage batteries, the best one of those tested was the type manufactured by the Metal Working Company, which presented a battery of 44 cells.

The international agreement between Germany and Switzerland and also between France and Switzerland in relation to night telephone operation is carried out on what is considered a very good plan. In the former case the rules apply to single communications or to subscribers, and the night messages are sent between 9 p. m. and 6 a. m. or 8 a. m., according to the season. Subscribers' rates for the night system are only one-half of what is charged for the day system, and subscriptions are taken for a minimum of one month. In order to accommodate the single conversations on the lines from non-subscribers, for which the full rates are paid, there is an interval of 10 minutes allowed between each conversation made by subscribers. In the French-Swiss arrangement, the hours for the night rates are the same, and subscribers for night messages also have the day rates reduced to one-half. Non-subscribers have a 60 per cent. rate.

One of the most important of the hydraulic plants in France, the Bellegarde station, which is situated on the Rhone, is to be increased by the addition of a new alternator group of 5,000 horsepower. This will give a total of 17,000 horsepower for the plant. The present group is designed for 2,500 volts. The moving mass, which is supported on the lower pivot-bearing, weighs 60 tons, of which 45 tons is upheld by hydraulic pressure. An increase of current is thus given for distribution in the district of Bugey and in the region of Lyons.

An electric railroad is to be constructed from Mährisch-Ostrau to Karwin, Austro-Hungary. It is a narrow-gauge line and will be about 12 miles in length. A 750-volt, direct-current system is used, with current supplied from a steam plant located at the middle point of the line. The motor cars are equipped with four Siemens-Schuckert motors.

A. DE C.

Great Britain.

London, May 2.—An attempt has been made to get over the disadvantages of the cost of high-candlepower metallic-filament lamps by the introduction of a lamp, say, of 100 candlepower, split up into five 20-candlepower lamps burning in series on the same base. The argument of the inventor is that, although the initial cost will be somewhat higher than a single 100-candlepower lamp, yet the cost of maintenance will be very much less, as each small unit can be replaced independently of the others, thus prolonging the life considerably.

The annual convention of the Association of Municipal Electrical Engineers will be held at Nottingham and district from June 30th to July 4th next.

The British Westinghouse Electric and Manufacturing Company makes a much more satisfactory showing for the year 1907 than was the case for 1906. The actual trading profits amount to $461,915, and after deducting debenture interest and also interest on temporary loans, there is a balance to be carried forward of $56,705. The report states that during the year there has been a substantial increase [illegible] done and that although the present demand is slack, the company's improved [illegible] advantage of any [illegible]

[illegible] under consideration a [illegible] wireless telegraph stations between the British colonies.

[illegible] a certain amount of activity in municipal electrical circles, [illegible] where the [illegible] to a loan for [illegible]

[illegible] of the London [illegible] doubt was ex- [illegible] a 10,000- [illegible] That [illegible] statement

is now made by the Parsons Company that in anticipation of the solution of the electric-power difficulty in the metropolis, they have already got out designs for a 20,000-kilowatt unit.

G.

Eastern Canada.

Ottawa, Ont., May 9.—As a result of competition the Cataract Power Company of Hamilton, Ont., has offered to supply power for the civic plants at 10 per cent. less than the Hydro-electric Power Commission, or at $16 per horsepower, which the company guarantees to be 10 per cent. lower than the commission's price for power in Hamilton. The company also offers to sell to the city the street-lighting plant, exclusive of the poles, for $50,000 cash, with a yearly rental of $6.50 for each lamp for use of the poles.

By a unanimous vote the City Council of Toronto has ratified the agreement by which the city buys 10,000 horsepower from the Hydro-electric Commission at a maximum price of $18.10 per horsepower. The Ontario government pays the cost of the transmission line from Niagara Falls, of which Toronto's share is estimated at $828,000. The city pays back to the commission four per cent. interest and a sinking fund on this amount.

The Ottawa Electric Company will this summer spend over $100,000 in remodeling the old Standard company's station, now used as an auxiliary. This has become necessary by the great expansion of the company's business, and the result will be to double the capacity of the station. The waterpower users at the Chaudiere Falls have come to an agreement and will build a new dam which will give all the plants more waterpower.

A new telegraph company which proposes to extend its lines from ocean to ocean across Canada and to cover thoroughly the settled parts of the Dominion is in process of formation in Montreal. It is known as the Northern Commercial Telegraph Company and will be capitalized at a large amount.

The City Council of Montreal has decided to admit into the city a competitor of the Montreal Light, Heat and Power Company. A new corporation, the Robert Syndicate, has agreed to supply electric energy in Montreal for incandescent lamps at 10 cents per kilowatt-hour, with a discount for cash payments of 5 and 10 per cent. The company will develop power from the Beauharnois Canal, and has offered to guarantee its good faith by placing with the city treasurer a forfeit of $50,000.

W.

New England.

Boston, Mass., May 9.—The Massachusetts Supreme Court yesterday announced its findings in the merger case, involving the right of the New York, New Haven and Hartford Railroad Company to own and operate electric street railways in this state. Briefly stated, they are to the effect that the statutes forbid such ownership; that the New Haven company has violated the law, and that a decree of injunction is issued to prevent the steam-railroad company from, directly or indirectly, holding or guaranteeing bonds, stocks and securities of Massachusetts street railways.

The decision is applied to specific companies named in the suit, six in number. There are 16 companies interested in all, with a total capitalization of $21,000,000 and having 565 miles of railway.

A railroad authority here familiar with the policy of the New Haven railroad company in the matter states that the decision apparently opens several alternatives for the New Haven company. It can submit unqualifiedly to the decision and absolutely dispose of its Massachusetts trolley holdings; it can probably appeal its case to the United States courts on the question of constitutionality; it can seek a new and modified form of holding device, or it can apply to the Massachusetts Legislature for a healing act or seek a compromise through that body.

The project advocated by the city of Cambridge for a municipally owned conduit system for wires of public-service corporations was again before the Legislature for approval this year, but was defeated.

The Street Railway Club of New England will meet on May 28th at the Worcester Institute of Technology's new electrical engineering building.

B.

New York.

New York City, May 9.—The Public Service Commission, second district, had 17 public hearings in Albany this week. Many of them involved questions concerning lighting companies. On Friday in Buffalo members of the commission continued the hearings on the application of the Niagara Falls Lighting Company for permission to construct an electric-light, heat and power plant in the city of Niagara Falls and town of Lewiston, and for authority to issue $100,000 capital stock and a mortgage for $500,000, and to issue $300,000 bonds under the mortgage.

Rev. Dr. Robert S. MacArthur on Sunday morning introduced Andrew McConnell of Washington in the Calvary Baptist Church for the first of a series of three lectures on a new system of healing by electricity generated within the body. The speaker said he had divided the subject into three lectures—"The Material Basis," "The Scientific Explanation of Mental and Spiritual Healing" and "Showing that Health and Religion Are One and Inseparable." Life power, Mr. McConnell said, was electricity, and by it any human being could cure the ills of any other human being and prolong life. He cited digestion, saying it was a process having the same chemistry, moisture, acids and alkalis that composed electricity, the mind acting as the battery. Nerve force and energy was simply a form of electricity.

Forty bids from 15 firms for the construction of the first sections of the Fourth Avenue subway in Brooklyn were opened Friday, and in a few days it is expected the contracts will be let. The six sections now under estimate extend from the Brooklyn end of Manhattan Bridge to Forty-third Street, South Brooklyn. The estimated cost of the work is $15,000,000. The contracts will be let for construction only. Bids for the pipe galleries have been called for, but they must be put in separately from the bids for the tunnel sections. The lowest bids are below the engineer's estimates.

During a severe rainstorm at going-home time on Thursday the elaborate signal system in the East River tunnel went wrong and Manhattan-Brooklyn Subway traffic was tied up about an hour.

W.

Southeastern States.

Charlotteville, N. C., May 9.—President W. Jordan Massee of the Central Georgia Power Company, with J. A. Campbell and a party of engineers, has inspected the Ocmulgee River power plant to be developed near Macon, Ga. The J. G. White company has the contract for the work. A $30,000,000 stock issue and $16,000,000 bonds have been authorized by the railroad commission of Georgia, and work on the dam will be started at once. The banking firm of A. B. Leach & Co. is interested in the development.

The Chadwick-Hoskins Cotton Milling Company, with $1,000,000 capital, has contracted with the Westinghouse company for electrical equipment valued at about $40,000. This indicates that electric drive will be put in to take the place of steam. Three large mills will be equipped.

The Tar River Light and Power Company of Wilson, N. C., has been chartered by C. E. Spurgeon and his associates to succeed the Carolina Power Company which had an authorized capital of $150,000.

Apropos of the installation of 137 arc lights in new territory in Richmond by the Passenger and Power Company, it is said that some of the city authorities, in view of the alleged reluctance of the receivers of the company to do the work, will guarantee the receivers that the city will reimburse the company in case the city establishes its own lighting plant, a question which has been under discussion for many months. The proposed extensions will represent about $12,000.

F. S. Tucker and others have organized a $10,000 company at Charlotte, N. C., to manufacture electric apparatus especially for street cars.

The Electric Power and Manufacturing Company has purchased the Spartanburg Street Railway Company. R. C. Crawford of Pittsburg, Pa., is president of the purchasing company, which will likely make extensive improvements on the newly acquired property.

The resumption of work on the large waterpower plant on the Pee Dee River, near Rockingham, N. C., has come about, following the adjustment of the affairs of the Knickerbocker Trust Company of New York, which was interested in the financing of the undertaking. It is the second largest project of the kind in North Carolina.

The Thomasville (N. C.) Light and Power Company has begun a 24-hour lighting service for the town for manufacturing purposes, in addition to the arc-light system.

The Southern Power Company of Charlotte, N. C., has, after a lengthy fight, gained entrance into the town of Salisbury, N. C., and will furnish power through a $20,000 sub-station to be built by the company and the Salisbury and Spencer Railway Company. A combination plan for distributing light seems to have been reached whereby the over demand will be met and the price of arc lights greatly reduced. Numerous cotton mills will also make use of the electric power brought in by the Southern Power Company.

L.

Northwestern States.

Minneapolis, Minn., May 9.—William M. Brogan has purchased an electric-light plant at Mora, Minn.

The Minneapolis Thresher Works, at Hopkins, Minn., contemplates replacing steam with electricity. The plant of the Minneapolis General Electric Company at Taylor's Falls will supply the current.

The Twin Cities and Lake Superior Railway Company has filed articles of incorporation. The company will build an extension from Minneapolis to Superior. The capital is $100,000.

The newly constructed Mankato electric railway commenced operations May 1st.

Prominent business men of St. Cloud, Minn., are

back of a scheme to connect that city and the Soo Railway, at Kimball or Fair Haven, by an electric line.

The contract for completing the surveys of the electric railway to connect Huron and Aberdeen, S. D., has been let to Cross & Mack of Minneapolis.

F. M. Sadler has been granted a 25-year franchise for furnishing electric street lights for Ellsworth, Minn.

The Escanaba Pulp and Electric Company's plant at Flatrock, Mich., will be put into operation in June.

It is reported that the Chicago, Milwaukee and St. Paul Railway Company has sold its Winneconne branch to the Oshkosh Traction Company.

Virginia City, Mont., will be lighted and the mines belonging to the Elling estate operated by electricity generated at Blaine Springs.

The Northern Power Company has commenced work on a power plant six miles north of Chisholm, Minn., for the projected interurban railway.

The Red Oak and Northwestern Interurban Promotion Company of Des Moines, Iowa, has been incorporated for the purpose of promoting an electric railway between Red Oak and Des Moines.

The City Council of Jefferson, Iowa, has decided to replace its incandescent street lights by 80-candlepower tungsten lamps. R.

Western Canada.

Winnipeg, Man., May 6.—Serious trouble has been caused of late by amateur electricians wiring houses and doing other electrical work in this city. A by-law is now being prepared making it necessary for each electrician to be bonded to the extent of $1,000, and it is thought this will do away with the trouble to a very great extent.

Representatives of the cities of Port Arthur and Fort William have been talking of selling the portion of the Port Arthur municipal street railway which runs in the sister city of Fort William. Port Arthur is willing to sell the Fort William portion for $162,000.

The City Council of Portage la Prairie, Man., has received an offer from the Central Electric Company of that city to supply light to the city for municipal and commercial purposes. The company asks for a 25-year franchise and is willing to install 25 arc lamps of 2,000 candlepower at $125 per annum, or 30 lamps at $120 per annum, the company to furnish the lights and keep them in repair. The rate for commercial lighting under this franchise would be 20 cents per kilowatt-hour, with 33⅓ per cent. discount. The matter is being considered by a special committee of the City Council. John O'Brien is manager of the company.

F. A. Cambridge, city electrician of Winnipeg, has received instructions from the City Council to prepare an exhaustive report on all cases in which it has been found that electric currents escaping from the street-railroad rails have damaged the city water mains. He is also requested to recommend a style of bonding for the rails which will lessen or do away with the damage.

It is understood that the Canadian Pacific Railroad is about to electrify its branch between New Westminster and Westminster Junction, thus forming an electric line between New Westminster and Eburne, B. C. The work is scheduled for next year. F. F. Busteed of Vancouver is general superintendent. R.

Pacific Slope.

San Francisco, May 7.—The North Mountain Power Company, which recently bought out the Eureka Lighting Company of Eureka, Cal., is now planning to build a third plant at Big Flat on the Trinity River with a generating capacity of 4,000 horsepower.

The Valley Power Company of Wenatchee, Wash., has plans made for a hydro-electric plant on the Wenatchee River, 15 miles from Wenatchee. It is to develop 4,000 horsepower at a cost of about $100,000. F. M. Schoble of Wenatchee is president of the company.

The Sultan Lumber Company is planning to install an electric lighting plant at Sultan, Wash.

The Four Metals Mining Company of Lone Pine, Cal., announces that it will put in a power plant as soon as a permit can be secured from the Forest Service.

In carrying out the proposed extensions of the Oregon Electric Railway Company of Portland, Ore., W. A. White of Moffat & White, New York, who are financing the road, will be in Oregon during this year.

The Board of Harbor Commissioners of San Francisco has directed the state engineer to prepare plans for the construction of an electric-lighting plant on state dredge No. 3.

The Pacific Gas and Electric Company of San Francisco has authorized the construction of a concrete power transformer house in Berkeley, Cal., at a cost of $12,000. The work will be in charge of H. C. Vensano.

The Carquinez Electric and Construction Company has been incorporated at Martinez, Cal., with a capital stock of $20,000 by E. W. Jensen and associates.

The National Electric [illegible] Company has been incorporated at San Francisco with a capital stock of $10,000 by B. L. Neel, [illegible] and C. M. Boyd.

The Battle Creek Power Company [illegible] notice that it will [illegible] Superior Court of [illegible] company must pay [illegible] Battle Creek.

The Marion Electric Light [illegible] Power [illegible] has been incorporated at Marion [illegible] capital stock of $10,000 [illegible] state. N.

PERSONAL.

Mr. W. M. Mordey has been nominated [illegible] president of the British Institution of Electrical Engineers by the council of that society.

Mr. L. S. Montgomery, who has been traveling in the southern states for the Western Electric Company, is now in the employment of the Federal Electric Company, Chicago, and is "covering" Ohio, Illinois and Indiana.

Mr. W. Barclay Parsons has been awarded a Telford gold medal by the British Institution of Civil Engineers for a paper which he read before that institution during the past session dealing with the New York Rapid Transit Subway.

Mr. B. E. Sunny, who recently resigned as vice-president and western manager of the General Electric Company, was elected president of the Chicago Telephone Company on May 13th, succeeding Mr. Arthur D. Wheeler, who becomes chairman of the board of directors. Mr. Sunny is also vice-president of the American Telephone and Telegraph Company and a director of the General Electric Company. He promises a "square deal" to the people of Chicago in the matter of telephone service.

A few of the most intimate friends of Mr. Thomas F. Mullaney assembled at the Engineers' Club in New York on Wednesday evening, May 6th, and gave him a complimentary dinner. Mr. Mullaney has just severed the business ties of more than twenty years with the General Electric Company to take the position of chief engineer of the Third Avenue Railroad of New York city. In the early days of the electrical business he was connected with the Thomson-Houston Electric Company, and, later, with the General Electric Company. From almost the first of his engineering career he had stood pre-eminent among construction and operating electrical engineers. Mr. William J. Clark of the General Electric Company acted as toastmaster of the dinner and presented Mr. Mullaney a handsome watch, chain and charm on behalf of his old associates in the General Electric Company. Among the guests were Messrs. Edward A. Maher, John W. Lieb, Edwin B. Katte, J. S. Doyle, Hinsdill Parsons, W. B. Potter, W. L. R. Emmet, T. Beran and others.

ELECTRIC LIGHTING.

The city of Poplarville, La., has voted bonds for $10,000 to extend the electric-light plant.

F. A. Ziegelbaur of Flatonia, Tex., has purchased the local electric-light plant of A. G. Kriestek.

W. J. Bell and others have formed a company to establish an electric-light plant in Mt. Ayr, Iowa.

The Newport (Ark.) Water, Light and Power Company has been incorporated with a capital stock of $100,000.

Senator Osborn of New Castle, Ind., is seeking a franchise in Tipton, Ind., for the purpose of constructing a lighting plant.

An election is to be held in Centralia, Wash., to vote on the proposition to issue $45,000 in bonds for a municipal lighting plant.

The City Council of Mt. Vernon, Ind., has granted a franchise to J. G. Hester and S. C. Goodrich of Flint, Mich., for the construction of a lighting plant in the city.

The Winchester Electric Company of Winchester, Ill., has been incorporated and intends to generate current for light, heat and power. The incorporators are William Millhouse, C. H. Condit and Sol Hainesfurther.

F. S. Ridgeway, formerly partner in the Ridgeway Electric Company of Freeport, Ill., has bought the electric-light and power system at Keithsburg, Ill., and is putting the station in first-class shape, rebuilding the line and putting arc lamps in the business district. George Cox, formerly chief engineer of the Freeport Railway, Light and Power Company, has charge of the power house.

One million dollars is the stated capital of the Northwest Light and Water Company, with headquarters at Carson City, Nev., which filed its articles of incorporation at Wallace, Idaho, a few days ago. The incorporators are Robert E. Strahorn of Spokane, president of the North Coast Railway Company; A. G. Smith, R. J. Danson and E. D. Doyle. It is generally believed at Wallace

[illegible]

ELECTRIC RAILWAYS.

[illegible] Vernon, Cal.

[illegible] added to the park.

The receipts of the Kansas City Railway and Light Company for March show a marked increase over March, 1907 [illegible] $178,464 in March, 1907.

The Owosso and Corunna [illegible] has gone into the hands of receivers, Edward E. Mandeville of Philadelphia and Gilbert L. Taylor of Owosso being the joint receivers. The company operated [illegible] in Owosso and Corunna and a municipal lighting plant in Owosso.

For the year ended June 30, 1907, the Federal Bureau of Statistics reports that there were in the state 31 street and interurban systems, and 17 succeeded in creating surplus funds out of their earnings, while 14 had deficits. The total number of passengers carried was 152,016,610, of which 28,082,487 were carried on interurban lines and 123,934,123 on city lines. The gross earnings of all companies was $10,378,939.76, and in 1906 $8,712,775.72. The grand total expenses in 1907 were $9,407,103.19, and in 1906 $5,551,456.59.

POWER TRANSMISSION.

George Nixon of the firm of Nixon & Kimmel of Spokane has been awarded a franchise by the commissioners of Spokane County for the installation of a power plant to furnish heat, power and electric lights for the towns of Deer Park, Chattarcy and Milan. The plant will be on the Spokane River, near Deer Park.

Representatives of the Wenatchee Canal Company, operating in the Wenatchee Valley west of Spokane, and the Valley Power Company, have ordered machinery for a $100,000 plant on the Wenatchee River, five miles above Cashmere, Wash. Four thousand horsepower will be developed, the plant to be in operation next fall. The company will furnish power to ranchers to secure water for irrigation.

The power plant to be constructed by a Portland syndicate on the Snake River may generate at least 60,000 horsepower. Present plans call for a transmission system extending 350 miles, with numerous sub-stations in various directions from the main plant. Power will be furnished to the Seven Devils district and to mines in Eastern Oregon. Twelve thousand poles for carrying the wires are now on the ground.

The Central Georgia Power Company will erect a complete hydro-electric plant, with transmission lines, sub-stations, etc., on the Ocmulgee River, about 36 miles above Macon, Ga., supplying power to that point and to other points in the vicinity. The normal capacity of the plant will probably be 12,500 kilowatts, generated by waterwheels under a hundred-foot head. The crest of the dam will probably be 750 feet. J. G. White & Co. of New York have the contract for the engineering and construction.

Work to improve the plant of the York Haven Water and Power Company, which will require the expenditure of more than $500,000, was begun on May 8th. The improvements will double the present capacity of the plant, which is located on the Susquehanna River, about 10 miles from York, Pa. When the improvements are completed it is proposed to extend the high-tension lines to Lancaster, Spring Grove, Hanover and other towns and cities within a radius of 50 miles. The addition to the power house will be 280 feet long and two stories in height. It will be constructed of brick. New General Electric generators, driven by waterwheels, will increase the electrical output 10,000 horsepower.

PUBLICATIONS.

The New York Insulated Wire Company sends out its usual convenient blotters for May.

The May issue of Common Sense, the monthly publication of the Electric Controller and Supply Company of Cleveland, contains a number of inter-

[illegible] short articles and some common-sense ad[illegible] together with a few pages devoted to illustrating some of its well-known appliances and supplies.

The April number of Holophane is beautifully illustrated and is a special issue devoted largely to describing Holophane Luxoliers (scientifically designed lighting fixtures). Holophane is published monthly by the sales and engineering departments of the Holophane company.

The Central Electric Company, Chicago, is distributing a 47-page book, devoted to various types of porcelain insulators, covering all voltages found in commercial practice. This catalogue on insulators will be mailed upon request, and should be found interesting by consulting engineers and others interested in high-tension work.

The Electrical Testing Laboratories, New York city, has printed, in pamphlet form, the paper by Wilson S. Howell on "The Work of the Electrical Testing Laboratories." This paper was read at the Hot Springs (Va.) meeting of the Association of Edison Illuminating Companies. An abstract was given in the Western Electrician of January 18, 1908, page 67.

A convenient table for finding the total radiation required to heat any given room has been prepared by W. H. Schott, heating engineer. It shows the values necessary for any cubical contents and the added amounts requisite for various exposed walls and windows. Anyone having to do with heating problems will find Schott's scale for steam radiation valuable. Mr. Schott can be addressed at the American Trust Building, Chicago.

Matthews' Telephone Line Construction Book, just issued by W. N. Matthews and Brother, St. Louis, gives some valuable and accurate information and suggestions on problems of outside telephone construction. Many of this company's well-known specialties are listed, and the data, obtained from competent authorities, are supplemented by diagrams showing how to meet the various line problems. There is an appendix giving rules, tables, formulæ and other data on telephone construction.

The May issue of Graphite, published by the Joseph Dixon Crucible Company, Jersey City, N. J., has the first chapter on a new series by W. H. Wakeman, the well-known expert steam engineer and author. The series has been titled "Preventing Corrosion of Steam Machinery." Concerns that find it desirable to stop a certain portion of their machinery will find this series of value in emphasizing the precautions that should be taken to insure the prevention of deterioration of their machinery.

The Cleveland Gas and Electric Fixture Company of Conneaut, Ohio, has issued a handsome bulletin giving illustrations of the Conneaut tungsten luminiers and other scientific fixtures. This company has been in the fixture business for over 20 years and recently occupied its new factory at Conneaut, where every modern tool and appliance enable the company to manufacture high-grade fixtures and offer the highest class of lighting units. The bulletin gives some light distribution curves and data on efficiency and economy.

The Lincoln Motor Works Company of Cleveland, Ohio, has published a new 16-page bulletin, No. 10, containing a full description of Lincoln variable-speed motors, including detail drawings, speed and efficiency charts, table of ratings and general outline dimensions. The principle of operation of this company's type of variable-speed motor and its peculiar advantages for all forms of individual drive requiring variable speeds are fully described and a few illustrations typical of the application of the motors to machine tool drive are shown. The bulletin is attractive in appearance and very complete in the information which it contains. Copies will be sent to any person interested upon request.

SOCIETIES AND SCHOOLS.

The Canadian Electrical Association will hold its eighteenth annual convention in Toronto, June 10th, 11th and 12th. The local arrangements are in the [illegible] of which R. G. Black is chairman. The programme committee has the [illegible] subjects. The question box is in charge of A. A. Dion of Ottawa.

The fifteenth annual summer session of the Uni[illegible] vided into 36 courses. The 1907 summer session [illegible]

[illegible] Western Society of Engineers on May 8th. Mr. [illegible] electric lighting for automobiles, which he believes [illegible]

general discussion followed the reading of the paper.

A regular meeting of the Central Electric Railway Association and also the Traffic Association connected therewith will be held in the Boody House in Toledo, Ohio, May 26th.

At the regular meeting of the Western Society of Engineers on May 6th, a paper on "Steam-turbine Development" was presented by Prof. J. C. Thorpe of the University of Illinois. It is abstracted in another column of this issue. Professor Thorpe showed a large number of lantern slides of historic and of modern turbines. The paper was discussed by Messrs. W. L. Abbott, C. G. Y. King, W. B. Jackson, P. Junkersfeld, A. Bement, President C. F. Loweth and the author.

MISCELLANEOUS.

A medical journal says that in Munich, Germany, Dr. Riehl a few days ago accomplished a marked advance in the methods of observing the interior of the human stomach during life by passing a double tube through the esophagus to the stomach, the inner tube being fitted with a small electric bulb. According to the report, water is passed by means of a subsidiary attachment through the outer tube, filling the stomach. The light is then turned on, permitting the closest observation of the movements of the organ.

The Youngstown (Ohio) Sheet and Tube Company has lately placed a contract with Allis-Chalmers Company for three large motor-generator sets intended for operation in connection with two 1,500-kilowatt Allis-Chalmers steam turbines and generators ordered some time ago. The equipment will also include two induction-motor exciter sets, a balancer and transformers of the oil-filled self-cooled type. The main motor-generator sets each comprise 500-kilowatt, 250-volt, direct-current generators and 750-horsepower, 6,000-volt, 25-cycle motors. Julian Kennedy of Pittsburg, Pa., acted as consulting engineer.

At the close of 1907 one of the largest orders ever placed for mechanical stoking equipment was received by the Westinghouse Machine Company, aggregating 14,400 boiler horsepower. This was for one of the large Brooklyn power stations operated by the Transit Development Company, New York. This order comprises 24 stokers suited to 600-horsepower boilers of the Babcock & Wilcox water-tube type. This is the second large order placed by this company for Roney stokers and may be regarded as the direct result of a year's successful operation of the original 7,200-horsepower installation at the Kent Avenue station.

TRADE NEWS.

F. J. Travis announces that he is no longer in the construction business, but has affiliated himself with C. A. Hermann & Co., importers of high-efficiency arc lamps and electrical supplies, with offices at 640 Unity Building, Chicago.

The New York office of the Fort Wayne Electric Works, formerly located at 40 New Street, has been moved to the Cortlandt Building (Hudson Terminal), 30 Church Street. The Fort Wayne Electric Works will occupy a part of the fifteenth floor of the building.

The Central Electric Company of Chicago is planning to have a large exhibit of high-tension insulators and other specialties of this nature at the Chicago convention of the National Electric Light Association. The exhibit will be shown in booths 23, 24, 47 and 48.

Members of the National Electric Light Association, their guests and friends are invited to visit the exhibit of the American District Steam Company of Lockport, N. Y., at the thirty-first annual convention of the association to be held in the Auditorium Hotel, Chicago, during the week of May 18, 1908.

Baker & Co., platinum refiners, Newark, N. J., have recently moved their New York office and are now situated on the sixth floor of the Cortlandt Building, Hudson Terminal, with entrance at 30 Church Street. The company has excellent facilities in its new office and is prepared to give its friends most careful and prompt attention.

The Haller Sign Works, Chicago, will be represented at the National Electric Light convention. It invites convention visitors to call at its headquarters at the Auditorium Hotel and at its works, 319 and 321 South Clinton Street. This company makes a specialty of electric signs and has produced some of the largest signs now in use.

The business interests of the H. W. Johns-Manville Company in Detroit and nearby territory have [illegible] that a new branch is about to be opened by that company. This branch will be located at No. 72 Jefferson Avenue, Detroit, under the management of Mr. Willard K. Bush. Mr. Bush is well known in the West, having been [illegible] with the Milwaukee branch of the company for a number of years. The company will carry a complete stock of goods at the Detroit branch.

Announcement is made of the formation of the H. B. Kirkland Company, which will hereafter act as selling agent for the National Metal Molding Company, with offices at 608-609 Postal Telegraph Building, 253 Broadway, New York city. Information relating to the well-known products Flexduct (flexible conduit) and Economy (rigid conduit) will be furnished upon application.

Jones, Addington & Ames, lawyers, announce that they have moved their Chicago office from 100 Washington Street to the Fort Dearborn Building, 134 Monroe Street. This firm devotes its attention to the practice of general and patent law, including, particularly, corporation law, infringement suits, involving the electrical and other technical arts, interference causes, applications for letters patent, trade-marks, copyrights, etc.

A committee of the directors of the Illinois Manufacturers' Association has decided that 200 members of the association shall go to Japan, China, Korea, the Philippines and other countries within the next six months to work for the extension of American trade. The committee will be transported to Japan in a special steamer, the first of a new line of steamships that will ply between this country and the Orient.

Dossert & Co., 242 West Forty-first Street, New York, manufacturers of solderless connectors, cable taps and terminal lugs for electric cables and solid wires, will be represented at the convention of the National Electric Light Association in Chicago by H. B. Logan, president, and Charles A. Flynn, mechanical engineer. The exhibit will be in space No. 6 and will include a number of new devices for central-station work and connectors for heavy cables.

A report has been received from an American consular officer in a European country, in which he states that certain municipalities in his district have in contemplation several industrial projects, chief among which are the installation of electric-light and tramway systems. The consular officer in question is of the opinion that American manufacturers of the necessary equipment and supplies should find a ready sale for their products, and suggests that they should correspond with the officers of the municipalities referred to. The Bureau of Manufactures, Washington, D. C., can give information by reference to File No. 2232.

The Milwaukee Wisconsin says that the largest bankruptcy case ever heard in Milwaukee, that of the National Electric Company, was disposed of by Referee in Bankruptcy Nye on May 5th, when a final dividend of 0.00361 per cent., amounting to $3,953, was declared. This was the third dividend, one of 38 per cent. on preferred claims amounting to $599,737.31 and one of 2½ per cent., amounting to $27,313.50, having been declared previously, amounting in the aggregate to $631,003.81. The total receipts amounted to $1,503,500.83, but John I. Beggs, the trustee, had to expend upward of $100,000 a month for eight months to operate the plant.

In the exhibit of the H. W. Johns-Manville Company in spaces 15 and 16 at next week's Chicago convention a number of new devices will be shown, many of them for the first time. The new Linolite system will be used for lighting the booth. This system of tubular electric lamps is attracting much attention. A large line of Victor portable and switchboard instruments will be demonstrated, including the portable lamp-testing meter. A switchboard and sample board made of ebony asbestos wood and other asbestos wood products will be shown. The latest types of Noark fuse devices will be on exhibition. The following representatives will be in attendance: J. W. Perry, manager electrical department, New York; H. M. Frantz, manager electrical department, Chicago; G. L. Saylor, manager electrical department, Milwaukee; T. G. Younglove, manager Chicago office; F. G. Frumveller, Chicago office; E. B. Hatch, president the Johns-Pratt Company, Hartford, Conn.

The Wagner Electric Manufacturing Company will have on exhibition in booth No. 37, in the Auditorium Annex, at the National Electric Light convention a five-horsepower single-phase motor of the latest design, a 10-horsepower polyphase motor and a set of standard Wagner instruments. Visitors to the convention are asked to particularly notice the large material allowance and ample weight of the 10-horsepower polyphase motor of this company as compared with the general run of 10-horsepower motors. The finish, too, on Wagner motors is of the very best. The following-named gentlemen will represent the Wagner company at the convention. W. A. Layman, vice-president and general manager; W. Robbins, assistant general manager; V. W. Bergenthal, assistant manager of sales; Thomas T. Richards, advertising manager, all of St. Louis, and the following district managers: E. W. Goldschmidt, New York; F. N. Jewett, Chicago; John Mustard, Philadelphia; A. W. Wyckoff, Pittsburg; Dean Emerson, Cincin-

nati; A. H. Mustard, Atlanta, F. Johnson, St. Louis.

The Crocker-Wheeler Company will exhibit at the National Electric Light Association convention a lighting transformer, small induction motor and a form L direct-current motor. Heretofore the company has made its chief offering to central stations in the line of direct-current and alternating-current generators and its celebrated line of form L direct-current motors. It now takes its place as a supplier of alternating-current and direct-current motors and transformers of the enviably high Crocker-Wheeler standard.

The Allis-Chalmers Company's exhibit at the National Electric Light Association convention will represent all of the standard power and electrical machinery manufactured by this company, including every type of prime mover, generators, motors and all auxiliary apparatus, machines from the new line of type K motors for direct-current and AN induction motors for alternating-current being particularly prominent. The exhibit will be in charge of C. A. Tupper, and a large number of officers and salesmen of the company are to be in attendance, including, probably, President W. H. Whiteside, W. S. Heger, M. C. Miller, A. H. Whiteside, E. T. Adams, B. A. Behrend, James Gardner, S. R. Kerr, C. S. Buell, Ervin Dryer, J. M. Denniston, D. K. Chadbourne, H. I. Keen, A. W. Catlin, [illegible] L. E. Bogen, David Hall, B. Frankenfield, H. L. Watson, J. S. Jackson, J. S. Vrabek, D. H. Kelley, J. M. Kingsbury, W. G. Hammond, G. S. Burdick, R. D. Tomlinson, Percy A. Himes, D. P. Davis, L. C. Marburg, C. E. Lord, Willis Collins and C. A. Shearer.

An ingenious variable-speed device is being manufactured by the [illegible] Company, 589 Kent Avenue, Brooklyn, N. Y. It is known as the S. & S. variable-speed countershaft and consists of an arrangement of expanding belt operating pulleys, by means of which any variable-speed relationship desired within the limits of 4 to 1 can be maintained at its maximum and capable of ready adjustment at a moment's notice. The gear is made in 14 standard sizes, capable of transmitting up to 128 horsepower. The variation in the diameter of the expansion pulley is effected in a unique manner. Many distinctive claims are made by the manufacturer.

BUSINESS.

Allis-Chalmers Company of Milwaukee reports that it is shipping out and installing large blast-furnace gas engines, weighing 1,500,000 pounds each, at the rate of three a month. These are principally for the United States Steel Corporation, for its [illegible]

DATES AHEAD.

[illegible]

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July [illegible], 16th and 17th.

Michigan Electric Association (annual meeting), Grand Rapids, Mich., August [illegible]

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay Island, August 25th, 26th and 27th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 5, 1908.

886,338. Printing Telegraph. John C. Barclay, New York, N. Y., assignor to the Western Union Telegraph Company, New York, N. Y. Application filed August 15, 1905.

One class of signals operates the printing mechanism, another the shift mechanism of the printer and a third causes repetition of the character last printed. Two line circuits are provided.

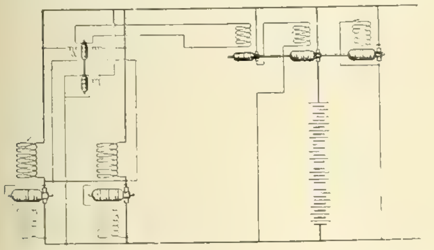
886,339. Automatic Telegraph Transmitter. John C. Barclay, New York, N. Y. Application filed July 22, 1907.

A message feeding mechanism, automatic transmitting contact mechanism and means for operating the same are described. An independent transmitter is arranged to be separately controlled and there is a switch for connecting either the automatic transmitting mechanism or the separate transmitter to line at will. Automatic stopping and starting means for the feeding mechanism are mechanically connected with the switch.

886,355. Invisible Electric Burglar and Fire Alarm. James W. Dawson, Kansas City, Mo. Application filed September 12, 1907.

Two pairs of spring contacts are used. If an insulated plate is withdrawn from the first pair, a contact-maker drops between the second pair.

886,371. System of Electrical Distribution. Albert S. Hubbard, Belleville, N. J., assignor to the Gould Storage Battery Company. Application filed August 10, 1905.



NO. 886,371.—SYSTEM OF ELECTRICAL DISTRIBUTION.

Combined are a number of compound-wound generators in parallel, a circuit in parallel therewith containing a battery and a booster armature in series with each other, and a plurality of regulating coils for the booster, each connected in shunt to the series-windings of one of the generators. (See cut.)

886,372. Electrical System of Distribution. Albert S. Hubbard, Greenwich, Conn., assignor to the Gould Storage Battery Company. Application filed April 15, 1905.

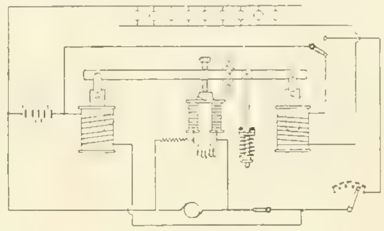
In combination with a working circuit of a main generator and compensatory circuit is a regulating coil for the compensatory circuit located in the generator circuit, and a second compensatory circuit connected to the generator circuit between the regulating coil and the generator.

886,374. Heat Coil and Protector Unit. William Kaisling, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Application filed May 29, 1905.

A mounting base, conductor springs, heat coil, carbon blocks and separators form the heat coil and carbon arrester protection for one telephone line.

886,395. System of Electrical Regulation. Morris Moskowitz, New York, N. Y., assignor to the United States Light and Heating Company, of New Jersey. Application filed June 28, 1907.

The system comprises a work circuit, a generator having a shunt field, a compensating storage battery in parallel across the line and a regulator for varying the field. There is a magnet coil in the main generator circuit, means for producing a mechanical force opposing the magnet coil, a coil in the work circuit assisting the mechanical force and means for breaking the work circuit so connected as to de-energize one of the coils and short-circuit the other. (See cut.)



NO. 886,395.—SYSTEM OF ELECTRICAL REGULATION.

886,443. Vibrator. Egmont M. Tormin, Newton, Mass., assignor to the Holtzer-Cabot Electric Company. Application filed January 23, 1908.

An electromagnetic winding is in series with a primary transformer winding, the circuit through the windings being permanently closed, and a condenser is in multiple with the circuit.

886,445. Car-lighting System. William A. Turbayne, Lancaster, N. Y., assignor to the Gould Coupler Company. Application filed June 20, 1906.

The combination consists of a variable-speed dynamo generator, a battery connected therewith, a dynamo crusher in the main circuit between the lamps and the junction of the battery and dynamo generator, a motor connected across the circuit on the generator side of the crusher and arranged to be variable in speed in accordance with the voltage variations of dynamo generator, and means for varying the voltage of the crusher in accordance with the varying speed of the motor.

886,497. System and Apparatus for Telephone Local Toll or Pay Stations. James Harrison, St. Louis, Mo. Application filed May 10, 1905.

The patent covers a coin-collecting or pay station for telephone systems.

886,498. System of Measured Telephone Service. James Harrison, St. Louis, Mo. Application filed May 10, 1905.

The mechanism for a measured-service telephone system is described.

886,499. Telephone Toll Box. James Harrison, St. Louis, Mo. Application filed January 12, 1906.

The coin-collecting box used in the system covered by patent No. 886,497 is described.

886,517. Trolley Harp. Hugh W. Kimes, Dayton, Ohio, assignor of two-thirds to J. H. Vaile, Dayton, Ohio. Application filed January 13, 1908.

The device has a split collar with means for clamping the sections on the axle, and means for locking the clamp in set position.

886,523. Spark Plug for Explosion Engines. Ellsworth A. La Har, Forestville, Conn., assignor to John B. Smith, New Britain, Conn. Application filed August 30, 1907.

The plug comprises a holding socket having an internal seat, a tubular cap for the socket, an insulator complete in itself and a middle sleeve permanently connected with the complete insulator.

886,559. Brush Holder. William L. Waters, Milwaukee, Wis., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed June 3, 1905.

A roller of insulating material is mounted between the ends of a bifurcated extension, a fork-shaped member extending from the brush-supporting frame. A helical spring is secured to the insulating roller and has adjustable engagement with the fork-shaped member, whereby the brush may be securely and flexibly held against the commutator. A lug on the [illegible] frame and a stop on the stationary arm form means for limiting the motion of the movable frame toward the commutator. (See cut on next page.)

886,561. Coil Support. William L. Waters, Milwaukee, Wis., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed September 4, 1906.

The coil support consists of a body portion extending axially and inwardly from a face plate adapted to be secured to the machine frame, the body portion having at its lower end an enlarged member having an opening therethrough, the enlarged member having a lower flat engaging surface to which the coils may be secured by means of a rope or string passing about the coils and through the opening.

886,562. Dynamo-electric Machine. William L. Waters, Milwaukee, Wis., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed December 13, 1906.

A shield of insulating material has slots registering with the slots in the brush yoke, and clamping studs secure the brush frames to the brush yoke causing the shield to be simultaneously clamped thereto, the shield of insulating material being interposed between the brush frames and brush yokes to electrically separate the section of the commutator engaged by the brushes from the brush yoke and bearing frame, thus preventing sparking between the commutator and brush yoke and bearing frame.

886,566. Electric Cable. Charles E. Wilson, Philadelphia, Pa. Application filed July 13, 1905.

The cable has a number of wires each composed of successive lengths of electrically conductive materials differing in their magnetic permeability, with alternation of the materials in opposed portions of associated wires, the wires being twisted together.

886,620. Electric Signaling Apparatus for Railroads. Paul J. Matter, Coswig, Germany. Application filed December 19, 1907.

An automatic railway signaling apparatus comprises a track, a sequence of conductor sections insulated from each other and located beside the track, both ends of each section being connected with it, a lamp connected in circuit at each end of each section, the lamp at the end of one section being located adjacent to the lamp at the commencement of the neighboring section, and a traveling source of electricity always in circuit with the track and with one of the sections.

886,634. Cable Hanger. Henry W. Pleister, Newark, N. J., assignor to Henry B. Newhall, Plainfield, N. J. Application filed January 24, 1907.

A resilient wire cable hanger comprising a head having a constricted throat to engage a support and retain a hanger thereon is described.

886,645. Trolley Guard. Jean E. Saucier, Montreal, Quebec, Canada. Application filed June 30, 1906.

A yoke is pivotally mounted on the upper end of the pole, the yoke comprising two divergent arms, a portion disposed at an angle to the arms and adapted to lie beneath the trolley pole. A spring is adapted to bear against the under face of the pole to maintain the opposite end of the yoke elevated.

886,649. Battery Cover and Element Support. Charles B. Schoenmehl, Waterbury, Conn. Application filed May 29, 1905.

The battery bridge has a depending conical supporting member protecting lug extending below the solution surface.

886,650. Battery Cover and Element Support. Charles B. Schoenmehl, Waterbury, Conn. Application filed May 29, 1905.

The combination with an electrode consists of an electrode-supporting device comprising a depending longitudinally extending protecting sleeve having a shouldered and threaded upper portion, a member having a threaded recess extending partially therethrough, and a perforation continuing therefrom and adapted to register with the opening through the sleeve.

886,651. Negative Element for Primary Batteries. Charles B. Schoenmehl, Waterbury, Conn. Application filed June 2, 1905.

A compressed metal oxide battery element has its surface coated with finely divided particles of the same metal as contained in the oxide.

886,652. Electric Battery. Charles B. Schoenmehl, Waterbury, Conn. Application filed March 29, 1906.

A negative element for batteries is covered, comprising a thin pressed cylinder of metal oxide and a perforated and pocketed sheet of metal extending therein and having its edges turned over to engage the cylinder and to support the same.

886,676. Automatic Electric Signal System for Railways. John P. Buchanan, Cleveland, Ohio, assignor of one-half to Frederick B. Wiegand, Cleveland, Ohio. Application filed August 3, 1906.

Combined with an actuating circuit are means responsive to an established current adapted to control the actuating circuit, and other means not responsive to such established current but to a current part of whose circuit or path is the ground, likewise adapted to control the circuit.

886,678. Electric-driven Tool. Allen F. Carver, New York, N. Y. Application filed February 5, 1907.

An electric tool-driver combination with plunger consists of coils adapted to impart a different polarity to the plunger when it has about completed its stroke, and means connected with the tool for reducing the current in one coil while a greater current flows through the other coil. (See cut.)

886,682. Electric Heater and Rheostat. James H. Delaney, Berwyn, Ill., assignor to the Electric Controller and Supply Company, Cleveland, Ohio. Application filed August 23, 1906.

A heater and rheostat consist of the combination of a spirally formed laterally flattened electrical conductor, the cross-section of the coils of which is reduced in thickness from the central part of the spiral to its outer boundary, and a core or support of insulating material having a screw thread formed on its periphery adapted to hold the spiral by the inner edge of its coils.

886,706. Vapor Electric Lamp. Richard Küch, Hanau, Germany, assignor to the firm of W. C. Heraeus, Hanau, Germany. Application filed September 6, 1905.

A gas or vapor electric lamp is covered, having the electrode material formed of a mixture of metals vaporizable at different temperatures, the metal constituting the greater part of the mixture being vaporizable at a higher temperature than the remainder of the mixture.

886,740. Relay for Signaling Apparatus. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 25, 1907.

This is an alternating-current relay having two windings and laminated cores for the windings, the pole pieces of the cores having opposite portions thereof sheathed with copper. A movable contact-actuating member is in operative relation to its windings. These windings have means whereby the action of the current in one or the other winding will predominate according to the frequency of the current.

886,741. Automatic Train Controller. Guy Toft, Camden, N. J., assignor of three-fourths to Thomas Marrin, Philadelphia, Pa. Application filed January 2, 1907.

Electrical means are provided for actuating throttle valve and air brakes.

886,755. Telegraph Instrument. Benjamin F. Bellows and Ambrose Behner, Cleveland, Ohio; Behner assignor to Bellows. Application filed September 27, 1904.

A vibrating spring carrying one terminal of an electric circuit seems to be an essential feature of this system.

886,757. Art of Reducing Aluminum and Other Metals. Henry S. Blackmore, Mount Vernon, N. Y. Original application filed August 22, 1904. Divided and this application filed November 14, 1905.

This process of reducing aluminum consists in fusing the aluminum-containing substances by passing a nonmetal-yielding current through the fused material between contacts, and liberating the aluminum from its compound by the action of a metal-yielding current.

886,769. Warp Stop-motion for Looms. Joseph B. Derfinak, Mystic, Conn. Application filed September 16, 1907.

[illegible] electric circuit effects the desired object.

886,775. Computing Scale. John J. Duffie, San [illegible], Cal. Application filed November [illegible], 1907.

[illegible] the platform of the scale a [illegible] thereby producing light inside [illegible]

886,788. Course and Log Recorder. Theodore M. [illegible], Mass. Application filed Au[illegible]

[illegible] trically recorded.

[illegible] George H. [illegible] and John L. Hagadorn, Detroit, Mich. Application [illegible]

[illegible]

zel, Baden, near Vienna, Austria-Hungary. Application filed July 16, 1907.

The combination patented relates to the method of fastening or holding portions of the filament in a metallic filament incandescent lamp. A central support is an essential feature. (See cut.)

886,824. Choke Coil. Louis O. Langworthy, Bradford, Pa. Application filed October 4, 1907.

The coil has two cores arranged so that a variable air-gap may be produced.

886,827. Electric Door Opener. Joseph Loch, Brooklyn, N. Y. Application filed April 16, 1907.

When a magnet is de-energized a bolt is released.

886,833. Combined Gauge and Signal Device. Mark G. Melvin, Scranton, Pa., assignor of one-half to Edward A. Jones, Scranton, Pa. Application filed March 16, 1907.

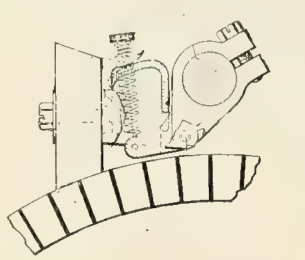
The movable element carries a contact for actuating the switch of a signaling circuit.

886,842. Electric Railway Gate. Richmond M. McGee, Dallas, Tex., assignor to the McGee Switch and Signal Company, Dallas, Tex. Application filed August 8, 1907.

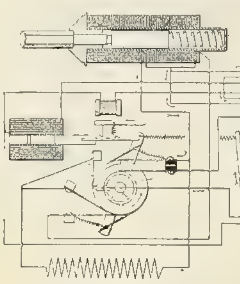
A motor raises and lowers a gate arm. Switch mechanism changes the poles of the motor circuit at approximately the limit of movement of the gate in either direction, and electromagnetic means are provided for independently actuating the switch mechanism.

886,847. Automatic Railway Signal. James P. Norwood, Chicago, Ill. Application filed October 5, 1906.

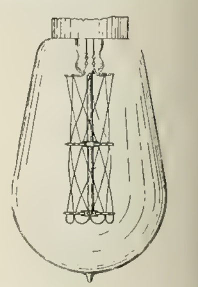
The arrangement is such that by breaking the circuit of a third rail at crossings or other danger points a motor-driven generator on the railroad car automatically operates a semaphore by electric power.



NO. 886,559. BRUSH-HOLDER.



NO. 886,678. -ELECTRIC TOOL.



NO. 886,821.—METALLIC-FILAMENT LAMP.

886,856. Electric Furnace. Edgar F. Price, Niagara Falls, N. Y., assignor to the Central Trust Company of New York. Application filed November 14, 1905.

Construction details are described.

886,857. Electrolytic Process of Producing Metals. Edgar F. Price and William S. Horry, Niagara Falls, N. Y., assignors to the Central Trust Company of New York. Application filed December 29, 1906.

This process of producing alkali or alkaline-earth metals consists in electrolyzing a molten salt of the desired metal with an anode essentially comprising a carbide of that metal.

886,858. Process of Producing Low-carbon Ferroalloys. Edgar F. Price, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company, Chicago, Ill. Application filed September 24, 1907.

The body of a molten alloy is made the secondary of a transformer, and electric current is supplied to the primary of the transformer.

886,869. Electromagnet. Harold Rowntree, Chicago, Ill., assignor to the Burdett-Rowntree Manufacturing Company, Chicago, Ill. Application filed June 23, 1905.

886,870. Electromagnet. Harold Rowntree, Chicago, Ill., assignor to the Burdett-Rowntree Manufacturing Company, Chicago, Ill. Application filed April 6, 1907.

The first patent relates to an alternating-current magnet with a laminated core. The laminations are united to form a closed magnetic circuit at one end. In the second patent the principle is applied to the plunger of a solenoid.

886,874. Apparatus for Producing Electric Discharges Through Gases. August Schneller, Ginneken, near Breda, Netherlands, assignor to Percy Thompson, East Orange, N. J. Application filed April 25, 1904.

The invention describes an apparatus for subjecting gases to invisible electric discharges, comprising discharge terminals and means for circulating between them a flowing dielectric medium for the purpose of cooling the terminals.

886,879. Signaling System. John Shepherd, Chicago, Ill. Application filed September 17, 1906.

Means are provided to test the ground connection of the line circuit without breaking the line.

886,880. Trolley. John Shepherd, Chicago, Ill. Application filed December 20, 1907.

Details are described.

886,909. Party-line Telephone Selector and Lock-out. Herbert D. Williams, Vermilion, Kan. Application filed June 19, 1906.

Means are provided for impressing currents of different intensities upon the line. Responding to a current of a certain intensity, the locking means operating the individual switch controlling the talking circuit is released.

886,942. Trolley-line Clamp. Auguste Caron, Indian Orchard, Mass. Application filed July 25, 1906.

Two separable clamping members have grooved arcuate line-engaging faces. One of the members is provided with a central aperture and the other member is provided with a threaded shank engaging the aperture and having wire receiving slots.

886,947. Railway Block Signal. David H. Coker, Piedmont, and Whitfield A. Scarbrough, Chocolocco, Ala. Application filed April 3, 1907.

Magnets attract a semaphore in either direction, according to the operation of separate circuits.

886,978. Connection Box. Russell D. Holabird, Los Angeles, Cal., assignor to the Holabird-Reynolds Electric Company, Los Angeles, Cal. Application filed May 21, 1907.

A connection box for electric wiring comprises a body section and interchangeable end sections, the sections having co-operating connecting means and additional means for connecting a number of body sections to form a larger sectional box.

886,983. Coherer and Decoherer. Joseph L. Jones, Kizer, Tenn. Application filed December 26, 1906.

The patent covers a decoherer electromagnet, an armature arranged within the field of force of the magnet and having a hooked end, a make-and-break device, and a coherer supported by the hook.

886,993. Electric Signal for Railways. Anton Kuzel, Cleveland, Ohio. Application filed December 30, 1907.

This is a safety electric signal device which works by a trip device upon the track and a signal circuit upon the locomotive.

887,038. Duplex Telegraph. John J. Ghegan, Newark, N. J. Application filed May 20, 1907.

A duplex telegraph system is described having a relay and adjustable resistance in the line in combination with two shunt circuits, one around the relay and the other around the line resistance, and a transmitter controlling the shunt circuits, whereby the operation of the transmitter increases or decreases the resistance in the line to operate a distant relay without affecting the relay at the transmitting station.

887,052. Electrical System of Distribution. Walter E. Winship, New York, N. Y., assignor to the Gould Storage Battery Company of New York. Application filed September 25, 1906.

The system comprises two sources of electric supply, a motor generator connecting the same, and means for oppositely regulating the electromotive forces generated by the two ends of the motor generator responsively to fluctuations of load of one of the sources.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 12, 1908:

451,921. Secondary Battery. J. Emmner, Jr., Washington, D. C.
451,948. Galvanic Battery. G. C. McCullough, Richmond, Ind.
451,951. Printing Telegraph. E. Pope, Quebec, Canada.
451,980. Electrically Propelled Car. S. H. Short, Cleveland, O.
451,981. Mounting for Electric-car Motors. S. H. Short, Cleveland, O.
451,997. Fusible Cut-out for Electric Connections. W. I. Dow, Braintree, Mass.
451,999. Electric-railway Signal. W. C. Walter, Richmond, Va.
452,003. Electromagnet. C. E. Lipe, Syracuse, N. Y.
452,026. Electrical Signaling Device. C. J. Kintner, New York, N. Y.
452,042. Electric Riveting Apparatus. E. E. Ries, Baltimore, Md.
452,056. Apparatus for Heating by Electricity. C. Zipernosky, Buda Pesth, Austria-Hungary.
452,099. Electric Railway. M. W. Dewey, Syracuse, N. Y.
452,161. Electric Railway. F. O. Blackwell, New York, N. Y.
452,163. Thermostat. A. M. Butz, Chicago, Ill.
452,176. Electric-car Motor. J. Christiansen, Quincy, Mass.
[illegible] Electric Motor. D. [illegible] Chisholm, New York, N. Y.
[illegible] Tubular Pole for Electrical Railroads. T. J. Bray, Warren, O.
452,276. Electric Meter. H. W. Miller, London, England.
[illegible] Electric Reciprocating Engine. C. J. Van Depoele, Lynn, Mass.
[illegible] Primary Battery. W. Hanson, London, England.
[illegible] Incandescent Lamp Socket. W. M. B. Keen, New York, N. Y.
[illegible] Electrical Measuring Instrument. E. Weston, Newark, N. J.

NATIONAL ELECTRIC LIGHT CONVENTION NUMBER.

Western Electrician

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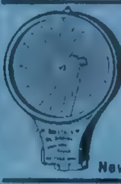

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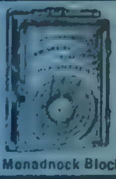

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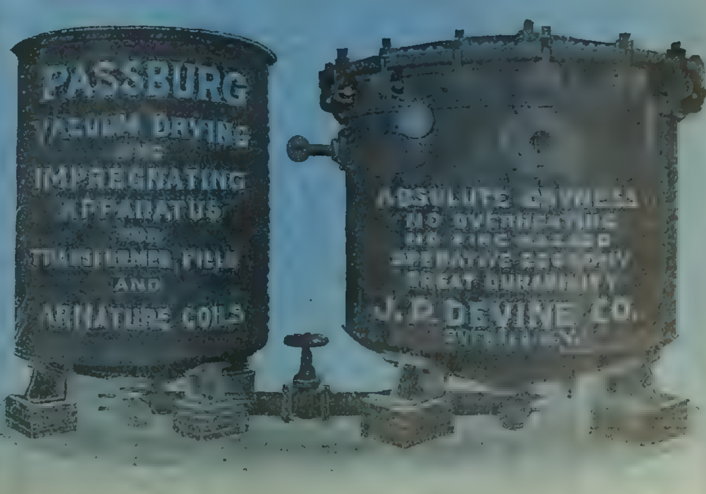

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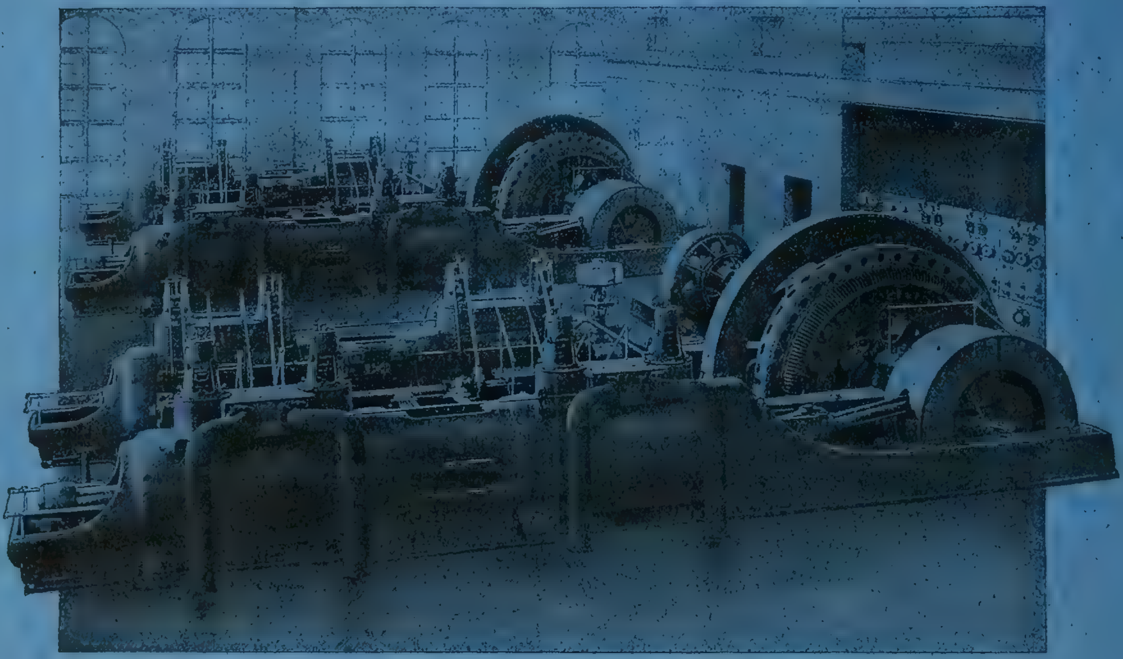

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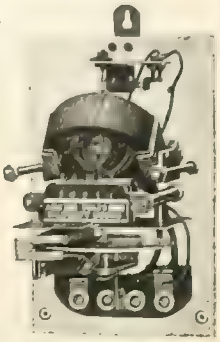
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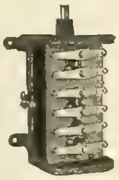
Oil-immersed Self-starter

worked them out and built the apparatus to accomplish the result desired. Each new problem we have solved has added to our knowledge regarding the best and most economical methods of electric control, and the data we have accumulated in the course of years constitute, today, a store of information on this important subject, the like of which does not exist elsewhere.

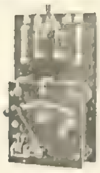
The letters we receive come from all parts of the country and from people engaged in many and various lines of work—managers of central stations, consulting engineers and architects, electrical supply houses and contractors, college professors, manufacturers of motors, machine tools, pumps, air compressors, ventilating fans, cranes, elevators, etc.; foremen of machine shops and printing offices, mill and mine superintendents, railroad men, inside wiremen, electricians of industrial plants, etc.


Limit Switch for electric elevator

These inquiries receive the most careful attention. They are the seeds from which orders grow. Every morning the Chief Engineer and his assistants assemble in the office of the General Manager and the mail is read aloud. Your inquiry (if you favor us with one) will be

There is an EASY SOLUTION to every problem involving the control of electric motors.

It consists in addressing a letter to THE CUTLER-HAMMER MFG. CO., MILWAUKEE


D. C. Motor Starter

answered by one of the group, but that answer will represent—not the opinion of one man—but the consensus of opinion of a group of engineers who have been described as "the court of last resort on the subject of electric control."

From the very start sixteen years ago The Cutler-Hammer Mfg. Co. has specialized along this one line—the control of electric motors. Cutler-Hammer apparatus (counting standard constructions only and taking no account of the large number of special devices built to meet exceptional conditions) comprises today more than 2,500 types and sizes of electric controlling devices. These standard constructions are all pictured and described in our general catalogue, which is sent free on request to those who really have occasion to use it.

We **know** that we can be helpful to anyone who uses electric motors and who wishes to control them either by manually operated starting and speed regulating devices, installed in the vicinity of the motor or by solenoid operated devices designed for automatic operation or remote control. The INDEX TO BULLETINS in the next column will give you an idea of the scope of our work.

Write us today if you have before you any problem involving the starting, stopping or speed control of electric motors and we will send you illustrations, prices and full descriptions of apparatus that will accomplish the desired result.

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Starting Panel for 1,500 H. P. motor

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In addition to the above we make Battery-charging Rheostats, Dynamo Brushes, Brake Magnets, and Special Apparatus for the control of all types of alternating and direct-current motors.

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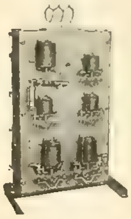
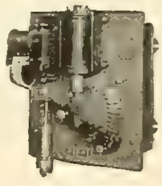
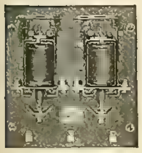
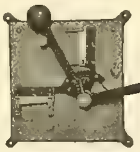
Crane Controller

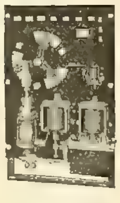

Self-starter for 25 H. P. motor

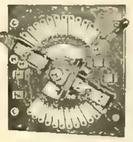

Self-starter for electric elevators


Self-starter for D. C. motor

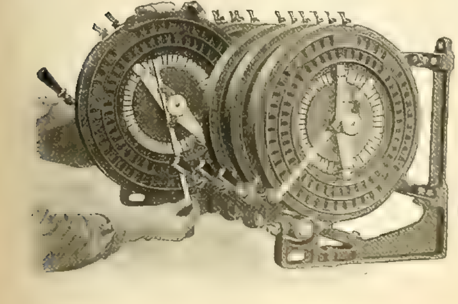
Gauge Type Pressure Regulator used with self-starter


Float Switch used with self-starter


Self-starter for A. C. motor

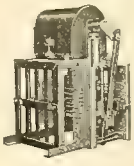

A. C. Motor Starter

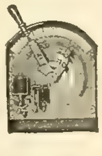
Speed Regulator

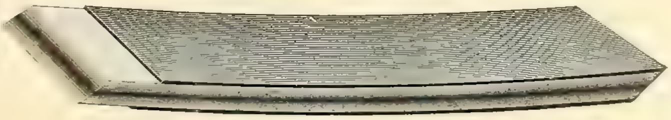

Cutler-Hammer "Simplicity" Theater Dimmer

Machine Tool Controller

Dynamo Field Regulator


Elevator Controller


Printing-press Controller


Dynamo Brush (Wirt type)

The Cutler-Hammer Mfg. Co.

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5. FREEDOM FROM SECONDARY ACTIONS.

The grid, or support plate, must contain no elements that may promote or even allow any local action, frequently styled "self discharge," between itself and the active material. In the Gould plate only chemically-pure rolled lead, free from antimony and other hardeners, is employed, and the active material is formed electrochem cally out of the metal composing the contact surface or support plate. Hence local action or "self discharge" is totally out of the question.

We invite the most critical comparison of the Gould plate with all other types, for any service whatsoever.

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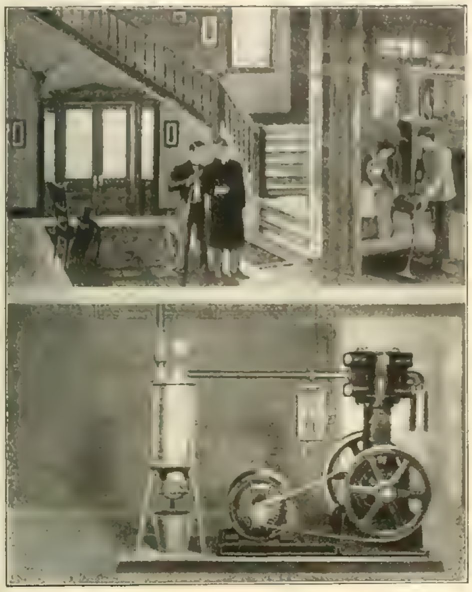
Central Station Managers

Increase Your Day Load

BY INSTALLING

Vacuum Cleaning Machinery



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This type of cleaning equipment is suitable for Residences, Apartments, Office Buildings, Hospitals, Churches, Schools, Hotels, Stores, Libraries, Lodge Buildings, Club Buildings, City, County and State Buildings, Factories, Etc., Etc.

We are the PIONEERS in the invention, design and manufacture of Mechanical Air Cleaners.

The sweeping service is efficient and perfectly dustless. The apparatus is simple, durable and a child can operate the cleaning tools.

We make strictly High-grade Equipments for High-grade Sanitary Cleaning Service, and for High-grade People.

The Vacuum Cleaning load never touches your peak load, as the cleaning is usually done between 9 and 11 A. M.

NOTE THE PREDICTION: In less than five years all the buildings mentioned above, in all parts of the country, will have vacuum cleaners. CAN YOU IMAGINE WHAT THIS MEANS FOR YOUR DAY LOAD?

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(THURMAN SYSTEMS)

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Catalogue will tell you why

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WALL

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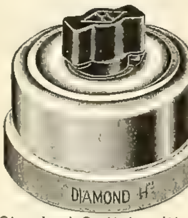
Flush Push Switch



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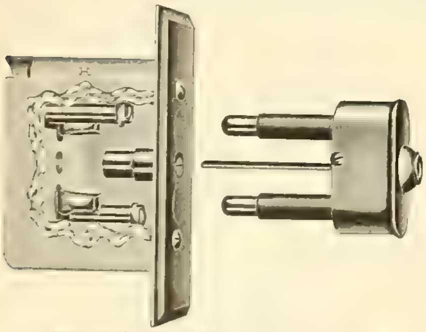
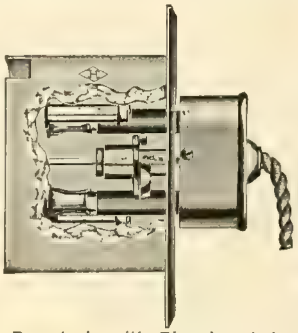
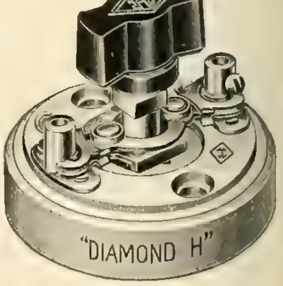

Receptacle with Plug Ready to Insert

Flush Receptacle with Plug Ready to Insert


Receptacle with Plug Inserted



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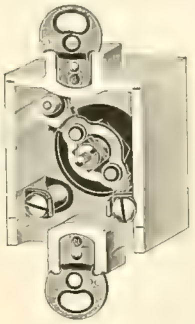

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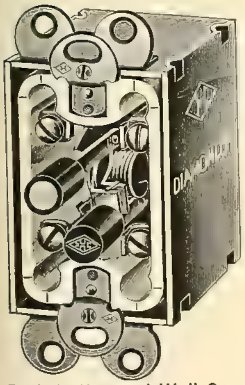
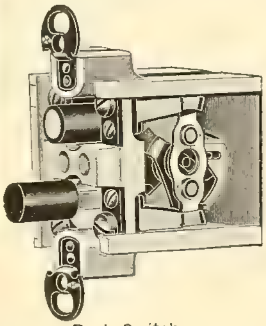


Push Button and Wall Case

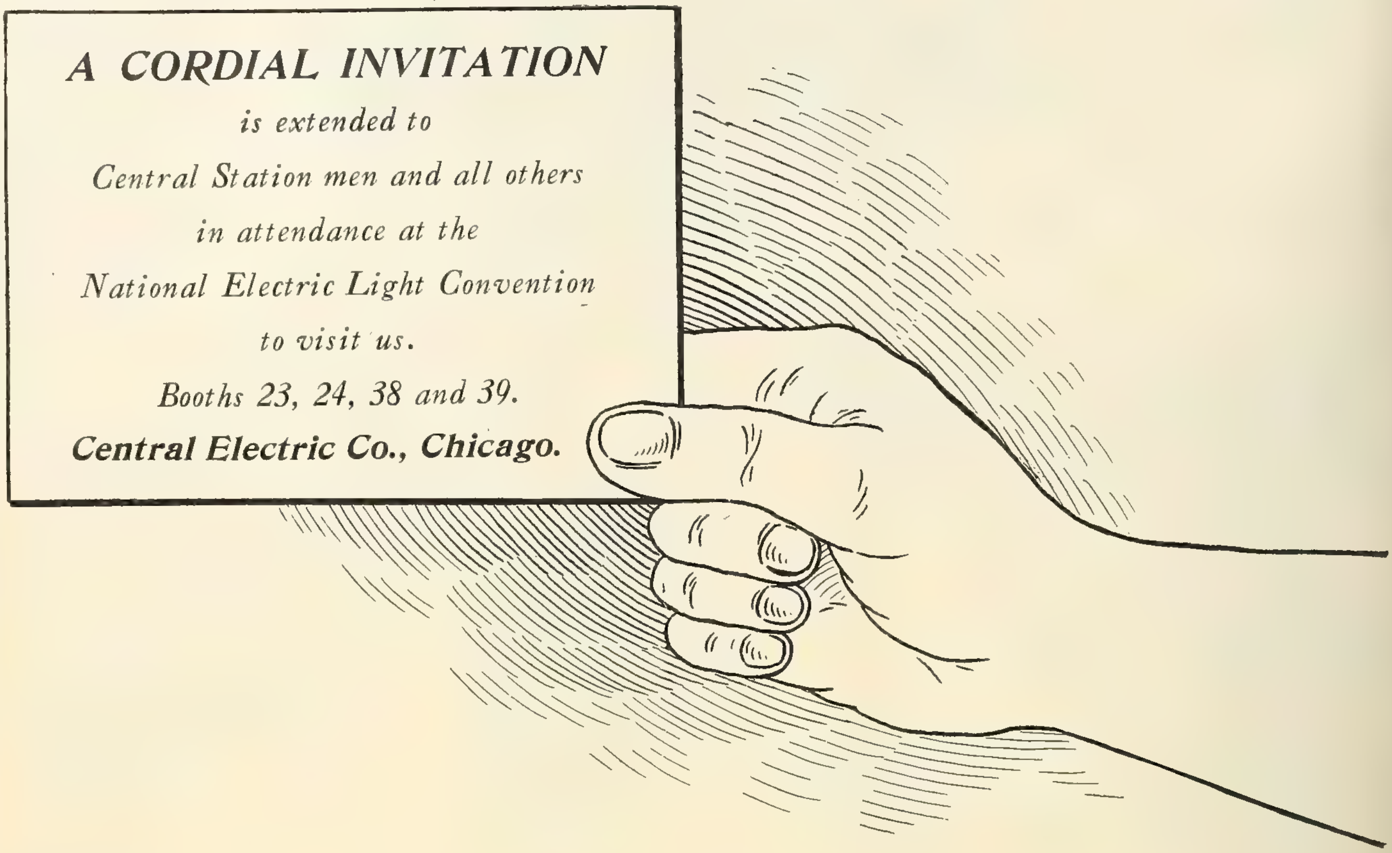


Push Switch

Flush Receptacle with Plug Inserted

Standard Switch with Indicating Dial

MFG. CO.
RD, CONN.



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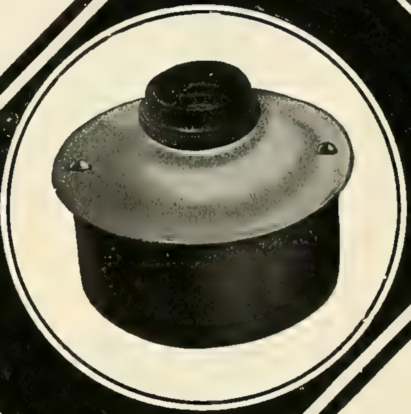

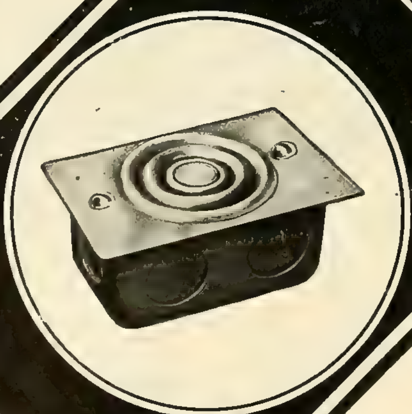

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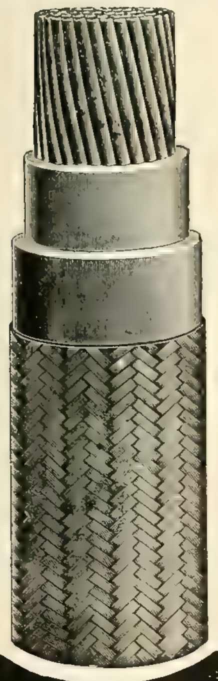

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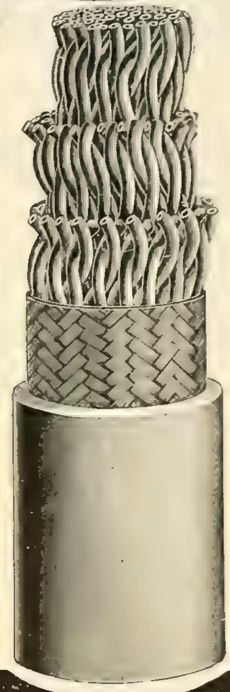

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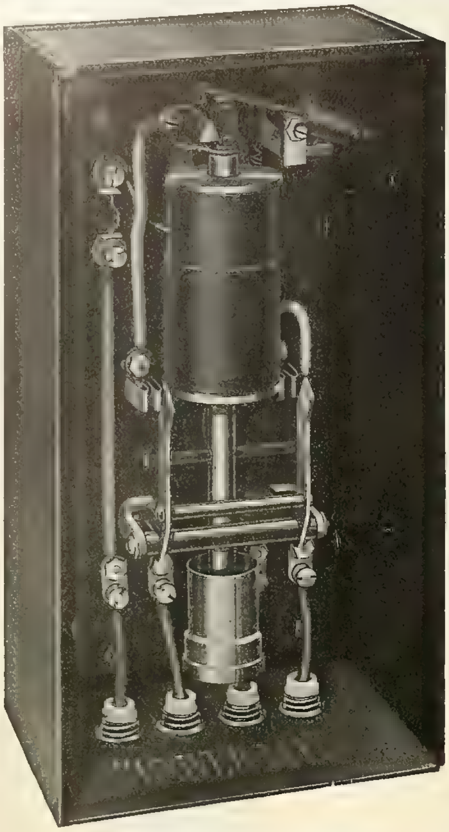

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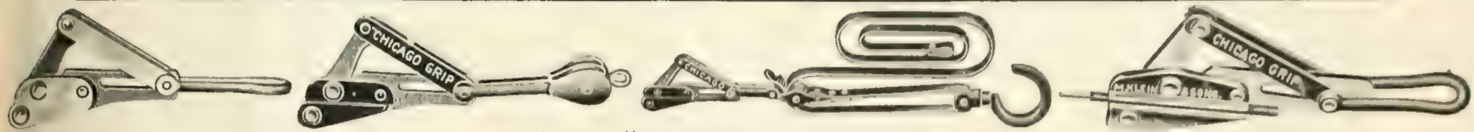

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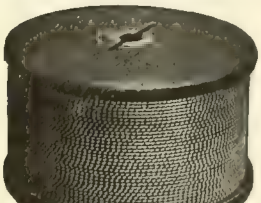

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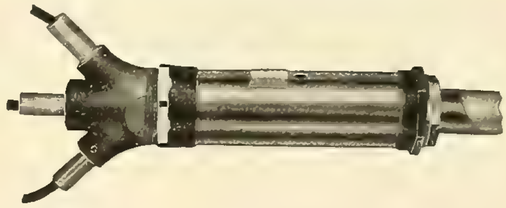

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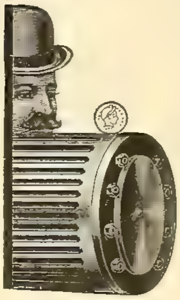

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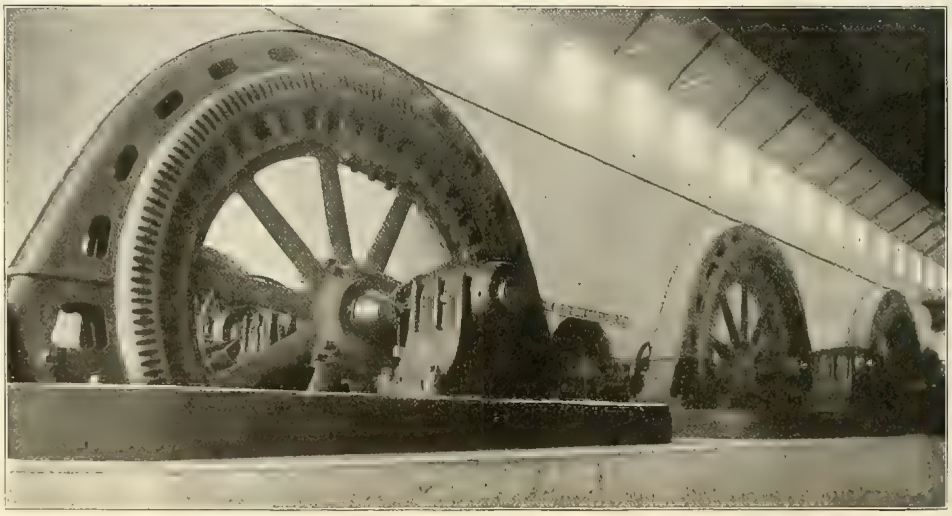

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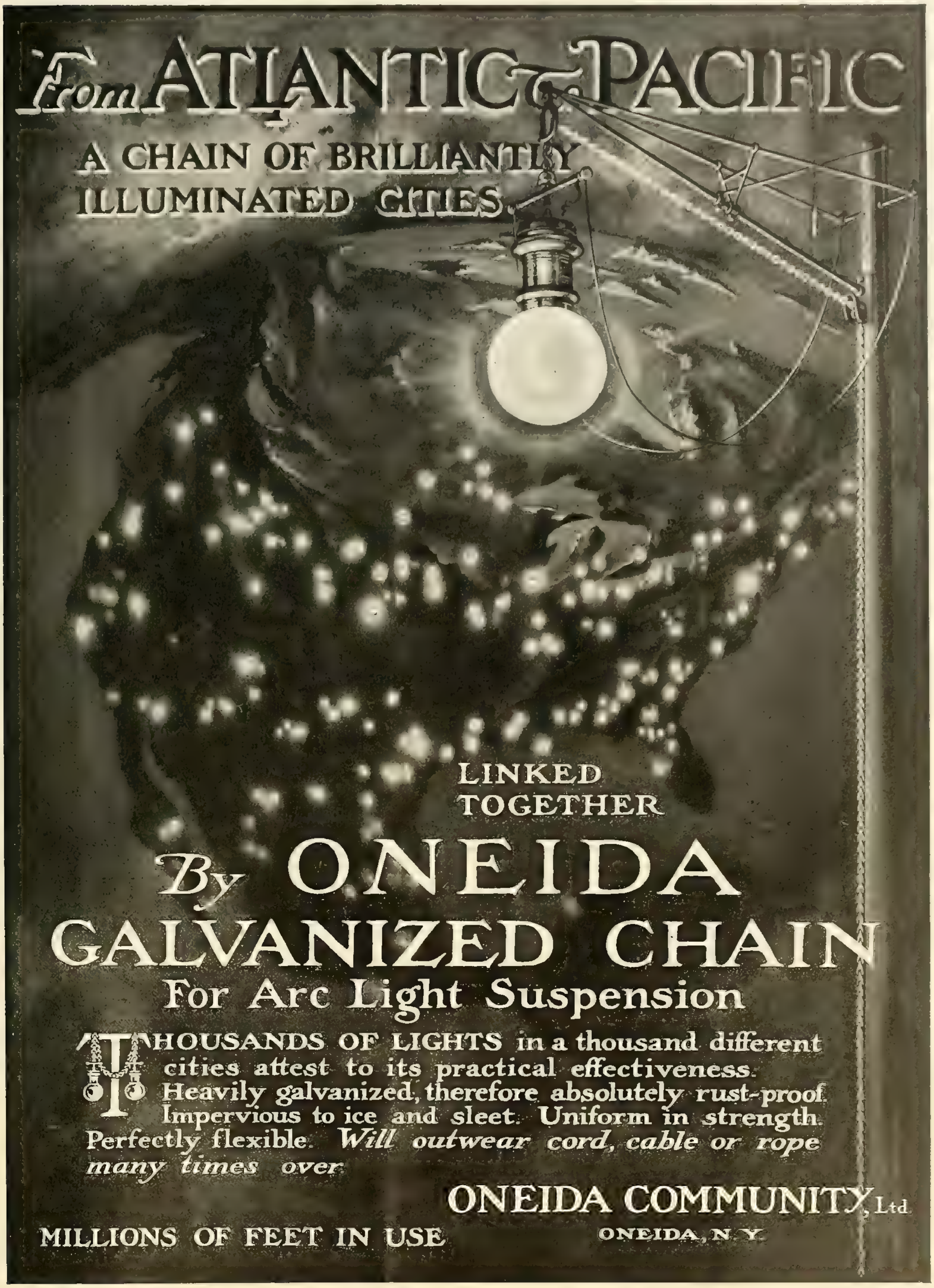
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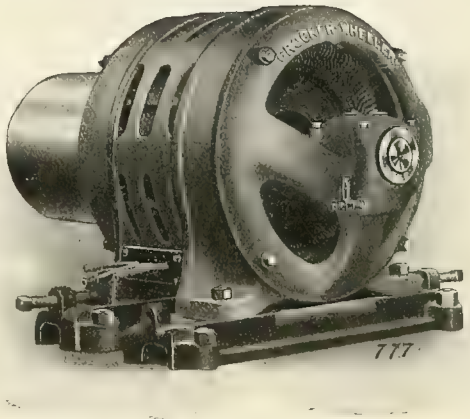

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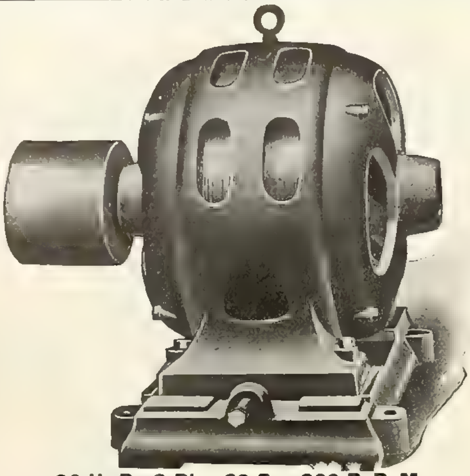

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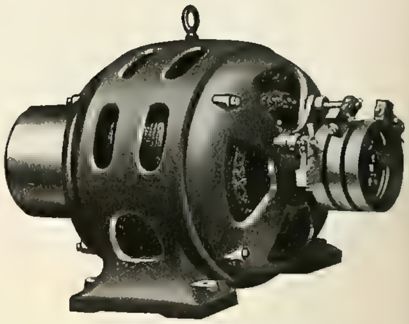

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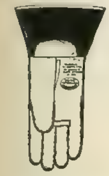

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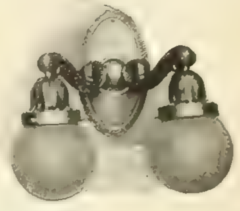

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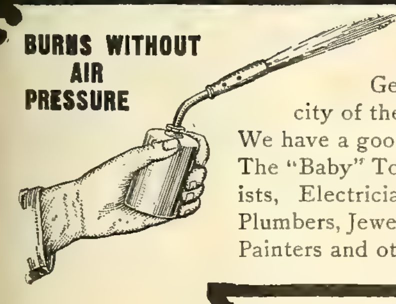

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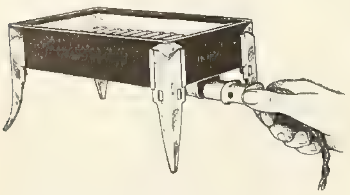

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EDISON MFG. CO., 7 Lakeside Ave., Orange, N. J.
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In cylinders, bearings, gears and all friction points Dixon's Flake Graphite saves wear and power.

Successful engineers use it. Write for free booklet and sample—write to-day.

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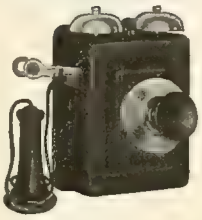
SWITCHBOARD & SUPPLY CO. CHICAGO



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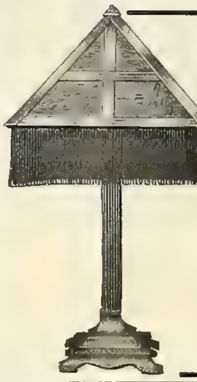
KELLOGG NEW STEEL TELEPHONE

FOR RESIDENCE AND HOTEL USE

IT IS STRONG, COMPACT, SERVICEABLE

WRITE FOR PARTICULARS

Bulletin No. 35-L



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No. **6048** Electrolier. Extreme Height, 24 inches.
Finished in Brushed Brass and Black,
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Fitted with two-light Cluster, supporting shade from top, two Pull Sockets, 6 ft. Code Cord, Detachable Attachment Plug and No. 6050 12" Square Shade in Amber, Green, Pink, or Sunset Glass, with Fringe.
List each complete, except bulbs, **$16.88**

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WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD.

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POLISHES ALL METALS. BRANCHES NEW YORK, CHICAGO, SAN FRANCISCO. 295, E. WASHINGTON ST. INDIANAPOLIS, IND.

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Electric light companies and repair men given special attention.

Worth Having!

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of the first cost of automatic telephones (over and above the regular manual maintenance cost of receiver and transmitter repairs) keeps them in good condition.

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of seven of the largest Automatic exchanges in the United States, taken from a careful tabulation of all repair materials they have purchased in the past two years.

Don't you wish

your old-fashioned manual apparatus was costing you no more? It never has and never can approach the low cost of automatic maintenance because it is continually subject to wear and tear from the careless handling of operators. The Automatic is continually and consistently "the economical system."

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The Western Electrician will publish a full and complete report of the proceedings of the National Electric Light Convention in its issues of May 23rd and 30th.

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Copy should be forwarded at once

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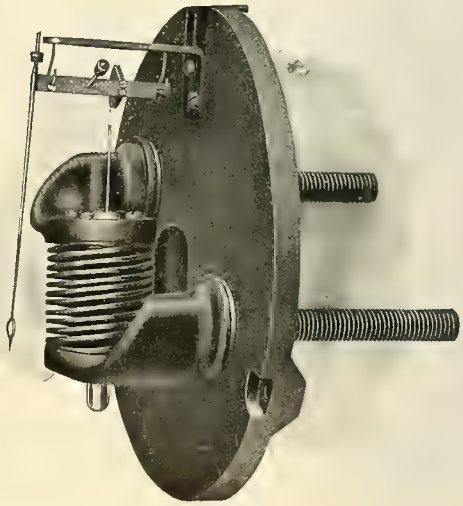
Type "K" Meters

As Designed by Lord Kelvin

The lowest priced, high-grade, nine-inch switchboard meters on the market

Alternating and Direct Current



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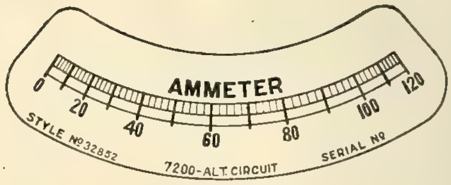
No delicate parts. No jewels, no springs. Practically uniform scale. Absolutely dead beat. Self-calibrating attachment. Will stand short-circuits. Torque 20 times that usual in such meters. Absolutely simple and easy to repair. Unaffected by external fields. Electrical errors negligible.



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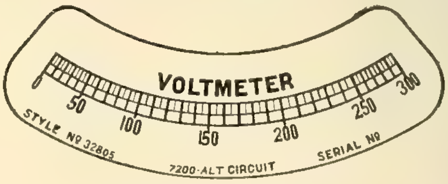

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Fully described in Circular No. 1098

We make 6 other types of Switchboard instruments, also portable and precision instruments

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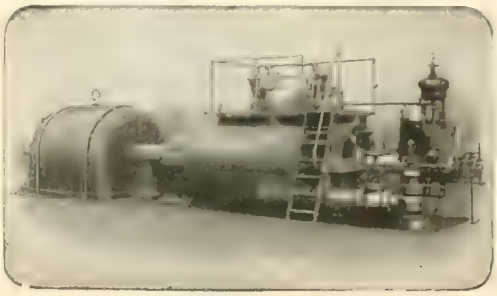
The first heavy-duty steam turbines in the field, and the first in position today. Over 1,250,000 horsepower in operation or in course of erection. A Westinghouse Steam Turbine, once installed, has never been displaced.



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For Light and Power Service

The Synchronous Regulator is a feature found only in Westinghouse Rotaries; it results in:

High Efficiency

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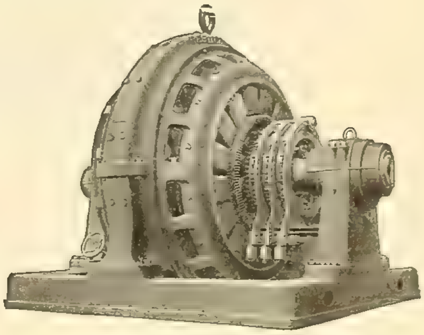
Minimum Floor Space



Ask nearest office for particulars.

1000 K. W. Westinghouse Rotary Converter, with Synchronous Regulator.

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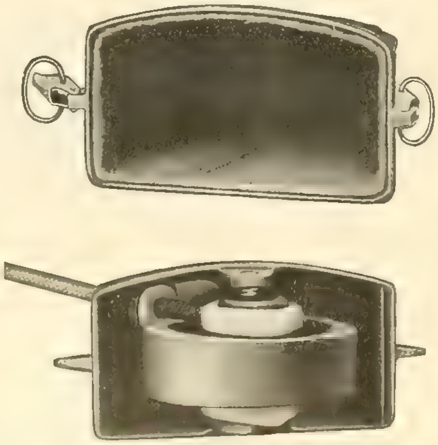
Westinghouse

Protective Apparatus

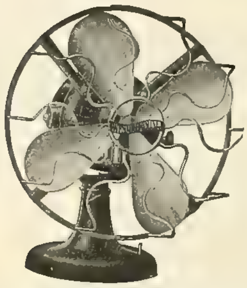
The Westinghouse M. P. Lightning Arrester is single pole for use on potentials not exceeding 1,000 volts, and can be located on a car, on a pole, or in a station.



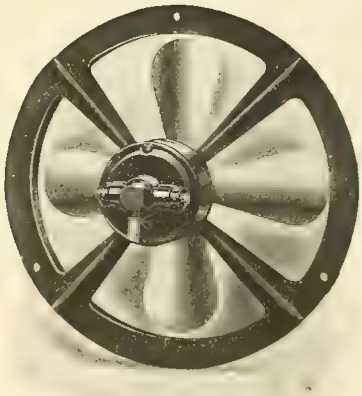
It embodies a new principle in protective apparatus. The static discharge spreads itself over a carborundum block, along a number of minute discharge paths. The voltage across each gap being very small, the line voltage cannot maintain an arc across them.

Circulars 1132 and 1146 give full particulars.

Electric Fans



Westinghouse Electric Fans represent the successful culmination of a series of experiments, carried through many years, to determine the exact blade curvature required to produce the greatest breeze with the least consumption of power.



Westinghouse Fans are made with 8, 12 and 16-inch blades in the Combination Desk and Bracket and Ventilating types, and with 57-inch blades for Ceiling, Floor and Counter-Column types.

Full particulars in our 1908 Art Catalogues

Westinghouse Electric & Manufacturing Co.

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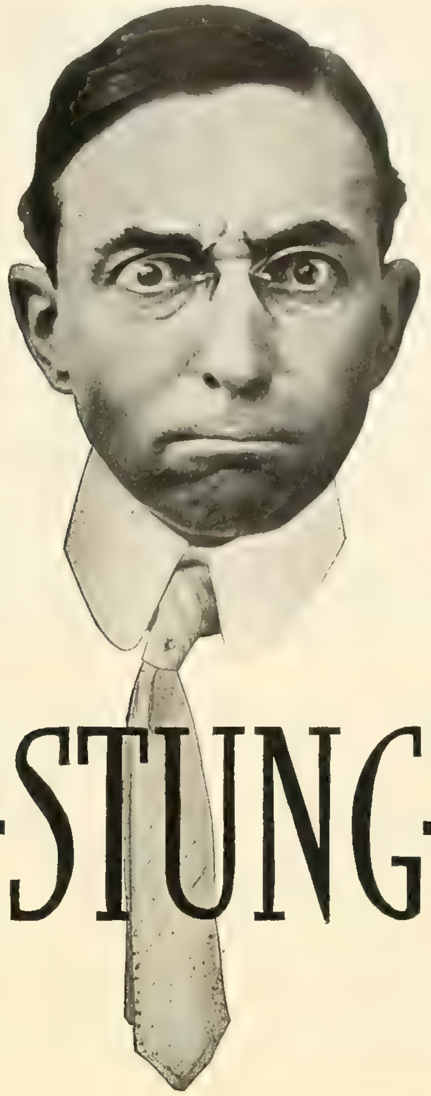

STUNG

STUNG ! ! !

Did the Money Panic sting YOU too? Did merchants in your town cut down their lighting? Shops reduce their power demand? Residence customers cry, "Cut it out?"

Of course, like others, you are still smarting from the effects of the stringency. It would be hard work to talk DISTRICT STEAM HEATING just now, BUT —— it is a fact, that the companies who supplied steam for heating purposes last winter DIDN'T KNOW MUCH ABOUT THE PANIC. Their earnings in the steam heating department were not curtailed. People HAD to have HEAT. Not only THAT, —— those companies actually INCREASED THEIR EARNINGS.

How?

By taking the opportunity, presented by the panic, and compelling owners of isolated electric plants to abandon them and buy their LIGHT, HEAT AND POWER. The majority of isolated plants in medium to large cities are operated at a great expense, because the owners MUST HAVE HEAT. The electricity is generated as a BY-PRODUCT.

The net income per building for HEAT is more than the combined income from gas, water, electric light and power.

The ability of electric companies to furnish steam for heating purposes has proven to be one of the best means of securing new electrical business. As an illustration,—we installed a DISTRICT STEAM HEATING SYSTEM for an electric company in a town in the Middle West and in a comparatively short time they increased their electrical business over 400% and succeeded in shutting down every isolated electric plant along their heating mains. CAN YOU BEAT IT?

Call on us at the N. E. L. A. convention and ask questions.

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THE
DUNCAN METER
STANDARD OF THE WORLD

BOOST A BIT
AND USE DUNCAN METERS

"Here! you discontented knocker,
Growlin' 'bout the country's ills;
Chloroform yer dismal talker;
Take a course o' liver pills.
Stop yer durn ki-o-tee howlin',
Chaw some sand an' git some grit;
Don't sit in the dumps a-growlin,—
Jump the roost
An' boost
A bit!

USE DUNCAN METERS

"Fall in while the band's a-playin',
Ketch the step an' march along—
'Stead o' pessimistic brayin',
Jine the halleluyah song!
Drop yer hammer—do some rootin'—
Grab a horn, you cuss, and split
Every echo with yer tootin'—
Jump the roost
An' boost
A bit!"

USE DUNCAN METERS

DUNCAN ELECTRIC MFG. CO.
LAFAYETTE, IND. U. S. A.

FOR
WHITEST LIGHT
LONGEST LIFE
CLEANEST GLOBES
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·TRADE MARK·

ELECTRA CARBONS

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CLEAR STEADY
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FOR ALL TYPES
OF ARC
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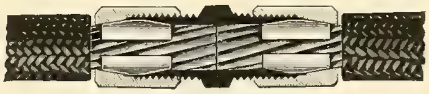
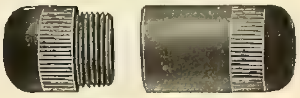
CABLE TAP
These connectors will be furnished to tap from any size Main to any size Branch. No cutting of the cable. Save their cost in cable.

Dossert Joints



2-WAY, TYPE A, SHOWING DETAILS



DOSSERT INSULATED COVER
These insulated covers are for a special type of connector and are not made for sizes larger than No. 1 stranded.

THE ONLY OFFICIALLY APPROVED SOLDERLESS CONNECTOR

A Marvel of Convenience and Efficiency

Why Solder?

The Code authorizes the use of

Dossert Joints

WITHOUT Solder. They are approved and endorsed by leading engineers.

SAVE Cable.
SAVE Solder.
SAVE Gasoline.
SAVE Time.
SAVE Labor.
SAVE Money.
SAVE Trouble.
SAVE Blow Torches.

ARE Durable.
ARE Adjustable to all Size Cables.
ARE Convenient.
ARE Adaptable to all conditions.
ARE Inexpensive.
ARE Cheaper in Quantities.
ARE Economical.
ARE Safe.

USED IN THE FOUR LEVIATHANS OF MODERN TIMES

Metropolitan Life Tower
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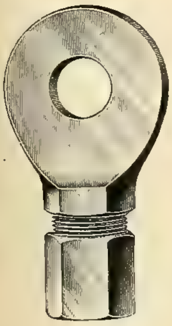
They make the biggest Joints in the smallest space. Used on the 2,500,000 C. M. feeder cables on the Williamsburg Bridge



BACK LUG

FRONT LUG

The Dossert Solderless Wire and Cable Connector is the most important advance made in recent years in electrical construction and is rapidly displacing the old, troublesome, expensive and inefficient soldering process. It can be applied by any ordinary workman in a few minutes and furnishes an absolutely perfect mechanical and electrical connection.

WRITE FOR THE MOST SUGGESTIVE AND VALUABLE BULLETIN IN THE TRADE

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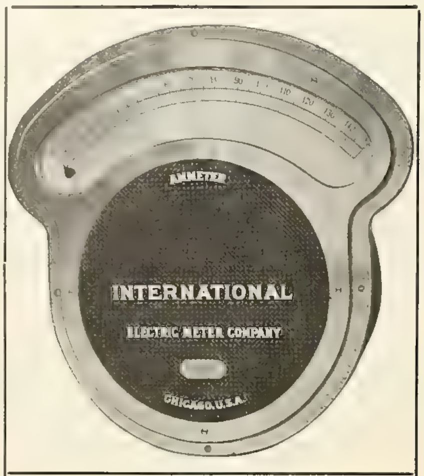

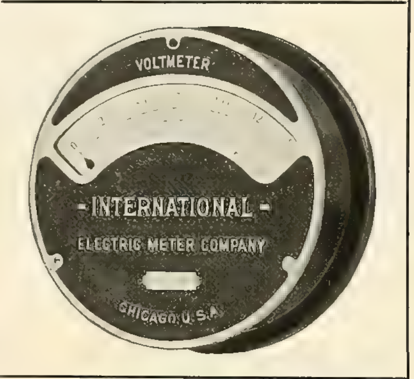

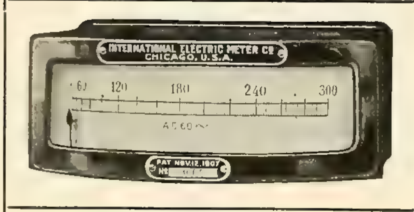

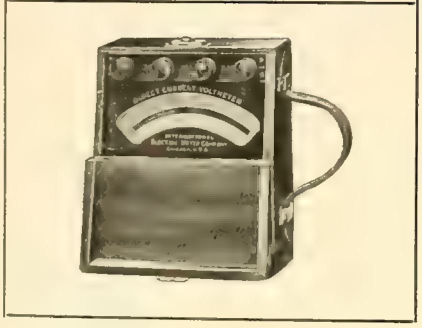

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Every
Detail
Is
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In
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International
Alternating
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International Electric Meter Co.

CHICAGO, U. S. A.

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"UNION"

Trade Mark

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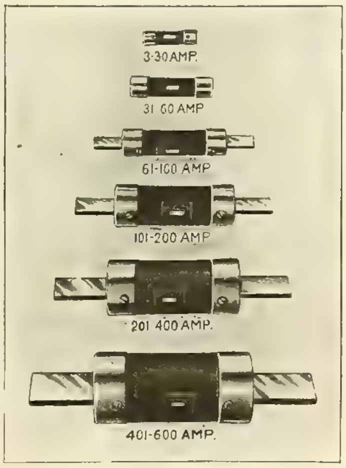
ENCLOSED FUSES

ACCURATE, UNIFORM, RELIABLE, EFFICIENT, INDICATING

ENCLOSED FUSES AND BLOCKS

UNIFORM

because carefully manufactured, the different parts of the fuse made from dies which cannot vary one thousandth part of an inch. Workmanship is the best.



250 and 600 Volts

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can be depended upon to protect your installation under all conditions.

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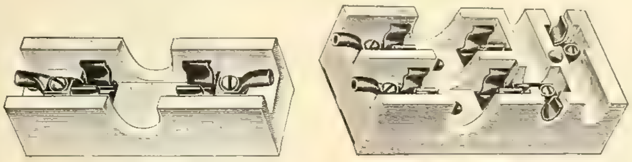
each fuse tested before leaving factory.



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Our blocks are Neat in Design, with ample Metal and Contact Area to prevent undue heating at point of Contact.

Fuse Manufacturers for 19 Years
Write for Fuse Catalogue No. 19

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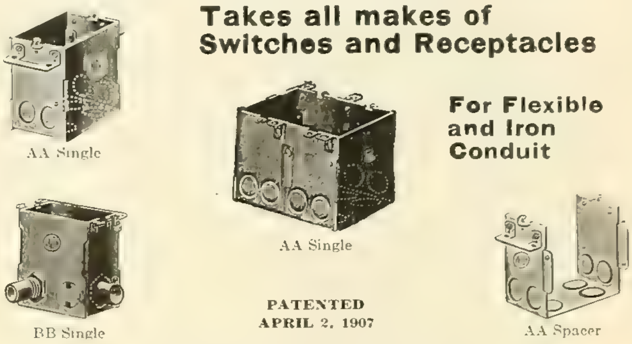
Takes all makes of Switches and Receptacles

For Flexible and Iron Conduit



AA Single — AA Single — BB Single — AA Spacer

PATENTED APRIL 2, 1907

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Union Sectional Switch Boxes can be built up into any number of gangs by using a screw-driver and inserting spacers.

Furnished in any desired depth; equipped with reversible and sliding ear so as to be adapted to plastered or unplastered walls. Suitable for new or old installation in buildings. Provided with clamp for securing flexible conduit when desired.

CONDUIT BOXES AND COVERS

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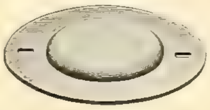

The "UNION" Stamped Outlet Boxes and Covers make a PERFECT JOB. Ample room for reliable connections. KNOCK-OUTS EASILY REMOVED

CHICAGO FUSE WIRE & MFG. CO.

CHICAGO AND NEW YORK

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ST. LOUIS, U. S. A.

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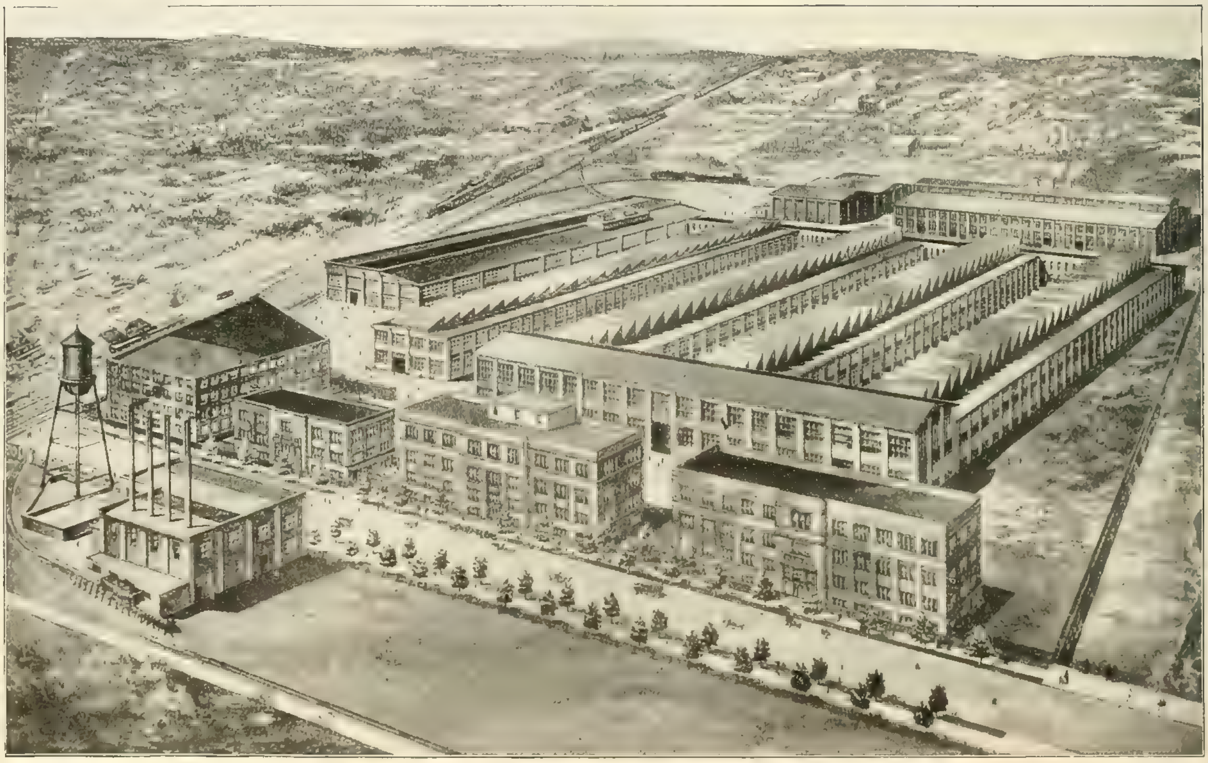
Lighting Transformers.
Power Transformers.
Polyphase Motors.
Portable Instruments.
Switchboard Instruments.
Single-phase Motors.



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High-Efficiency Type Transformer

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Answers to Some Central Station Questions about Single-phase Motors.
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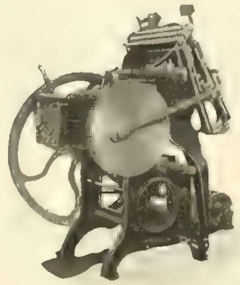
THE DAY-LOAD BUILDERS

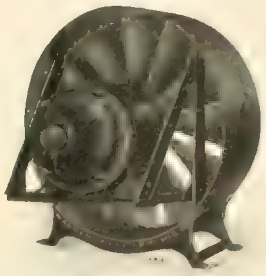
Standard type "BA" Single phase Wagner Motor. This motor will pull up full load and a generous overload from a state of rest. It is susceptible of remote control and starts of itself when current comes on after a line interruption.

Its starting operation is extremely simple,—simply a switch. The material allowance in this motor is very large; the workmanship extremely fine and accurate, all parts being made to templet.

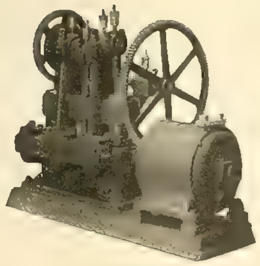
We solicit the opportunity of bidding on your requirements.



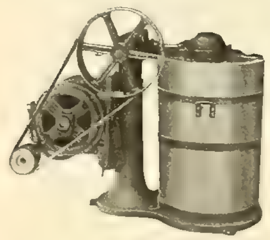
The motor application above suggests many possibilities for electric drive in printing shops. You will note that while this is a belted outfit, it is a variable speed outfit, with variable speed box underneath the feeding table. The pressman has absolute and instantaneous control over this outfit. This outfit is extremely economical of operation.



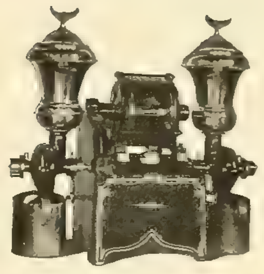
The illustration above shows a variable speed ventilating fan outfit. This outfit pays for itself in a very short while in the comfort it brings to users. It is just the thing for halls, churches, lodge rooms, stores and offices where the air is liable to become vitiated. Congregations sit up and take notice; lodge rooms have "something doing;" clerks work with vim and energy, and customers buy freely where there is snap and energy in the air. This can be accomplished only by some form of ventilating apparatus.



A pumping outfit is extremely desirable where there is scarcity of water. For apartment houses and country places nothing equals an outfit driven by a single-phase motor. They are entirely automatic in their action.



The adaptation here shown is a long-tried commercial success. Hotels, confectioneries, drug stores and others have found this outfit paying for itself in a very short while. In the home, perhaps, where you would not need a power ice-cream freezer, a motor will do your washing and ironing.



A coffee grinder and pulverizer gives to the store a smart and up-to-date appearance and replaces those long waits of your customers and weary hours spent by you in the hardest kind of manual labor. With this machine you can serve five customers in the time taken to serve one by hand. These machines can be obtained in almost any capacity. This same type of drive is furnished in sausage-grinding and meat-cutting machines.

Chicago Office, 1625 Marquette Bldg.

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SERIES REPULSION INDUCTION

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SINGLE-PHASE MOTORS

Self Starting—Low Starting Current—High Starting Torque
Interchangeable Voltage Connections

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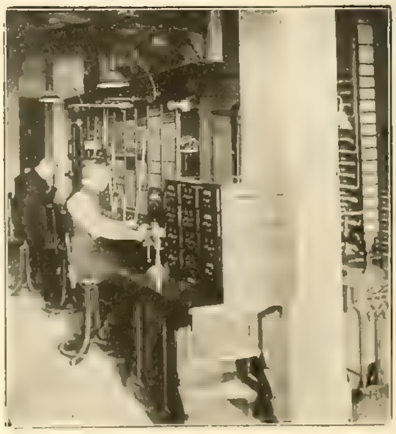
Our experience is the experience of years.



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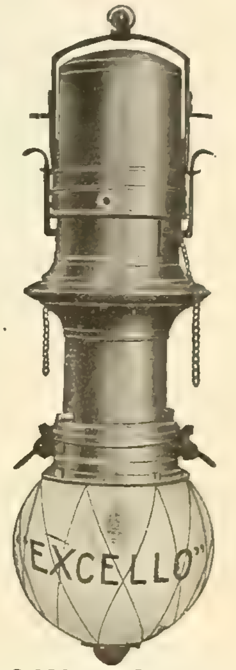

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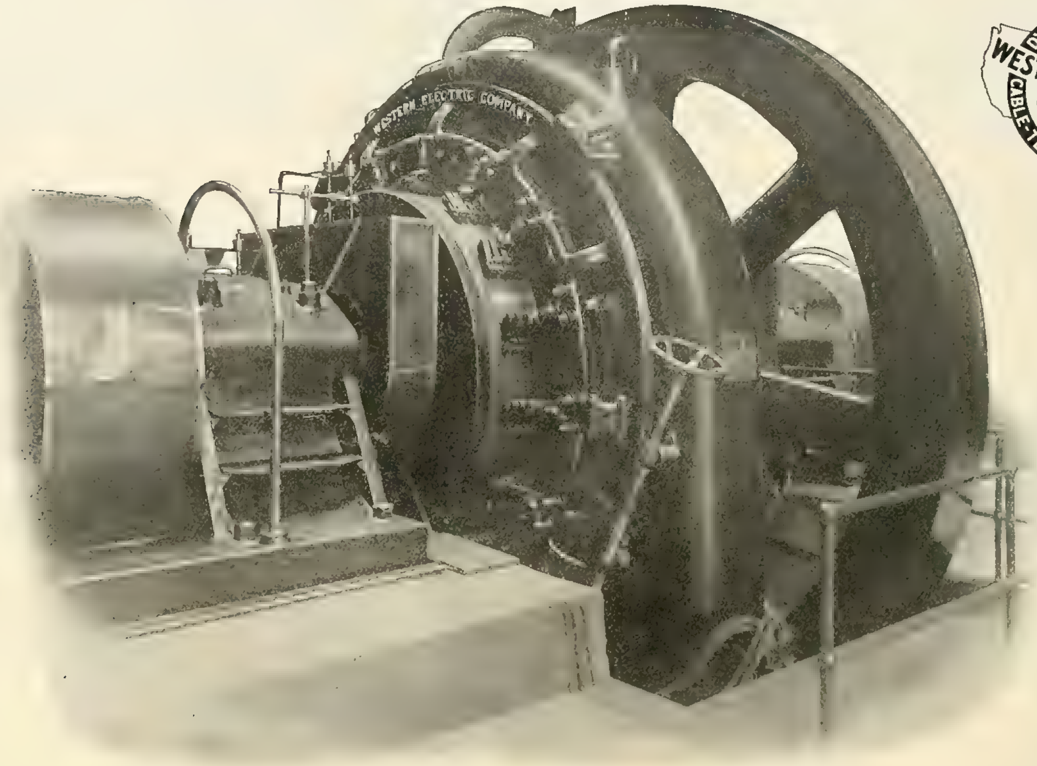
DYNAMOS-MOTORS WESTERN ELECTRIC COMPANY CABLE-TELEPHONES-SUPPLIES



Laminated Cast-in pole pieces will **increase** the magnetic contact between the pole pieces and the frame almost

300 Per Cent

over the common bolted and cast types. Western Electric D. C. generators are made this way, which is one of the **reasons** they are so **efficient.**

Western Electric generators have their frames **divided vertically,** which allows the frame to be drawn apart horizontally so that the armature can be **easily** inspected or removed.

If you want a generator that will do **more** than we claim for it, let us furnish it for you. Write **today** for our catalogue No. 702, and let us quote on your next installation.

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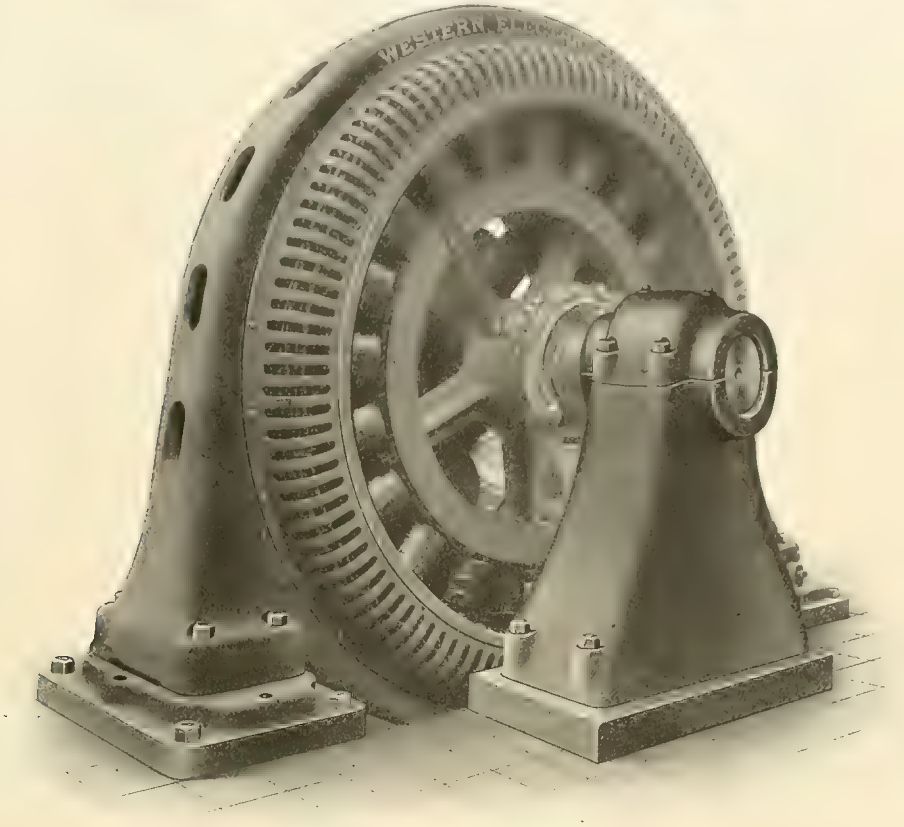

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From **your** standpoint as the **user,** the three most important features of **A. C. Generators** to be considered are Heating, Regulation and Efficiency.

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Western Electric A. C. Generators will give you the **highest average** or **all-day efficiency.**

Send for a copy of our Catalogue **No. 706** on **Alternators.**

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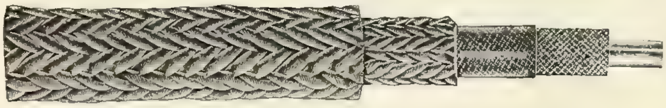
The character and treatment of the outer covering are such that a single braid will stand much more abrasion and be as equally weatherproof as three ordinary braids. It is cheaper, lighter and presents a smaller surface for the accumulation of ice and snow.



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National Codes walls of rubber, one rubber filled tape and one Habirshaw Tree Wire Braid.

Prices furnished on application for any size required, any wall of rubber and any number of braids.

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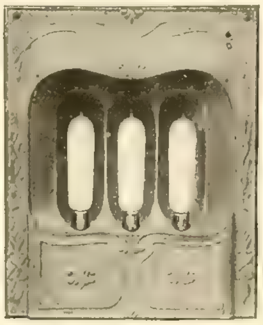
Does not burn up the oxygen in the room as gas grates do. ABSOLUTELY WITHOUT ODOR.

Can be placed anywhere in the room, NO CHIMNEY FLUE BEING REQUIRED.



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TWO SIZES { 24x30—3 lamps— 750 or 1,500 watts
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THESE FIREPLACES WILL BE EXHIBITED AT THE GENERAL ELECTRIC CO.'S EXHIBIT

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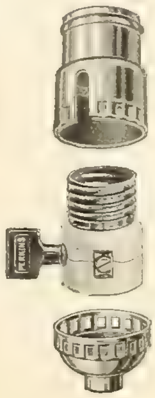
These are some of its advantages:



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Shell will enter cap in any one of twenty places.

Cap is always tight.

Key is always where it is wanted.

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Unnecessary to find one particular place to insert shell. Could be assembled in the dark readily, as wrinkles act as guides.

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Cannot come apart accidentally.

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Switch entirely enclosed.

No live parts exposed except binding posts.

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Binding posts diametrically opposite.

Screw shell held by three screws and a brass ring.

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Longest break of any socket made.

Binding posts that facilitate connection and provide exceptionally secure contact.

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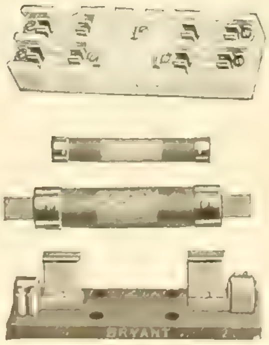

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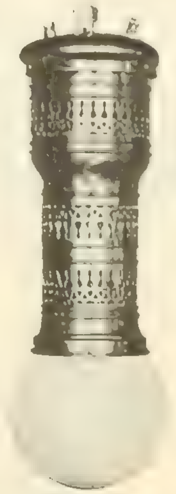

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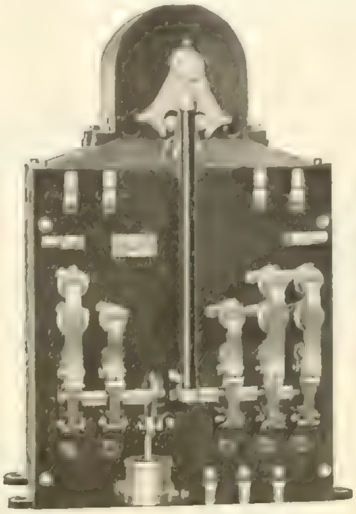
For Direct and Alternating Current



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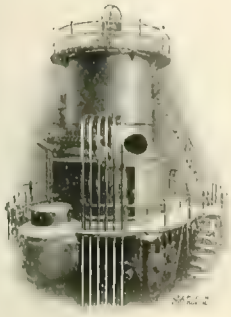

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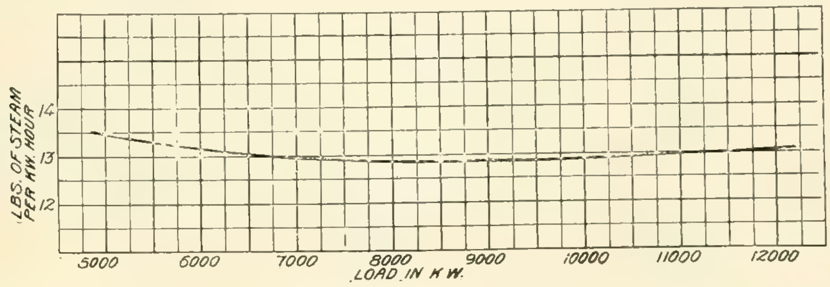
Show a Nearly Constant Efficiency Over a Wide Range of Load

The following load curve is based on tests made in the Fisk Street Power House of the Commonwealth Edison Company, Chicago, Ill., and shows a maximum variation in economy of 5% and 5,000 to 12,000 kilowatts.



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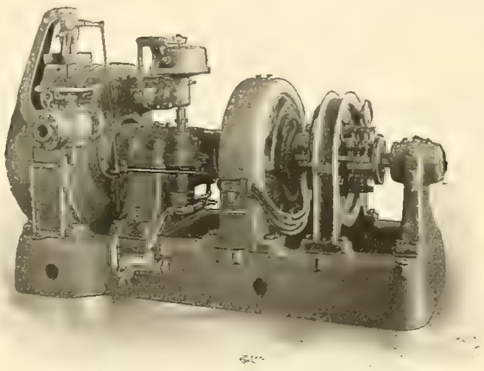
The Curtis Low Pressure Turbine is available in standard sizes from 300 kilowatts up, utilizes exhaust steam from 1 pound gauge pressure to 29 inches of vacuum, adds 30 to 100% to the output of steam engine plants and does not require a pound of additional fuel. Some installations have been in successful operation for years.



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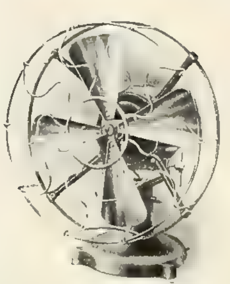

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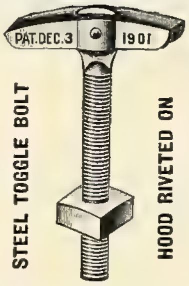

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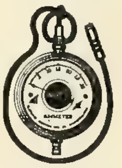

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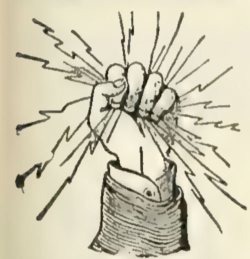

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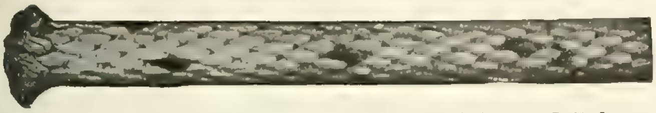

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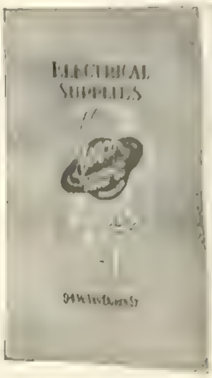
SEND FOR SAMPLES SAMSON CORDAGE WORKS, Boston, Mass.



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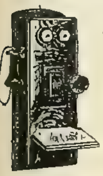

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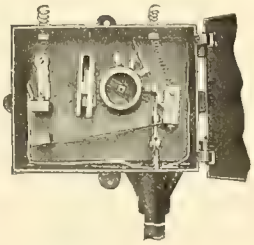

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RENEWABLE CARBON CONTACTS
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"O. K." Weatherproof Wire
"Parac" Rubber Wire
Bare Copper Wire
Slow Burning Weatherproof
Railway Feeder Wire
Slow Burning Wire
PHILLIPS INSULATED WIRE CO.
OFFICE AND FACTORY, PAWTUCKET, R. I.

In 1907
The Western Electrician published 1,098 LARGE pages of reading matter and 1,806 illustrations. This is 3,294 columns or over 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber send in your order now.

Western Electrician
507 Marquette Building, Chicago

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

FOR SALE

Electric light plant in a town of 1,200 people in Southern Kansas, has an ice plant in connection. Is a good proposition, but am engaged in other business and cannot give this the attention it should have is my reason for selling. Address Box 820, Western Electrician, 507 Marquette Bldg., Chicago, Ill.

FOR SALE

5 5-amp., 2-wire, 100-110-v., D. C., T. R. W meters. Price, $8.

1 100-amp., 100-110-v., D. C., T. R. W. meters Price, $12.00.

Meters are in good condition, have never been overloaded or abused. Write us at once if you want these big bargains in meters.

Also have 15 G. E. Form 6, Ox. copper finish A. C. enclosed arc lamps, almost new, for sale. Price, $12. LAWRENCE ELECTRIC LIGHT CO., Lawrence, Kan.

FOR SALE

One 25-kw. General Electric, direct-current Dynamo, 125 volts, 675 R. P. M. Machine practically new in every respect; sold for no fault; discontinued business. Will ship to any responsible concern, and if machine is not satisfactory no sale. Address Box No. 190, Beaufort, S. C.

FOR SALE

One 20-kw. bi-polar E. Generator, 125, 1,400 R. P. M. Price, $100.

Two 45-kw. multipolar Edison Generators, 128-volt, 3-wire system, type C. L., 975 R. P. M. 22 months in use, first class in every particular. Switchboard complete, 2 ammeters, voltmeter 2 circuit-breakers. Price, $1,000. Address Ronceverte Electric Company, Inc., Ronceverte, W. Va.

FOR SALE

For immediate delivery two 400-kw., 1,100-volt, two-phase, 60-cycle, 150 R. P. M. Westinghouse Alternators, direct connected to 20x25-inch Williams twin simple vertical engines, complete with switchboard apparatus. Both machines in A1 condition and ready to operate without repairs. Machines can be rewound for 2,200 volts, two-phase or three-phase at reasonable price. Address St. Joseph Railway Light, Heat & Power Co., St. Joseph, Mo.

FOR SALE

1 Standard Center Crank Armington and Sims Engine, cylinder 18½" dia. by 18" stroke.

3 Horizontal Tubular Boilers, "Mohr," shells 66" dia. by 16' long, with full fronts; one stack for the three with britchens and dampers.

1 300 H. P. Wainwright Straight-tube Heater.

2 7"x4½"x8" Snow-Worthington Boiler Feed Pumps.

Exhaust head, steam separator, pipe covering, pipes, valves, etc.

The above steam plant has been used only five months and is as good as new for all practical purposes.

3 60 K. W. Westinghouse Alternators, 1,100 volts, 125 cycles, with one extra armature, and three exciters.

1 60 K. W. Thomson-Houston Alternator, 1,100 volts, 125 cycles, with extra armature and exciter.

2 100 K. W. Brush Electric Co., Direct-current Generators, 125 volts, with one extra armature.

Switchboard Instruments, Switches, etc., for above.

These dynamos are now in use, but will be for sale in two months.

3 Doble Tangential Water Wheels, 24" dia. designed for streams up to 1¼" dia. under 875 ft. head.

2 Pelton Tangential Water Wheels, 24" dia. designed for streams up to 2" dia. under 875 ft. head.

1 set wheel complete with shaft, bearings, pulley, deflecting nozzle and gate valve.

THE ROARING FORK E. L. & P. CO.
ASPEN, COLO.

A GRAND OPPORTUNITY

A German Storage Battery manufacturer, located in Chicago, wants to enlarge present facilities. Has well-established business. Needs some additional capital and re-location for factory with cheap power. Liberal inducements for right man. Address Box 819, care Western Electrician, 507 Marquette Building, Chicago, Ill.

FOR SALE

Three-Phase, 60-Cycle Motors

	H. P.		Speed.
2	3	Westinghouse, type C. C. L.	1700
1	3	Westinghouse, type C. X.	1700
1	5	Wagner, type B. M.	1720
1	7½	Gen. Elec., form K.	1800
7	20	Westinghouse, type C. X.	1120
1	25	Gen. Elec., form K. S.	900
5	30	Westinghouse, type C. X.	1120
1	30	Gen. Elec., form L.	900
4	40	Westinghouse, type C. X.	
6	40	Westinghouse, type C. X., vertical	850
1	50	Westinghouse, type C. C. L.	840
2	50	Gen. Elec., form L.	900

Send for our **Monthly Bargain Sheet**, showing complete stock with **net** prices.

Gregory Electric Co., Chicago

FOR SALE

Electric Plant in Central Illinois town of 2,000. Revenue last year $9,000. Coal cost was $2,150. Yearly earnings can be increased to $14,000 by supplying power demand serving nearby town. Can be handled by one practical man and two helpers. Long franchise. Street lights $200 per month. Rare opportunity for practical man or several men that have ⅓ of price of $21,000. Balance long time

Address Box 821, care Western Electrician
507 Marquette Bldg., Chicago, Ill.

HAPGOODS

THE NATIONAL ORGANIZATION OF BRAIN BROKERS

With offices in 12 cities and a force of 350 people, 's at your disposal and can be of inestimable value to both employer and employe.

Do you need a man?
We can get him for you.
Is your present position unsatisfactory?
We can provide the opportunity for a better one.
Call or write today for a copy of either Hapgoods opportunities or Hapgoods men. Mention this paper.

HAPGOODS
1010 HARTFORD BLDG.
CHICAGO, ILL.

Offices in all Principal Cities

PLACE YOUR

"Want" and "For Sale" advertisements in the

WESTERN ELECTRICIAN.

Immediate Returns.

FOR SALE

On account of consolidation of power houses, we have for sale, at a bargain:

1 200-K.W. and 1 100-K.W. Fort Wayne Alternators.

1 200-K. W. and 1 75-K. W. Westinghouse Railway Generators.

1 100 and 1 D62 General Electric Railway Generators.

6 Standard, High-speed Engines, 150 to 500 H.P.

7 Return Tubular Boilers.

Also Steam Shovels, Locomotives and Miscellaneous Machinery for Railway Construction.

TERRE HAUTE, INDIANAPOLIS & EASTERN TRACTION CO.
TERRE HAUTE, INDIANA

BARGAIN PRICES

ON NEW AND USED ELECTRICAL MACHINERY

1—10 H. P., 500 Volt, 1,350 R. P. M. Multipolar Wagner Motor - - - - - - - - - - - **$110.00**

1—50 K. W., 125 Volt, 640 R. P. M. Lundell Belted Type Generator - - - - - - - - **$450.00**

As good as new.

We have many other attractive propositions, and as we buy, sell, and trade, can surely interest you.

Our Repair Shop facilities are excellent. Let us show you what we can do.

THE F. BISSELL COMPANY
TOLEDO, OHIO

COMMONWEALTH EDISON COMPANY REPAIR SHOPS

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280

High-Grade Machine Work of All Kinds Correspondence Solicited.

FIRST CLASS EQUIPMENT THROUGHOUT.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

FOR IMMEDIATE DELIVERY

Released Apparatus of the Chicago Edison Co. and Commonwealth Edison Co.

DIRECT-CONNECTED UNITS

One 1,000 K. W. G. E., 250 V., to Porter Allen Engine
One 750 K. W. G. E., 250 V., to Williams Engine
Two 400 K. W. G. E., 250 V., to Williams Engine
Three 150 K. W. G. E., 125 V. or 250 V., 3-wire, to Erie Engine.
One 100 K. W. G. E., 125 V. or 250 V., 3-wire, to Erie Engine

WATER-TUBE BOILERS

Two 700 H. P. Edgemoor
Two 650 H. P. Edgemoor
Four 400 H. P. Climax
Three 375 H. P. Heine
One 150 H. P. Heine
Three 350 H. P. Edgemoor

CORLISS ENGINES

21½x40x72" Geo. H. Corliss Twin Tandem Compound 3000 H. P.
32x52 Filer & Stowell L. H. heavy duty
30x54 Vilter R. H. heavy girder frame
30x60" Bass L. H. heavy girder frame
22x42 Bates L. H. heavy girder frame
20x48 Allis L. H. heavy girder frame
18x36" Vilter L. H. heavy duty
16x42" St. Louis L. H. heavy girder frame
14x36" St. Louis L. H. heavy girder frame
12x30" Allis L. H. heavy girder frame

AUTOMATIC ENGINES

20x30x24" Porter Allen Tandem Compound R. H. 200 R. P. M.
20x36" Porter Allen L. H. heavy duty
Three 13x20x15" Dick & Church, 225 R. P. M.

FULL LINE OF PUMPS, CONDENSERS, HEATERS, ETC. Write for complete list

CENTRAL STATION IMPROVEMENT COMPANY MONADNOCK BLOCK **CHICAGO**

PLACE YOUR
"Want" and "For Sale"
advertisements in the
WESTERN ELECTRICIAN.
Immediate Returns.

Busy people find the Telephone a valuable time-saver.

All points can be reached and many tedious trips avoided.

Time, otherwise lost, can be devoted to business.

CHICAGO TELEPHONE COMPANY
203 Washington St.

HELP

Secured quickly through Western Electrician "Help Wanted" ads.

GREGORY ELECTRIC CO.

CHICAGO, ILLINOIS
Corner 16th and Lincoln Sts.

Every machine sold is **completely overhauled at our works** before shipment and delivered practically **new.** Send for our **Monthly Bargain Sheet** showing complete stock with **net prices.**

Every machine listed in this issue is in stock and is offered subject to prior sale.

60-Cycle Alternators

	KW.		Speed
2	30	Westinghouse, single-phase, latest type revolving armature, 110, 220 or 500 v., with exciter	900
1	30	Westinghouse, single-phase, toothed armature, comp., 1100 volts, with exciter	900
1	45	Westinghouse, comp., single-phase, 1100 volts, with exciter	900
2	45	Westinghouse, 3-phase, rev. armature, type S frame, 220 or 440 volts, with exciter	900
1	45	Westinghouse, 3-phase, rev. armature, type S frame, 1100 or 2200 volts, with exciter	900
1	60	Westinghouse, single-phase, toothed armature, comp., 1100 volts, with exciter	900
1	75	Westinghouse, single-phase, toothed armature, comp., 1100 volts, with exciter	720
1	75	Ft. Wayne, Wood, type W. A. L., single-phase, toothed armature, comp., 1100 to 2200 volts, with exciter	600
2	90	Gen. Elec., type A.S. comp., toothed armature, single-phase, 1100 volts, with exciter	900
3	90	Gen. Elec., type A. S., comp., toothed armature, single-phase, 2200 volts, with exciter	900
2	100	Gen. Elec., 3-phase, type A. T., form B., comp., toothed armature, 2300 v., with exciter	900
1	120	Gen. Elec., type A.S., single-phase, toothed armature, comp., 1100 volts, with exciter	900
1	120	Gen. Elec., type A.S., single-phase, toothed armature, comp., 2200 volts, with exciter	900
1	120	Westinghouse, 3-phase, slotted armature, comp., 220 volts, with exciter and switchboard	720
1	120	Westinghouse, 3-phase, slotted armature, comp., 1100 or 2200 volts, with exciter	720
1	150	Gen. Elec., type AM, monocyclic single-phase, comp., toothed armature, 1100 volts, with exciter	600
2	150	Stanley, 3-phase, inductor type, 2400 volts, with exciters	600
3	180	Gen. Elec., type A. S. single-phase, 1100 or 2200 v., toothed armature, comp., with exciter	600
1	300	Gen. Elec., type A. T. B., 3-phase, revolving field, 2500 v., 3-bearing, pulley 42"x38", with exciter	450

125-133-Cycle Alternators

	KW.		Speed
1	50	Ft. Wayne, Wood, type W. A., toothed armature, comp., 1100 or 2200 volts, with exciter	1400
1	50	Ft. Wayne, Wood, type W. A. L., comp., toothed armature, 1100 volts, with exciter	1400
1	60	Gen. Elec., type A. S. 60, comp., toothed armature, 1100 volts, with exciter	1500
1	65	National, comp., toothed armature, 1100 volts, with exciter	1500
1	70	Thomson-Houston, type A 70, comp., 1100 or 2200 volts, with exciter	1070
2	75	Ft. Wayne, Wood, toothed armature, comp., 1100 or 2200 volts, with exciter	1050
3	90	Gen. Elec., type A. S., comp., toothed armature, 1100 or 2200 volts, with exciter	1250
1	100	Ft. Wayne, W. A. L., toothed armature, comp., with exciter, 1100 or 2200 volts	1050
1	120	Gen. Elec., type A 120, toothed armature, comp., 1100 or 2200 volts, single-phase, with exciter	1070
1	150	Stanley, inductor type, 1100 or 2200 v., 2-phase, with exciter	800
1	150	Stanley, 2-phase, inductor type, vertically split, 1200 or 2200 volts, with exciter	1000
1	150	Ft. Wayne, type W. A., single-phase, 3-bearing toothed armature, comp., 1100 or 2200 volts, with exciter	700
1	200	Ft. Wayne, type W. A. L., single-phase, 2-bearing toothed armature, comp., 1100 or 2200 volts, with exciter	700
1	300	Stanley, single-phase, inductor type, 1200 or 2400 volts, 3-bearing, pulley 46"x40", with exciter	400

25-Cycle Alternators

	KW.		Speed
1	110	Westinghouse, 3-phase, 440 volts, revolving field, speed	500
2	275	Westinghouse, 3-phase, revolving field, 6600 volts, 3-bearing	375
1	250	Westinghouse, Rotary converter, 550-600 volts, direct and, 3-phase, 25 cycle, alternating, with starting motor on shaft	500
2	400	Westinghouse, 3-phase, revolving field, 440 volts	360

Three-Phase, 25-Cycle Motors

	H. P.		Speed
1	10	Westinghouse, 440 volts	1420
1	20	Westinghouse, 440 volts	1420
1	20	Westinghouse, type F, variable speed, 440 volts	900
1	30	Westinghouse, 440 volts	720

Three-Phase, 60-Cycle Motors

	H. P.		Speed
3	3	Westinghouse, 110 volts	1700
1	3	Westinghouse, 220 volts	1700
1	5	Wagner, type B. M., 220 volts	1720
1	7½	Gen. Elec., 220 volts	1800
7	20	Westinghouse, 220 volts	1120
4	20	Westinghouse, 440 volts	1120
1	25	Gen. Elec., form K. S., 220 volts, with starter	900
3	30	Westinghouse, 220 volts	1120
5	30	Westinghouse, 440 volts	1120
1	30	Gen. Elec., 440 volts	900
1	30	Gen. Elec., 220 volts	900
3	40	Westinghouse, 220 volts	850
4	40	Westinghouse, 440 volts	850
4	40	Westinghouse, vertical, 220 volts, with starter	850
6	40	Westinghouse, vertical, 440 volts, with starter	850
1	50	Westinghouse, type C. C. L., 220 volts	840
1	50	Gen Elec., 220 volts	900

Single-Phase, 60-Cycle

	H. P.		Speed
1	¼	Advance, new, 110 v., auto	1800
1	½	Gen. Elec., type I. S., form K. G., 110 volts	1800
1	1	Gen. Elec., type I. S., 220 volts, with condenser	1800
5	5	Wagner, auto, 220 v., Model B	1750
1	1	Century, special vertical type, 110-220 v.	1750
2	12	Holtzer-Cabot, 110 volts, self-starting	1800
1	5	Gen. Elec., type I. S., 220 volts, with condenser-comp.	1800
3	5	Westinghouse, 110 v., type C. C., with phase splitters	1120
1	5	Century, 110 or 220 v.	1750
1	5½	Westinghouse, type C, 220 volts, with phase-splitter	1700
1	7½	Wagner, auto, 110 v.	1750
1	10	Gen. Elec., type I. S., 220 volts, with condenser-compensator	1800
1	10	Wagner, model Z, auto, 440 volts	1800
1	15	Wagner, model Z, auto, 220 volts	1200
1	30	Wagner, 220 volts, auto	1200

Two-Phase, 60-Cycle

	H. P.		Speed
1	5	Gen. Elec., form K, 110 volts, with compensator	1800
2	5	Gen. Elec., form K, 110 volts, with starter	1200
1	7½	Westinghouse, 110 volts, with auto starter	1120
1	7½	Westinghouse, type F, variable speed, 220 volts, size No. 102, without controller	900
1	125	Gen. Elec., form L, 2200 volts	600
1	150	Gen. Elec., 2200 volts, form L, 3-bearing, new	600

300 ELECTRIC SIGNS

FOR SALE AT A VERY LOW PRICE

BY THE

Edison Electric Illuminating Co. of Brooklyn

On the 30th day of April, 1907, the Board of Aldermen of the City of New York passed "An Ordinance regulating the placing of Electric Signs in the City of New York and providing that the same shall be licensed." Section 2 of this ordinance reads as follows:

"Electric Signs may be hung or attached at right angles to buildings, and extend not to exceed six feet therefrom in said space, and to be ten feet in the clear above the level of the sidewalk in front of such building, upon the payment of an annual license fee of 10 cents for each square foot of sign space or part of square foot of such sign space, to be collected by the City Clerk of the City of New York."

One result of this ordinance has been to displace and render useless for Brooklyn purposes about 300 panel signs. While these signs themselves do not exceed 5 ft. 3 in. in length, they were attached to buildings in such manner as to infringe upon the provisions of the ordinance and could not be brought within the 6 feet and 10 feet space limits without modifying or destroying their usefulness to the customer. They comprise various types of popular panel signs, including those with scroll-work frames, and are for the most part in very good condition. They are now in our storehouse occupying valuable space.

These signs cost the Brooklyn Edison Company an average of about $35.00 each. In order to dispose of them promptly, however, we will sell them as they stand for

TEN DOLLARS EACH

F. O. B. BROOKLYN

This is an unusual opportunity for central stations not hampered by sign ordinances to buy useful types of signs at a minimum figure. We will be glad to have you inspect these signs by appointment, or, upon request, will send you a list showing in detail the types of signs in stock and the number of each.

Edison Electric Illuminating Co. of Brooklyn

360 Pearl Street, BROOKLYN, N. Y.

Federal Tungsten Cluster of Exceptional Beauty

Designed for store lighting and for use in halls, offices, etc. Has a 20-inch porcelain reflector and undercone, stem, canopy and fittings of brass. May be used with 60 to 100 watt lamps. Efficiency 1¼ watts to candlepower, as per manufacturers' test.

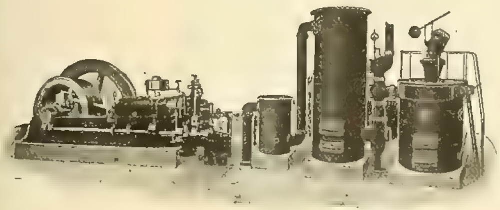
Write for Bulletin 87

FEDERAL ELECTRIC COMPANY

56 North Desplaines Street. CHICAGO

MINNEAPOLIS STEEL & MACHINERY CO.

MINNEAPOLIS, - MINN.



Manufacturers of

Muenzel

Gas Engines

and

Gas Producer Power Plants

FOR

Electric Light Plants

ECONOMY THE GREATEST
EFFICIENCY THE BEST

We have installed, in the last two and one-half years, more than forty **MUENZEL** Power Plants, aggregating over 4,000 horse-power, all making good.

LET US SEND YOU CATALOGUE "G"

Face to Face with OPPORTUNITY

Electricity controls more trades, directs more men, offers more opportunities than any other power that man has yet discovered. A knowledge of electricity makes those opportunities yours. It opens to you new fields, gives you new ideas, keeps you abreast of the times. You can get that knowledge by ***home study*** during your spare time, from the

CYCLOPEDIA OF APPLIED ELECTRICITY

NEW SIX-VOLUME EDITION JUST OUT

5,000 Pages, 7x10 Inches, Bound in Half Red Morocco

500 New Pages—Innumerable New Ideas

Treats in detail every practical, up-to-date electrical appliance. Every subject mentioned below presents a new opportunity; every page tells you how to grasp it and profit by it. It is written so simply and clearly, and is so comprehensive and authoritative, that you will find it **full of opportunities for you,** whether you are already an expert electrician, or a young man just learning a trade.

Each section is written by an expert, illustrated by special drawing, diagram or photograph, simplified by tables and formulas, proved by practical test questions, and carefully indexed for ready reference.

The **Practical Electrical Engineer** will find in these books much new and valuable information on such important subjects as the Theory, Calculation, Design and Construction of Generators and Motors; Location and Remedy of such Troubles as Sparking at the Commutator, Heating, etc.; Central Station Engineering and Design; Storage Batteries, including Charging, Discharging, Troubles and Their Remedies, Tests for Impurities, etc.; Electro-Pneumatic Control of Electric Railways; Single-Phase Electric Railway, and hundreds of other recent electrical appliances, as shown by the brief table of contents below.

$18.00 Special Price—Regular Price **$36.00**

To introduce our correspondence courses, from which the Cyclopedia was compiled, we make this special 30-day offer:

Absolutety FREE for 5 days' examination. Sent express prepaid, on receipt of Coupon. If you want the books, pay us $2 within 5 days and $2 a month until you have paid the special price of $18.00; otherwise, return them at our expense. ***We employ no agents to annoy you.***

BRIEF LIST OF CONTENTS

Theory, Calculation, Design and Construction of Generators and Motors; Types of Dynamos and Motors; Elevators; Direct-Current Motors, Management of Dynamos and Motors, including the Location and Remedy of Troubles, such as Sparking at the Commutator, Heating, etc.; Power Stations; Central Station Engineering; Central Station Design; Storage Batteries, including Charging and Discharging, Troubles and Their Remedies, Tests for Impurities, etc.; Power Transmission; Alternating-Current Machinery, including Alternating-Current Generator; Synchronous Motor, Induction Motor, Transformer, Rotary Converter, Frequency Changer, etc.; Electrical Measurements; Electric Lighting, including Arc and Incandescent Lighting, Nernst Lamp, Cooper-Hewitt Lamp, Osmium Lamp, etc; Electric Railways, including Third-Rail System, Multiple Unit Control, Electro-Pneumatic Control; Alternating-Current Motors, etc.; Single-Phase Electric Railway; Electric Welding; Mercury-Vapor Converter; Electric Current; Electric Wiring; Electric Telegraph; Wireless Telegraphy; Telautograph; Telephony, including Instruments, Lines, Exchanges, Common-Battery Systems Operation, Maintenance; Automatic Telephone; Wireless Telephony; Telegraphone, etc.

We shall be glad to send you on request FREE illustrated handbook containing over 200 pages of interesting information on engineering subjects, including Electrical Engineering, Central Station Work, Electric Lighting, Mechanical Engineering, Mechanical Drawing, Stationary and Civil Engineering, Etc.

AMERICAN SCHOOL OF CORRESPONDENCE

CHICAGO

..................**COUPON**—Clip and mail today..................

WEST. ELEC. 5-16-08

American School of Correspondence:

Please send Cyclopedia of Applied Electricity for FREE examination. I will send $2.00 within five days and $2.00 a month until I have paid $18.00; otherwise I will notify you to send for the books.

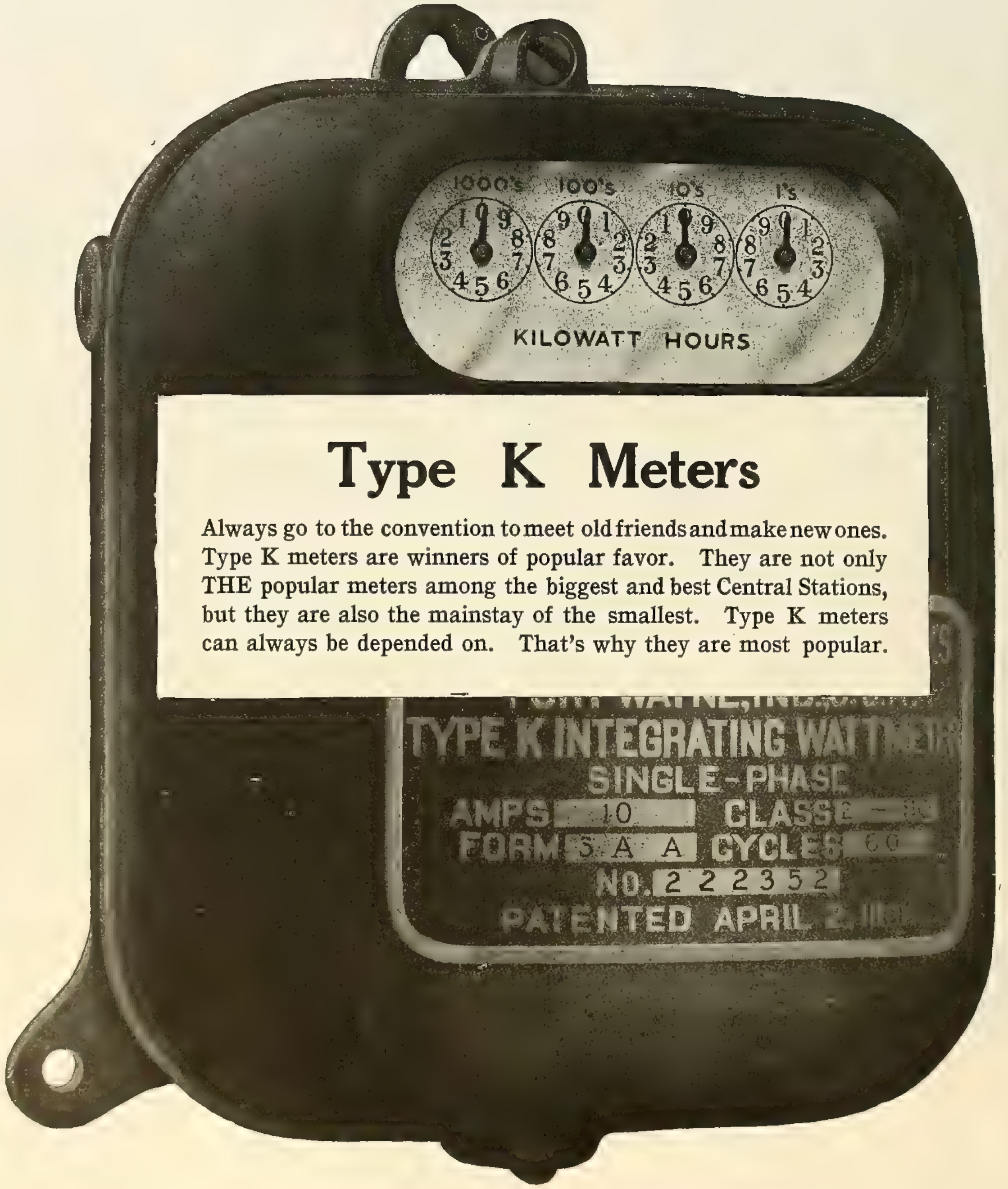
Name..

Address..

Occupation..

Employer..

FORT WAYNE ELECTRIC WORKS
"WOOD" SYSTEMS



Type K Meters

Always go to the convention to meet old friends and make new ones. Type K meters are winners of popular favor. They are not only THE popular meters among the biggest and best Central Stations, but they are also the mainstay of the smallest. Type K meters can always be depended on. That's why they are most popular.

689

Sales Offices

Atlanta, Chicago, Boston, Grand Rapids, Cincinnati, New Orleans, New York

Main Office

FORT WAYNE
INDIANA

Sales Offices

Pittsburg, St. Paul, Philadelphia, San Francisco, St. Louis, Syracuse, Yokohama

THE HOTEL JEFFERSON—ST. LOUIS

ONE OF THE BEST HOTELS IN THE WORLD
FINDS IT EXCEEDINGLY PROFITABLE TO USE

Bryan-Marsh Tantalum Lamps

HERE IS THEIR LETTER

Mr. E. H. Haughton, Mgr., Bryan-Marsh Company, St. Louis, Mo., May 1, 1908.
315 Dearborn St., Chicago, Ill.

Dear Sir: In reply to your communication of the 28th ultimo, will state that I have found since you installed the Tantalum lamps throughout the Jefferson, there has been quite a saving in our electric light bill; in fact, it has made such an impression on the Union Electric Light & Power Co. that they have sent around to have our meters tested. I figure that since the installation of the lamps we have made without exaggeration a saving in our electric light bill of 25%, besides having our hotel better lighted than ever before, so much so that it has caused frequent favorable comment from our guests. Yours very truly,

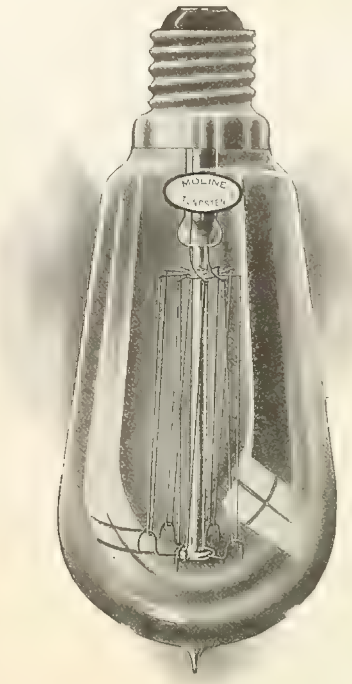
Signed LYMAN F. HAY, Manager, The Jefferson Hotel.

Some New News for Central Station Men

WE can help you fight gas competition. We have arranged with a large fixture manufacturer to furnish us a specially designed line of Tungsten fixtures. We ship them to you, complete, lamps and glassware, even wired, all ready to hang up. They run low enough in price to kill a gas arc lamp first pop. For the more elaborate requirements, we're fixed for those too. Write for blue prints at once. Haven't had time to get up fancy plates; but we've got the goods and a true picture of them. That's all you want anyway.

BRYAN-MARSH CO. CHICAGO

MINNEAPOLIS CINCINNATI DENVER



MOLINE TUNGSTENS

1¼ Watts Per C. P.

For immediate delivery

MOLINE JEWELS

2½ Watts Per C. P.

In all Standard and Meridian types

MOLINE CANDELABRAS
and
STANDARD MOLINE LAMPS

In all types and for all voltages

Write for our Illustrated Catalogue and Price List

Moline Incandescent Lamp Co.

BRANCHES:

Chicago St. Louis New York Kansas City
Buffalo Peoria St. Paul Dallas

Main Sales Office and Factory:
MOLINE, ILL.

INC. LAMP BUYERS NOTICE!

We have bought out the **SOLAR GLASS CO. OF TOLEDO,** and the Company and plant have been reorganized.

The factory will be moved to Detroit as soon as possible.

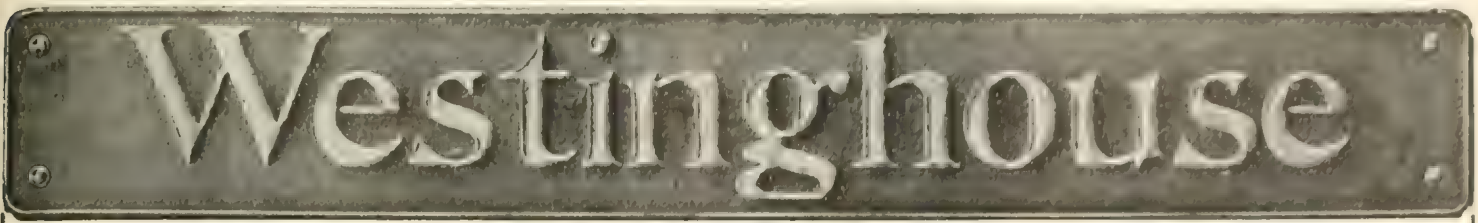
A Good Big Stock will Always be Kept on Hand

THE NEW "CLARK" LAMP IS NOW ON THE MARKET TRY OUR PRICES

For the present and until otherwise notified, address

CLARK INC. LAMP CO.

TOLEDO, OHIO



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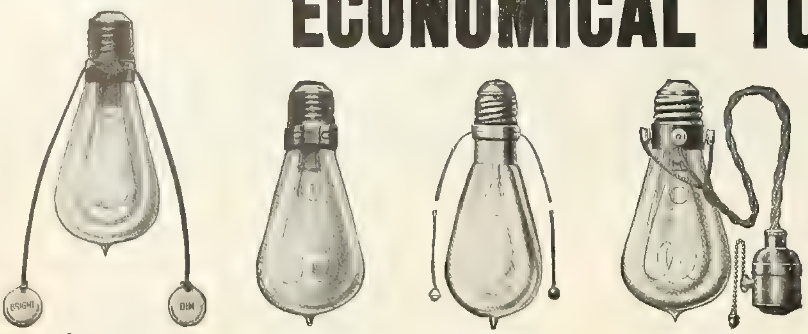

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Pull String

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Turn Bulb

STYLE 7
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These Couplings are of Steel and are made in the best possible manner.

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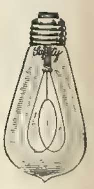

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We have revised and lowered our price lists, and you will find that we are offering a very complete line at very attractive prices.

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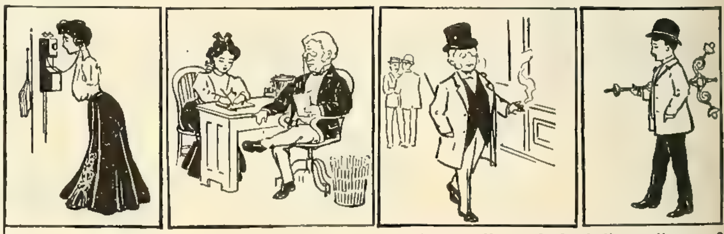

Will you phone us? Or drop us a line? Will you call on us? Or shall we call on you?

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WE MANUFACTURE the most popular line of GAS and ELECTRIC FIXTURES in the World. We have the most complete catalogues in existence, illustrating all grades, from the inexpensive fixture for the cottage to the classical fixtures for the palace; also supplies directly connected with the lighting industry. We are always in the lead and strictly up-to-date. That's why we want YOUR ORDER.

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Shall we beg for it?

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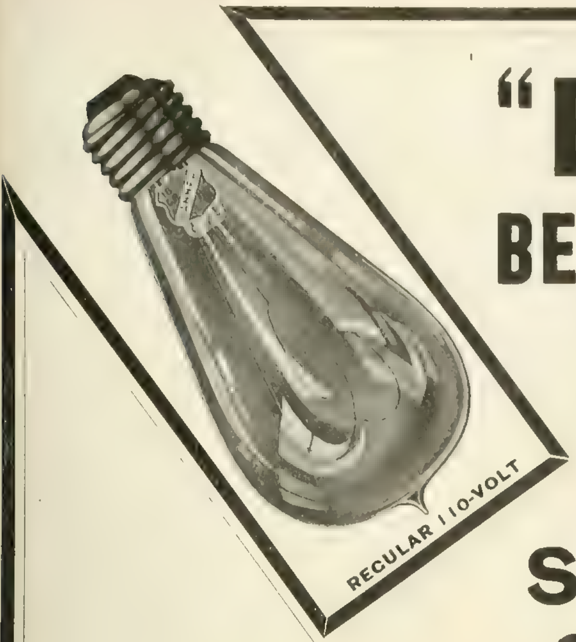

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THE BANNER TUNGSTEN

consumes 1¼ watts per candle and gives a white light, also the most economical lamp ever produced for A. C. or D. C. circuits, any frequency.

40 watts, 32 cp. 60 watts, 48 cp. 100 watts, 80 cp. 100 to 125 volts

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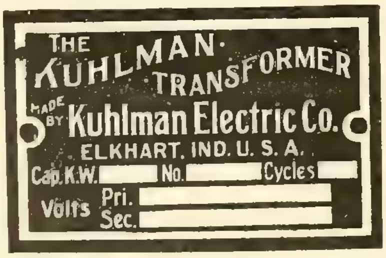

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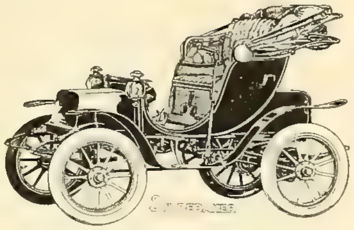
¶ As producers of electricity, Central-Station men have a commodity to market. As manufacturers of electric vehicles, we also desire a market for our vehicles. Our customers become your consumers.

DO NOT OUR INTERESTS MORE THAN TOUCH?

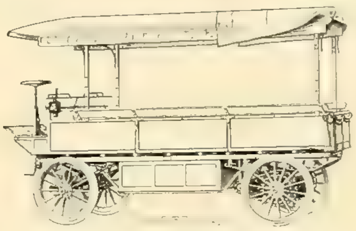
¶ We have interested many electric companies throughout the country, and would like to talk this matter over with you when you are in Chicago during the Convention. In ***space No. 61 in the exhibition hall,*** adjoining your convention chambers at the Auditorium, we will exhibit one model of passenger vehicle, together with an up-to-date arc rectifier—***and at our store, 378 Wabash Avenue,*** we will have a complete line of our electric pleasure and commercial vehicles, and men to present them, giving figures and facts.

¶ We are not trying to sell anything to you, but would be glad to have you feel at home at STUDEBAKER'S. We are within two blocks of your headquarters.

IF FOR ANY REASON YOU ARE UNABLE TO ATTEND THE CONVENTION, ANY OF OUR BRANCH HOUSES WILL BE GLAD TO EXPLAIN OUR PLANS



Studebaker Electric Carriage



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Photograph by the New York Edison Company, 55 Duane Street.

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Experts have pronounced it one of the most striking and effective examples of modern advertising. It is one of many ways in which

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is the only heater that has a **cool settling chamber** and is **guaranteed** not to get foul with scale, and that **will continue to heat as hot after years of constant use** as when new. This is the **only** feed water heater that has an oil pressure separator that is **at all times surrounded by the cool feed water when it first enters the heater,** and is **guaranteed to extract more oil from exhaust steam** than can be extracted by any other device in the market. This heater is **guaranteed to give perfect satisfaction** or the manufacturers will **pay all cost** of placing and removing, also freight both ways.

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We manufacture and guarantee our apparatus to be the most complete and efficient on the market.

Write us your requirements, and we will tell you the best, safest and easiest means of accomplishing results.

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There's No Friction

with the Fibre-Graphite Commutator Brush.

Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre Graphite is therefore the most economic brush on the market. Send for price list.

HOLMES FIBRE-GRAPHITE MFG. CO.

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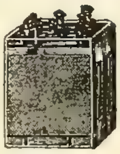

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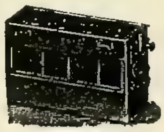

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Stationary and Portable Batteries, 200 different sizes.

We also furnish various sized plates for renewing batteries in any other make. Prices on application. Liberal discount to the trade.

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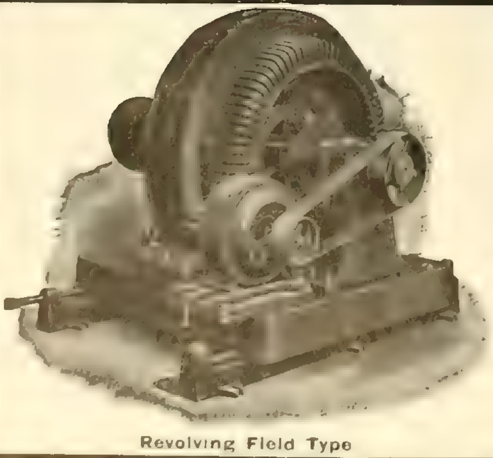

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THE WARREN ALTERNATOR

MANUFACTURED BY

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WEMCO A. C. AND D. C. MOTORS

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FORT WAYNE ELECTRIC WORKS
"WOOD" SYSTEMS

1½ Times Better

Type A transformers are that much better than they would ordinarily need to be, but in that one point lies the reason for Type A Superiority. We are not satisfied with just meeting the requirements — every advantage we can gain above requirements makes the Type A transformer that much better, although it is now the most reliable transformer.

The insulation of Type A transformers wears like iron. The quality and quantity of insulating material used are rightly proportioned to attain maximum insulation strength in minimum space. Type A transformers have *safe* insulation. No Type A transformer ever suffered a break-down in insulation between primary and secondary, endangering life. The insulation is *safe*—it is 1½ times better.

15 K. W. Type A Transformer

Their Service is your Guarantee

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690

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SYSTEMS

Originality of Design and Superiority of Construction
are Features in which We have no Competition

W. H.
SCHOTT
ENGINEER
CHICAGO

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLII. CHICAGO, MAY 23, 1908. No. 21

How an Electric Power Business Was Built Up in Laredo.

By W. D. Hornaday

The first electric railway to be built in Texas and one of the first in the United States was at Laredo. The building of this line in 1889 by the Laredo Improvement Company attracted wide attention. The use of electricity as a means of rapid transit was at that time just emerging from its experimental stage. The promoters of the Laredo project believed that that town was destined to become a great commercial and manufacturing center, and for a few years the place enjoyed a wonderful growth and activity. The initial electric-railway line was a little more than five miles long.

Shortly after the building of the railway a long period of business depression occurred, and the enterprise passed through many trying vicissitudes. The plant was finally taken over by the Laredo Electric and Railway Company. The holdings of this company include the electric-lighting system as well as the street railway. The lighting system is unique in the fact that it does an international business, the plant providing lights for the city of Nuevo Laredo, situated on the Mexico side of the Rio Grande.

The business of the Laredo Electric and Railway Company possesses many features of unusual in-

An Irrigating Canal Near Laredo, Texas.

[illegible]

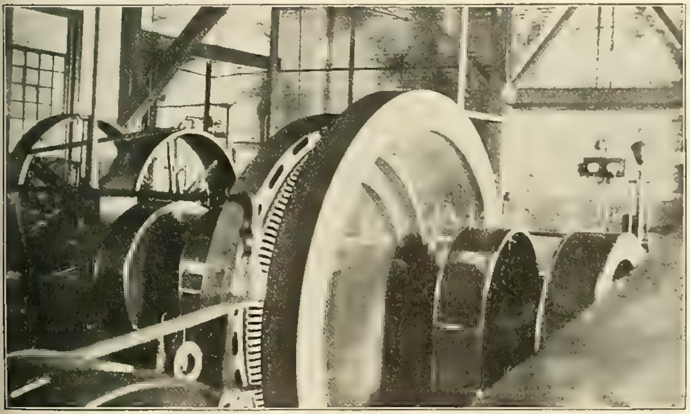
[illegible]

[illegible] greatest Bermuda-onion-producing regions in the world. This year's crop, the harvest of which was begun the first part of April, was [illegible] acres. All of this land must be irrigated, and the only source of water supply is the Rio Grande River. This acreage was almost double that of the preceding year, and next year the acreage will show a still greater increase, it is asserted.

It occurred to Mr. Scovill that here was an opportunity for his power plant to render a good service and at the same time add materially to its revenue. Gasoline and coal were the fuels that were being used by the numerous irrigating pumping plants, scattered along the river front. The substitution of electricity for this fuel was urged by Mr. Scovill, and he finally awakened an interest in his proposition. He personally guaranteed the success of the first pumping plant he sold last August. It was installed in time for the watering of the onion seed beds, which work was begun the latter part of September.

Power House.

An Onion Farm Near Laredo Irrigated by Electric Power.



Interior View in Power House.

Electric Irrigating Pumping Plant.

USE OF ELECTRIC POWER NEAR LAREDO, TEXAS, FOR IRRIGATING ONION FARMS.

terest. The railway and lighting plant has been completely overhauled and rejuvenated during the last three years, and the business extended to a remarkable degree under the direction of the manager, Mr. Frank E. Scovill. At the time Mr. Scovill took charge of the plant, in December, 1904, the cars were being run with little attempt to observe a regular schedule, and the lighting service was very unsatisfactory. The plant at that time consisted of two 60-kilowatt, single-phase machines and a small direct-connected 64-ampere, 500-volt machine for operating the street cars over the 5¼ miles of railway. The circuits at that time were fairly well loaded. The engines were old and needed attention.

One of Mr. Scovill's first acts was to purchase two second-hand tandem-compound condensing engines that had been used 14 years, and a couple of three-phase, 150-kilowatt generators. He changed the circuits from single-phase, 125-cycle, to three-phase, 60-cycle, and began installing small motors for power purposes, afterward increasing to larger size motors until the company now has in operation 233 horsepower in power motors, ranging from two horsepower to 40 horsepower capacity, besides a large number of one-fourth and one-half-horsepower motors on coffee mills and such small work. When the circuits were changed to 60-cycle there were 26 fans in service. The number of fans has now been increased to more than 200.

The lighting and power business has increased so rapidly that the company has just purchased and

This pioneer irrigating installation consisted of a 40-horsepower, 2,300-volt motor, direct-connected to a Janesville Iron Works No. 8 pump, which was set in a well 36 feet deep and 12 feet across, built of concrete, and located upon the bank of the river. On its completion a test showed that the plant was a success. The pump was guaranteed to lift 1,400 gallons of water a minute at a total elevation of 75 feet, through 600 feet of 12-inch pipe. This electric pumping plant has been in operation constantly ever since its installation, and it has attracted much attention among the onion growers. Two more electric pumping outfits were soon sold and installed and were in successful operation during the onion-growing season. The company received several other applications for

these outfits during the fall and winter, but could not get deliveries in time to care for the season's crop of onions. The onions in the Laredo territory are transplanted from the seed beds from November 20th to January 1st and are harvested from about April 1st to the 10th of May.

The first 40-horsepower plant for operating these irrigating pumps was close to town. The other two pumping stations, being farther away, a transmission line had to be built more than four miles from the edge of the lighting district into North Laredo. At present the service for operating these pumps is being furnished from the regular lighting circuits, but the calls for additional motors are so numerous that it will be necessary to build a new transmission line direct from the power plant across the country to North Laredo, in order to meet the demand for additional installations. In building this line a step-up transformer will be used at the plant, stepping down again to 2,300 volts about the center of the pumping district. The company has assurance of enough additional pumping plants to justify this proposed enlargement, and it will be completed some time during the coming summer, in time for next season's crop.

ELECTRIC CAR USED IN LAREDO, TEXAS.

In addition to this proposed transmission line that is to be built to the onion-growing district of North Laredo, another line will be built to South Laredo to operate the pumps of the growers of that section. The South Laredo district onion growers are now securing right-of-way across the different tracts of land, called "porciones," to allow the company to extend its line to them to operate six pumping plants which will be installed immediately. One of these plants will be of 30 horsepower; three will have 40-horsepower motors, and two 60-horsepower motors.

The embarking into the electrical pumping business makes the Laredo plant one of the most unique power stations in the country, as its day load for nine months of the year will be in excess of its night load.

Mr. Scovill is a believer in the three-phase method of power distribution. He installed the first three-phase machine in Texas in 1895 at Austin. At the time of the break in the dam across the Colorado River at that place this machine fell with the power house and was covered under seven feet of sand for some weeks. It was then taken out, washed off with a hose and taken apart and sand removed, dried out, and used as a motor to drive a Worthington pump at the waterworks at Austin for some time, afterward being replaced by a larger motor. The same machine is now doing service in the Austin electric-light plant.

In connection with the irrigating pumping plants in the Laredo district, the Laredo Electric and Railway Company made a rate of five cents per kilowatt-hour. The cost to the consumer for operating the pumps being a little less than four cents per horsepower-hour, is said to be much better for the average onion grower than the use of steam [illegible] of an expert or constant attention. During the last season one of the 30-horsepower pumps, operated by electricity, [illegible] for the entire winter's irrigation.

[illegible] fallen in the Laredo section for more than eight [illegible] great amount of water, this record of cost is surprisingly small. As compared with the revenue per [illegible]

It is stated that some of the steam pumping plants have done a little better than the electric plants in the matter of cost, but in figuring their cost the amount that must be expended each year in repairs to their boilers and plants is not included. When these incidental expenses are added the cost will be found greater than that of the electric stations, it is said. Many of the onion growers say that the freedom from the worry and expense of operation and making repairs which the electric pumping stations afford them is worth much more to them than whatever slight difference there may be in the cost per horsepower-hour of their operation.

PROSPECTS FOR FUTURE BUSINESS.

There are good prospects of a good business being built up on the Mexico side of the river in operating irrigating plants with electricity. Onion growing has just been started on that side of the Rio Grande, about 100 acres being devoted to this fragrant crop last season. The Laredo Electric and Railway Company has a lighting contract with the city of Nuevo Laredo, Mexico, as well as with Laredo, Texas. In Mexico the concession is held by one of the citizens of Nuevo Laredo, and, in turn, the company leased this concession for a term of years. The company furnishes the same 24-hour service on the Mexico side as it does on the American side of the river. The principal article of food of the working class of Mexicans is tortillas, which are made from soft-ground cornmeal. The introduction of electric power for operating the tortilla mills, in both of the border towns, has displaced gasoline engines in these mills, and the company is doing a good business in operating these motors.

When Mr. Scovill assumed the management of the plant of the company it was in badly dilapidated condition and the owners had given up all hope of ever making anything out of it. But the development of the Bermuda-onion-growing business, the general prosperity of the town and the adoption of modern methods of operating the enterprise put new life into the concern. It is expected that the present capacity of the plant, which is 1,050 horsepower, will have to be nearly doubled within another year in order to meet the demands that are being made upon it for additional power.

The company's lighting and power rates are said to be as low as any in Texas. The city of Laredo has a population of about 3,500 Americans and 14,000 Mexicans. It is growing rapidly under the new industrial influences that have been awakened there by the success of onion growing. It is estimated that this year's onion crop will bring to that immediate locality more than $1,000,000 in cash. Much of this large sum will be expended in making improvements with the view of enlarging the industry. The rapid development of the Laredo Electric and Railway Company is an excellent example of what may be accomplished by an alert and capable management.

Electric Motors in African Mines.

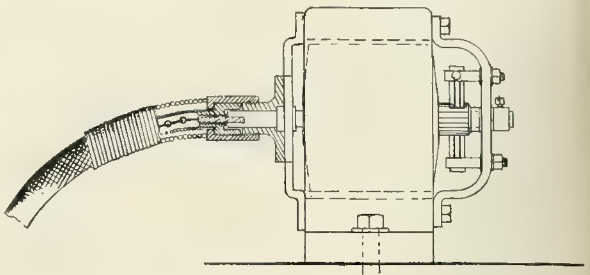
At a recent meeting of the South African Association of Engineers held at Johannesburg, A. W. K. Peirce read a paper on "The Choice of Electric Motors for Mine Equipment," confining his attention to three-phase motors of the induction type. He said that certain special applications of electric power, or the limitations imposed by the existing systems of supply, might occasionally render the employment of other types necessary, but that those circumstances would only be found in the exception. Discussing the point as to what gave best value for money, having regard to the varying conditions of voltage, speed, frequency, power factor, etc., he came to the conclusion that the most suitable motor for general use was one running at as high a speed as was consistent with its size, at a voltage not exceeding 400, on a circuit having a frequency of 50 cycles per second.

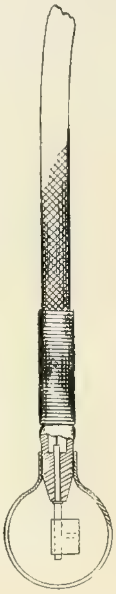
A Simple Vibrator.

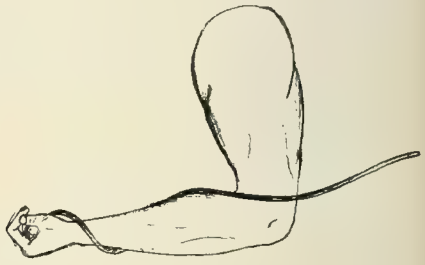
By J. J. O'Connell.

There are numerous electric vibrators on the market, and the demand seems to be growing, but I believe there is none more simple and effective than the one designed on the lines shown in the accompanying sketches.

To an ordinary fan motor (which may be operated on a continuous or alternating current) is attached a flexible shaft, on the free end of which is attached a weight. This weight, being eccentric to the shaft, causes it to vibrate as the weight revolves with it. The rate and intensity of vibration depends on the speed of rotation and the degree of unbalance to which the shaft is subjected by the weight. The vibration is felt throughout the entire shaft, which may be wrapped around the arm of a subject, as shown.







A SIMPLE VIBRATOR.

Chicago Drainage Canal May Get Increased Intake.

The sub-committee of the House committee on rivers and harbors has reported to the full committee in Washington in favor of permitting an intake of 14,000 cubic feet of water a second from Lake Michigan for the Chicago Sanitary Canal. The plan of the sub-committee will remove all opposition, it is said, to the Drainage Canal and to proposed improvement of the Mississippi River based upon the claim of experts that an intake of 14,000 cubic feet at Chicago would lower the level of the Great Lakes.

The Michigan-Lake Superior Power Company and the Chandler-Dunbar Company came to Congress rivals for permission to use the waters of the St. Mary's River for power purposes. They started a controversy which has resulted, after careful investigation, in a decision that the government itself assert its control of the St. Mary's River and erect above the falls, near Sault Ste. Marie, regulating works to impound the waters of Lake Superior and hold them in a reservoir. The average outflow from Lake Superior is now 65,000 cubic feet per second. It is proposed by regulating works to increase this flow to a daily average of from 80,000 to 85,000 cubic feet. The proposed regulating works at the St. Mary's River will cost $500,000, and, in connection with similar works that are to be erected near Buffalo, above Niagara Falls, will maintain, it is asserted, a satisfactory level upon all the lakes.

A representative of the Sanitary District says it would mean a great deal to Chicago to be allowed to use 14,000 cubic feet of water a second for canal purposes. With the improvements that the sanitary board has now before it this amount of water is necessary. Future improvement could not be made unless the right is given to take this amount of water from the lake.

"Wrinkles" in the Illumination of Residences and Small Stores.

At the last meeting of the Chicago Section, Illuminating Engineering Society, held at the Grand Pacific Hotel on May 14th, the subject for general discussion was the betterment of the illumination of residences and small stores. A number of members spoke of some "wrinkles" that had been found of value in solving such problems.

E. W. Lloyd spoke of the new tungsten lamp clusters being put out by the Commonwealth Edison Company for store service principally. They are meeting with marked success in this field and have proved to be the best competitor for the so-called gas "arcs." These clusters contain four 60-watt tungsten lamps hung vertically downward. This number was chosen so that in case any of the lamps should burn out the total light will not be so seriously affected. The company was the first to put these fixtures into general service and was not afraid of the results. There is now a general demand for more light rather than a curtailment of cost. There are two ways in which the lamps have been introduced: First, on a flat-rate basis, where the circuit is turned on and off at definite times by the company, and second, on a meter basis with a rental charge for the fixture, depending on the hours of use. All the fixtures are installed by the company and at its expense, and renewals as well as repairs are made by the company free of charge. Even the cleaning is undertaken in this way. It was found that the average life of tungsten lamps in service here was about 800 hours, though many exceeded this, some running as high as 2,000 hours.

W. R. Bonham gave many interesting facts in regard to tungsten lamps. Their candlepower depreciation during life does not amount to over 10 per cent. In other words, they have an excellent efficiency throughout life and do not have to be discarded when blackened like carbon lamps, because they do not blacken. The filaments are now much tougher and stand ordinary usage quite well. He has seen them in use with extension cords and lying on the floor. They can be used for portables very well. In a number of cases 110-volt tungsten lamps have been subjected to 220 volts without appreciably affecting their light-giving qualities.

George H. Jones showed designs of a combination gas and tungsten chandelier that was adapted for use where both kinds of service were desired. The tungsten-lamp arms are placed near the ceiling and the gas arms below. If the latter were to be discarded the lower part of the fixture could readily be disconnected. Other interesting "wrinkles" were the recently introduced three-way sockets for burglar and emergency use and locking lamp sockets.

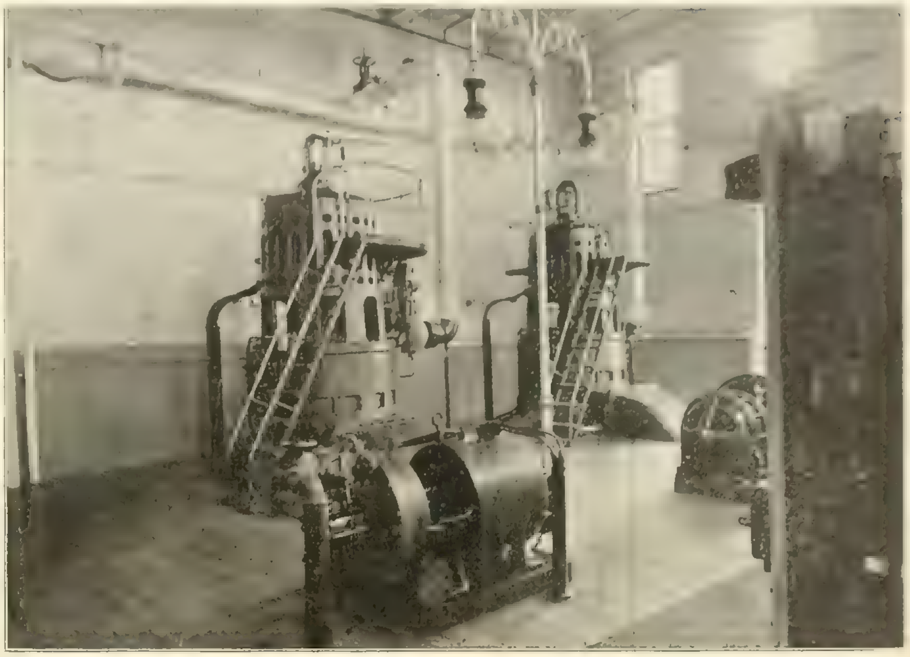
J. R. Cravath discussed the remodeling of old lighting installations in accordance with modern views on illumination, particularly in regard to the change of the common chandelier with lamps at 45 degrees. Sometimes these arms can be bent down so that opal or Holophane reflectors or domes can be used with high-efficiency lamps. If tungsten lamps are used, deep bowl reflectors must be used. If the arms cannot be bent down to reduce the glare and throw the light down, Holophane enclosing globes should be used. A still better way in this case is to use short extension cords, so that tungsten lamps can hang downward. A cluster with two 100-watt tungsten lamps was shown that was said to be the equal of any four-burner gas "arc." In general such tungsten clusters should have bowl reflectors over them to throw most of the light down, where it is wanted, instead of such a large proportion on the side walls and ceilings.

Municipal Financing in Ipswich.

The London correspondent of the Western Electrician tells of an interesting case of municipal financing which has come to light at Ipswich. The engineer and tramway manager having gone into the question of the renewal of the tramway track comes to the conclusion that the whole will need to be relaid in 1919. For the purpose of laying the track originally a loan of about $210,000 was sanctioned, and by the arrival of the time for relaying only $50,000 will have been repaid. On the present traffic returns it is improbable that a sufficient sum can be set aside to make up the deficiency and so the engineer recommends that an assessment be levied to make good. The finance committee of the corporation is opposed to this proposal, and the unsatisfactory condition of affairs is to go on.

A Compact Cotton-mill Power Plant.

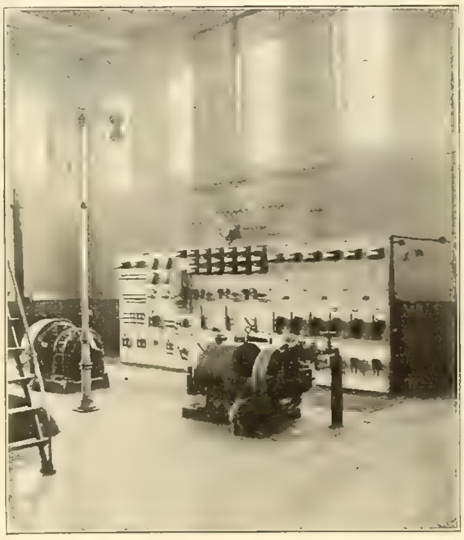
In [illegible] steam turbines in industrial plants [illegible]. The advantages which are claimed are high efficiency, compactness, simplicity and low cost of maintenance. Many persons are inclined to think that an excessive amount of auxiliary apparatus is required, but this does not appear to be the case, as an



A STEAM-TURBINE POWER PLANT IN A NASHUA (N. H.) COTTON MILL.

examination of the accompanying illustrations showing the interior of the Nashua Manufacturing Company's power plant at Nashua, N. H., will show.

Two 500-kilowatt, 600-volt, three-phase Curtis turbo-generators, one motor-generator set, one small steam-turbine generator set and a small circulating pump for the oiling system constitute the only moving apparatus in the station. The condensers, of the Manning-Bulkley type, are located on the outside of the building, where a sufficient head of water is provided for syphoning. No trouble is experienced in maintaining a vacuum of 28 to 29 inches, and as a consequence the only pump in the



MOTOR-GENERATOR, TURBO-EXCITER AND SWITCHBOARD IN COTTON-MILL POWER PLANT AT NASHUA, N. H.

entire installation is the one furnishing oil to the bearings.

The excitation for the 500-kilowatt units is provided at starting by the 25-kilowatt Curtis turbine generator set. This set also furnishes power for operating the watchman's lights throughout the factory and for lighting the boiler and engine room. Continuous excitation is furnished throughout the day by the 35-kilowatt induction motor-generator set.

The switchboard consists of generator, exciter and feeder panels of blue Vermont marble, and is [illegible] circuits.

[illegible]

ing current for the motors the turbines also supply current for lighting the mill.

An initial installation consisting of one 500-kilowatt unit gave such satisfactory operation that two years later a similar unit was installed to meet the increasing demand for power. Space has been left for a third unit, should future increase of business warrant its installation.

The first unit, after being in continuous service some 30 months, 10 hours daily, was taken apart and examined. The excellent condition in which the steel buckets and the entire interior of the turbine was found seems to refute the theory that steam at high pressure with more or less entrained water acts as a corrosive agent on the turbine buckets.

To Take Up Chicago Subway Question.

It is the plan of the committee on local transportation of the Chicago Council to take up the street-car subway problem on May 28th, when Chairman Foreman will present a preliminary proposition to the committee. This will not only be a big engineering problem but the question of financing the subway is one of the chief questions. The $5,000,000 to be contributed by the Chicago Railways Company and Chicago City Railway Company for this purpose will be but a small part of the amount needed. The legislation pending before the Legislature to enable the city to increase its bonded indebtedness will have a vital bearing on the subway project, it is pointed out. With the $16,000,000 additional that the city will be able to get if this legislation goes through, the municipality will be able to take care of new sewers, water mains, high-pressure water system and repaving the streets torn up for construction of the subway. The financing of all of these undertakings must be considered, it is asserted, as a part of the subway problem.

Proposed Meter Testing in Washington.

A strong effort is being made to provide for the testing of electric meters installed in the District of Columbia, and to that end a bill has been introduced in Congress by Senator Gallinger to provide for the fixing of fees for such service to be performed under the supervision of the electrical engineer of the District. The meters are to be considered correct if they shall register amounts not varying from the standard more than three per cent. The electric power companies will be expected to fit up laboratories for the purpose of making these tests, if the bill becomes a law.

Something About the Four Thousand Electric Signs of Chicago.

That the electric sign is one of the advertiser's best means of keeping his products in the public eye is now widely recognized. So rapidly has this form of publicity developed that in many cities the electric-sign load is one of the important sources of income to the central station, and the field is still broadening.

That it is profitable to the advertiser seems unquestioned when it is realized that many well-managed concerns are spending hundreds or perhaps thousands of dollars monthly for electric signs, and that campaigns are planned by individual houses that embrace many cities and towns.

In Chicago the use of large electric roof signs

CENTRAL-STATION ROOF SIGN ON HARRISON STREET STATION 204 FEET LONG.

has increased to a marked degree in the last year. As these signs are constructed on private property, no permit is demanded by the Department of Electricity of the city government for their installation, and, while they are inspected by the department, no record is kept as to numbers. Many of them, too, receive their current supply from isolated plants; therefore it is difficult to make a close estimate of the number of such signs in the city. Probably one hundred large electric roof signs are installed in various parts of the city. Several are illustrated herewith.

Street signs, however, whether projecting over the walk or placed parallel with the building, require a permit from the city for their installation. A careful record is kept by the Department of Electricity, which places the total number in the city at 4,149. Of these, 3,768 project over the walk at right angles and 381 are parallel with the building. For illuminating all these signs 248,940 in-

[illegible] WITH SIX-FOOT AND FIVE-FOOT LETTERS.

[illegible] of various sizes and 19 arc lights are used. The city ordinance requires that the [illegible] extra strong, to insure [illegible]

The signs for which permits are issued are re-[illegible] from dusk until 6:30 p. m., although many of them burn until midnight. [illegible] the equivalent [illegible] In this way many business streets are brilliantly illuminated with no extra expense to the city.

[illegible] in 1907 amounted to $23,592.53. The signs are regularly [illegible] which is under the supervision of Mr. George D. Bayle. [illegible] that

of the Commonwealth Edison Company, illustrated herewith. It is placed on the roof of the Harrison Street station of the company and is 40 feet high by 204 feet long. The letters in the upper row are eight feet in height, those in the two middle rows four feet, and those in the bottom row six feet. The lower row is interchangeable, so that the names of other customers can be inserted from time to time. The backs of the letters of this sign are of heavy galvanized iron, and the faces are of porcelain enameled steel which the maker considers the best sign material known, as it never requires repainting, but can be washed off with a damp cloth to make it clean and fresh as new. This sign has 2,002 sockets. If it burned five hours each night every night in the month, with four-candlepower lamps, the monthly current consumption would be in the neighborhood of 6,000 kilowatt-hours.

One of the most artistic signs in the city is the Gold Seal Champagne sign, which is 40 by 42 feet in dimensions. A good idea of this striking sign may be gained from the accompanying day and night views. It stands on a building at the corner of State and Lake streets, and is visible for a long distance. The letters and wreath are constructed entirely of galvanized iron, the wreath being painted green, the words "Gold Seal" yellow, the word "Champagne" red, and the bunch of grapes at the bottom is in purple. This sign has about 1,600 sockets, and the current consumption if burned from dusk to 11 p. m. 30 days a month, with four-candlepower lamps, would be about 4,800 kilowatt-hours.

The Fair sign, shown herewith, is about 35 by 100 feet. It is located on a building at the foot of Franklin Street on the north side of the river facing Wells Street bridge, where it is seen by thousands of people passing to the Northwestern Railway station and on the Northwestern Elevated. This sign has 1,424 sockets. It is constructed entirely of galvanized iron, the large letters reading "The Fair" being painted red and yellow and the remainder of the letters white. Capital letters in the words "The Fair" are 15 feet in height, the other letters being in proportion. With four-candlepower lamps the current consumption of this sign, if burned every night in the month, from dusk to 11 p. m., would be about 4,250 kilowatt-hours a month.

Whitney Sign, 22 by 32 feet, 1,583 Sockets.
Gold Seal Sign, 40 by 42 feet, 1,600 Sockets.
TWO CONSPICUOUS ELECTRIC SIGNS IN CHICAGO.

Much attention has been attracted to the Whitney Opera House "fireworks" sign, of which day and night views are shown herewith. This is not a roof sign, but is located on the street front of a building on the west side of State Street opposite the Palmer House. The effect, which is strikingly realistic, and required considerable skill to produce, is accomplished with flashers. The sign is 22 by 32 feet and has 1,583 sockets. Only the border and figures of the boys at the foot of the sign remain lighted all the time. The remainder of the sign goes on in a cycle. The light starts like a rocket at the flower pot and runs up a line of lamps in the middle to the top, where it branches into two downward showers, the effect being of two bombs bursting into colored stars as with skyrockets. These "stars" stay lighted for a few moments and then go out from the top, and as the last is extinguished, the word "Whitney" lights, this being followed by the words "A Howling Success," which in turn is followed by the words "Three Twins," after which the entire sign goes out and the cycle is repeated.

This sign would consume about 750 kilowatt hours per month with four-candlepower lamps if it burned steady every night from dusk to 11 p. m. With the flasher arrangement the consumption is about half this.

The electrical portions of the four signs mentioned above were constructed by the Federal Elec-

ROOF SIGN 100 FEET LONG WITH 1,424 SOCKETS.

tric Company of Chicago, the work of installation being done by sub-contractors. The signs have Federal copper shell clamp sockets throughout.

The Budweiser sign of the Anheuser-Busch company, shown herewith, is a striking roof sign. The picture only gives a partial idea of its attractiveness, as some of the colors are not brought out. The sign was erected by the Haller Sign Works of Chicago and may be found at Twelfth Street and Michigan Avenue. The letters and border are of the grooved or channel type, the border in green, the letter "A" in red and the balance clear lamps. There are 656 two-candlepower lamps in the sign.

The Kirk soap sign was also made by the Haller company. The letters are of the grooved skeleton type, those in the top row being six feet high and those in the bottom row five feet. The street sign on the Fair building was made by the same company. This is an unusual sign in that it is half a block long.

There are many other roof signs of which men-

ATTRACTIVE ROOF SIGN WITH 656 TWO-CANDLEPOWER LAMPS.

tion could be made, but enough has been said to show the marked growth in the field. Some of the smaller roof signs which consume much less current are very effective. As to the street signs, one has but to take a walk on Madison, Clark, Ran-

DEPARTMENT-STORE SIGN ONE-HALF BLOCK LONG.

dolph and other streets to realize the large proportions to which this class of advertising has grown.

Indiana Independent Telephone Association.

The third annual convention of the Indiana Independent Telephone Association was held in the Sun Parlor of the Claypool Hotel, Indianapolis, May 13th and 14th. About three hundred telephone men and fifty or more supply men were in attendance. The Indiana association is admitted to be one of the most progressive of the state organizations.

A. C. Lindermuth, president of the association, introduced Mayor Bookwalter, who welcomed the delegates to the city. He said the recent attempt to merge the competing telephone companies in Indianapolis would, in his judgment, cripple or destroy the great Independent systems throughout the state. He believes in competition in the telephone business, and advocated an exchange of traffic between companies when conditions are favorable. This can be done by a trunking arrangement between the companies. Mr. Bookwalter assured the Independents that they would have fair treatment as long as he occupied his present position.

There was much interest in the annual address of President Lindermuth, who is also president of the international association. In the face of the business depression of the last year, he said that a new and complete listing of the Independent telephone companies of the country shows over 11,000 in number, and if there has been any failure among those it has not been made known to the officers of the International association. Many of the companies have rebuilt or greatly enlarged their plants, and all have more or less improved their service and management. Many have also secured a deserved increase of rates during the year, thus increasing their income and placing their properties upon a firmer financial basis.

Reference was also made to the activity of the Bell company and its subsidiary companies in an effort to better their condition by merging and otherwise making physical connection with Independent companies. The remarkable fact about this arrangement is that in every instance, where physical connection is made with the Bell company by the Independent company, the latter is joined to the Bell system, and the Bell company never joined to the Independent system. President Lindermuth argued that all mergers of plants and companies that stifled or destroyed competition and tended to create a monopoly were in violation of the laws.

The reports of the vice-presidents of the 11 district associations in the state showed that the companies have all made money during the last year, and have expended large sums in the extension and betterment of their plants. An average increase of nearly two thousand telephones installed in each district during the last year was reported. It is said that there is a telephone in use for every ten persons in the state, and that by the use of the Independent long-distance line service can be had with 130,000 telephone users in the state.

The convention was addressed by President Beem of the Ohio association, who complimented the Indiana association and gave an interesting talk relative to conditions in Ohio. J. B. Ware, secretary of the International association, was in attendance and addressed the convention on the subject of the work of that association.

During the closing session a resolution was offered providing for the creation of an Indiana Telephone Commission, after the manner of the Indiana Railroad Commission, to regulate the telephone business in the state. The resolution was passed to the executive committee for future consideration.

The election of officers resulted as follows: President, C. S. Norton of Indianapolis; secretary, A. J. Payton of Rockport; vice-presidents, Theo- [illegible] Henry Landgreve of Huntertown, C. D. Knoefel of New Albany, W. H. [illegible].

Following the election of officers a committee was appointed to formulate a plan for the establishment and operation of a clearing-house system of settlement for toll-line [illegible] among the different companies in the state. A resolution was passed commending President Lindermuth for his good service to the association and congratulating him upon his selection as president of the International association.

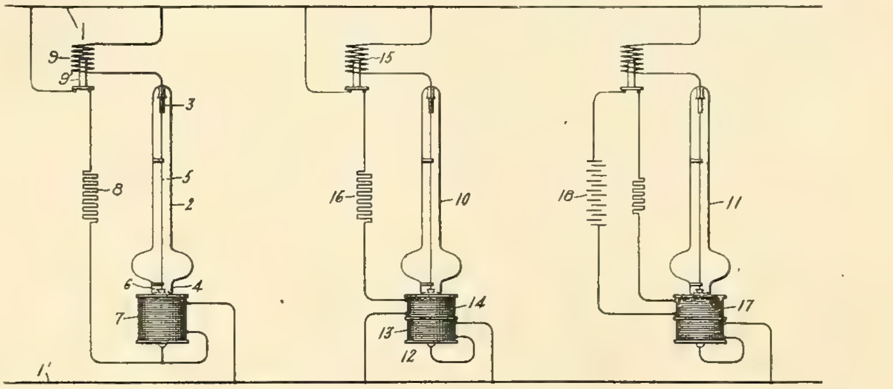
Starting Device for Mercury-vapor Lamps.

Dr. Charles P. Steinmetz has recently secured letters patent on an improved starting device for mercury-vapor arc lamps which is particularly applicable to lamps of the type in which a solenoid operates a plunger or other movable member to start the arc. The patent has been assigned to the General Electric Company.

In the accompanying diagram are shown three modifications of this device. The conductors (1) (1′) represent the distributing mains of the constant-pressure circuit supplying current to a mercury-vapor tube (2) of ordinary construction which may be operated in parallel with any other load, such, for instance, as the vapor lamps (10) and (11). The complete mercury lamp comprises the upper electrode (3), the mercury electrode (4), the starting filament (5) of suitable resistance material, the solenoid (7) and a magnetic plunger (6) floating on the mercury and carrying in a cup-shaped depression in its top a small quantity of mercury which makes a contact with the lower end of the filament.

When the lamp is started the current in solenoid (7) draws down the plunger (6) and opens the circuit through filament, thus forming a spark at the end of the filament and starting the mercury-vapor arc. The starting filament is preferably of very high resistance, so that under normal conditions of working, practically all of the current passing through the lamp will be carried by the mercury arc. In consequence of this high resistance the starting current in the solenoid is relatively small.

Considerable difficulty has been encountered in making this solenoid sufficiently powerful to operate the plunger without unduly increasing its resistance and hence its heat loss under normal conditions of working. To overcome these difficulties Dr. Steinmetz provides a resistance (8) in parallel with the



STARTING DEVICE FOR MERCURY-VAPOR LAMPS.

starting filament, but in series with the solenoid so that at the instant of starting, the current passing through the solenoid consists not only of the current in the starting filament, but also of the current through this resistance.

An automatic circuit-breaker (9) of ordinary form has its coil connected in series with the lamp tube so that when the current in the lamp has reached substantially its normal value the armature (9′) of this circuit-breaker will automatically open the circuit through the resistance and will keep the circuit open so long as normal current flows through the lamp.

While the arrangement above described for abnormally increasing the effectiveness of the solenoid during the interval of starting is believed to be the preferable arrangement, it is obvious that other modifications might be used to produce a similar result, and such a modification is illustrated in connection with lamp (10). The solenoid (12) is [illegible] carrying tube.

[illegible]

By this improved construction the inventor is [illegible] of the plunger, thereby materially improving the [illegible]

R. C. P. Holmes Found Dead.

Early on Thursday morning the shocking fact became known that Mr. R. C. P. Holmes, purchasing agent of the Commonwealth Edison Com-

R. C. P. HOLMES.

pany, Chicago, had met a tragic death early that morning within a few blocks from the Auditorium Hotel, where he had been in attendance at the convention of the National Electric Light Association earlier in the evening. His lifeless body was found in the alley off of Adams Street in the rear of Lyon & Healy's store at three o'clock in the morning. At this time exact circumstances surrounding the terrible tragedy have not been determined; but Mr. Holmes is believed to have been the victim of robbery and murder. He had a wound in the head, his face was black and his pockets were turned out, indicating that he had been choked and beaten to death.

Mr. Holmes was a popular man and enjoyed an unusually large acquaintance with men in the electrical field, many of whom held for him an especially kindly feeling. He had been connected with the Commonwealth Edison Company and its predecessors since 1882.

This terrible occurence has cast gloom especially over that part of the electrical fraternity which was assembled in convention in Chicago at the time, and out of respect to the unfortunate and highly esteemed man the association adjourned the session of Thursday morning.

At the regular meeting of the Electric Club of Chicago on May 13th Mr. F. J. Postel gave an interesting talk on the subject of bleaching flour by electricity.

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TUNGSTEN-LAMP lighting was conspicuous at the electric-light convention in Chicago this week. Both the Exhibition Hall and the Assembly Hall were supplied with these new metallic-filament lamps exclusively, and the delegates admired the fine white light. "This is the tungsten year," one of them remarked. Mr. Freeman's comprehensive paper on "The Status and Commercial Possibilities of High-efficiency Lamps" was presented late at the Wednesday evening session, and it was not discussed at that time. It will be given in full in the Western Electrician, beginning in this issue.

GROWING in importance as the years pass, the electrical industry is also growing in dignity. This tendency is well shown by the conventions of the great electrical societies. The juvenile, exuberant, cap-throwing era has passed. There is plenty of enthusiasm left; but everything is now done decorously and in order, with amplitude of care and forethought for minute details that were formerly disregarded. The hurrah days and the "boom" have been succeeded by the beauties of order and the elegances of form. No one who attended the Chicago convention of this week and noted the care and correctness with which all details of the exhibition and entertainment programme were arranged and carried out could fail to have been struck by the great advance shown in the niceties of convention management, provided he were familiar with the less studied methods of a few years ago.

IT IS INTERESTING to observe a tendency on the part of the technical societies to act in concert in the matter of the time and place of meetings. Thus the spring meeting of the American Society of Mechanical Engineers will be held in Detroit on June 23d to 26th. Simultaneously and in the same city will be held the meetings of the Society for the Promotion of Engineering Education, the Society of Automobile Engineers and the mechanical branch of the Association of Licensed Automobile Manufacturers. Furthermore, it was seriously discussed whether the annual convention of the American Institute of Electrical Engineers should not be held at the same time and place, inasmuch as that organization and the Mechanicals have about 250 members in common. But the plan was abandoned, owing to the doubt whether suitable hotel accommodations could be secured, and the electrical engineers will go to Atlantic City a week later.

Simultaneous meetings have disadvantages as well as advantages, and it is a question whether the latter outweigh the former. One drawback is diversity instead of concentration of interest and allegiance. It is a mistake to undertake to do so much that nothing is done well. But in the case of the two great engineering societies, with many interests in common, the proposal is perhaps worth a trial.

GAS ENGINES formed the subject of one of the most important and elaborate committee reports presented at this week's Chicago convention of the National Electric Light Association. The committee on gas engines, of which Mr. W. C. L. Eglin of Philadelphia is chairman, presented a printed report of 172 pages, with over 60 illustrations and a number of tables. The conclusions of the committee are conservative, but may be considered as favorable to the gas engine. The efficiency of the combined gas engine and producer is said by the committee to be higher than that of a combined steam plant of boilers and steam engines or boilers and steam turbines. Large gas engines have been used long enough to demonstrate that continuous service is assured. Sizes ranging to a maximum of 5,000 horsepower are available. The capacity rating of gas engines should, however, be standardized. The cost of gas engines is much higher than that of either steam engines or steam turbines. The gas producer does not seem to have reached the stage of development that has been attained by the gas engine.

These are some of the points brought out in this excellent report, which is a mine of data on the subject. It is by such work as this that the National Electric Light Association demonstrates its usefulness to its members and to the whole engineering fraternity. Technical investigations of the newer types of apparatus that are at once skillful and disinterested are very useful.

MR. ROBERT C. P. HOLMES, purchasing agent of the Commonwealth Edison Company of Chicago, was found dead with his pockets rifled in the rear of a building at the corner of Adams Street and Wabash Avenue, Chicago, at an early hour on Thursday morning of this week. It is believed that he was robbed and murdered. This shocking affair cast a deep gloom over the National Electric Light Association, which was in convention at the time at the Auditorium Hotel, but a few blocks from the scene of the tragedy. Mr. Holmes had been engaged in the electrical business for nearly thirty years, and he was widely known all over the country. He was a member of the reception committee for the convention and was present, with his daughter, in that capacity at the Annex on Monday evening. He attended the Tuesday and Wednesday sessions of the convention. Mr. Holmes was sergeant-at-arms of the Edison Association, and was a great favorite among electrical men everywhere.

Chicago electrical men are greatly distressed that this outrage should have taken place within the borders of the city during the electric-light convention. The details of the assault are shrouded in mystery at this writing, but apparently Mr. Holmes was waylaid at night and robbed and killed by a blow on the head during a desperate struggle with his assailants. The police, who should have afforded protection against such an attack, are endeavoring to unravel the mystery. It is earnestly hoped that any guilty person or persons may be brought to justice. To the surviving members of the family the Western Electrician offers its heartfelt sympathy.

ELECTRICAL MEN may well congratulate themselves that after a year which included a severe business depression the National Electric Light Association should hold the largest and undoubtedly the most successful convention in its history, as it is doing in Chicago while these words are being written. This fact indicates with great certainty the strong and stable character of the electric-light and power industry in the United States. The business of supplying electricity has become such a prime necessity to the people of this country that it is less affected by dull times than almost any other industry of equal magnitude, while it is so buoyant in the knowledge of its own possibilities that it quickly rises from such comparatively slight depression as it has experienced. If this were not the fact, it is hardly to be supposed that the largest gathering in its history of 23 years would be held by the great central-station organization in this year of grace 1908.

The number of persons actually present at the Chicago convention on Wednesday evening of this week was 1,625, with two days' registration yet to come. It is altogether probable that the total attendance will be in the neighborhood of 1,800, which is to be compared with the final attendance of 1,675 at Washington last year, before the monetary stringency had struck the country and with the attraction of the nation's capital and the neighborhood of many centers of large population to help swell the number present.

The result is one in which the electrical interests of the country may take a just pride. Chicago was the birthplace of the association in 1885, and as six of the conventions of the National Electric Light Association have been held here, the electrical men of this city take a particular interest in the association. These electrical men of Chicago—not a few of whom worked hard in co-operation with many others throughout the country in preparing for the convention—experience much gratification in the knowledge that, regardless of the recent drawback in general business conditions, the 1908 assemblage was the largest and most successful of a long line of good conventions, each, of late years, regularly overtopping its predecessor.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The Chicago Convention of This Week.

Judging by the first two days, the proceedings of which are given in this issue, the thirty-first convention of the National Electric Light Association, held at the Auditorium Hotel, Chicago, May 18th to 22d, must be pronounced an unqualified success in every respect. The actual number of persons in attendance up to Wednesday evening, as indicated by the badges given out, was about 1,625. The members of the association and the electrical men who were their guests discussed a programme of papers and committee reports that was carefully prepared, not overloaded, and of great practical usefulness to central-station men. In addition, they examined a brilliant exhibition of electrical appliances that was entirely up-to-date, with the latest things in applied electricity outside of heavy machinery and construction work and which was of conspicuous educational value. Besides all this, there was a programme of entertainment, largely but not exclusively planned for the benefit of the ladies by the local entertainment committee, which was varied and pleasing and carried out with a precision and method and thoughtfulness which won the highest praise. Thus, in its four leading features—attendance, useful work accomplished, exhibition and entertainment—the convention was a conspicuous success, all the more noteworthy owing to the recent industrial depression.

Opening of the Exhibition.

The first feature on the convention programme was the opening of the attendant exhibition of electrical appliances. This event took place on Monday evening, May 18th, at eight o'clock. Mr. Dudley Farrand, president of the association, escorted by Mr. Frank H. Gale, chairman of the exhibition committee, threw the switch that turned on the large number of tungsten lamps, used exclusively for lighting Exhibition Hall, which was on the ninth floor of the Auditorium. The scene was a bright and dazzling one. The space was divided into a number of exhibit booths and was beautifully decorated, the prevailing colors being shades of green. The great feature was the fine, white-light illumination of the new tungsten incandescent lamps, which were supplied without charge, in honor of the association, by the General Electric Company and the National Electric Lamp Association. It was noticeable that the tungsten lamps enabled the delicate color effects to be brought out as well, apparently, as by daylight. At nine o'clock, or soon thereafter, the "private view" of the exhibition for members was brought to a close; but it was necessary to turn the lights out gradually, beginning at one end of the hall, as a gentle hint to visitors that the opening hour was over and that they were expected to attend the reception in the Annex.

A description of the exhibition and of individual exhibits will be given in the Western Electrician of next week, which will also contain the concluding portion of the report of the proceedings.

The Reception.

The reception of Monday evening, following the opening of the exhibition, was a brilliant affair. It was held in the beautiful gold banquet room of the Auditorium Annex and was attended by perhaps a thousand ladies and gentlemen. The guests were presented to Mr. Samuel Insull, Chicago, chairman of the reception committee, and Mrs. Insull, who in turn introduced them to these officers of the association and accompanying ladies, who constituted the receiving line: President Dudley Farrand, Newark, N. J., and Mrs. Farrand; Vice-president Alex Dow, Detroit, and Mrs. Dow; Vice-president W. C. L. Eglin, Philadelphia, and Miss Eglin; Secretary and Treasurer W. W. Freeman, Brooklyn, and Mrs. Freeman; Assistant Secretary and Treasurer Harriet Billings, New York; Mr. Louis A. Ferguson, Chicago member of the executive committee, and Mrs. Ferguson.

After the reception there was dancing to the music of Hand's orchestra, and a supper was served. With the beautiful golden setting of the hall, the music of a fine orchestra, the handsome gowns of the ladies, the animated conversation of old friends' meeting and new friends in the making, the rhythm of dancing feet, the subdued clink of glasses as gay toasts were pledged, the light, color and animation of it all, the scene was indeed a notable one. The reception served to introduce the Chicago convention under most noteworthy and happy auspices.

Tuesday's Proceedings.

The convention proper was opened without any preliminaries on Tuesday morning by President Farrand. Secretary Freeman was in his place on the platform of the Assembly Hall, which adjoined, on the north, the Exhibition Hall on the ninth floor of the Auditorium, with which it is connected, although actually in the Fine Arts Building. The first feature was the president's address, an abstract of which follows:

President Farrand's Address.

Our membership is now: Class A, 664; Class B, 394; Class D, 151; Class E, 93; honorary, 25; total of all classes, 1,327—an increase during the year of 124, or 10.3 per cent. Our finances are in good condition.

During the period which has elapsed since our last annual meeting we have experienced serious business depression. The volume of general business of the country has been very considerably reduced and the interests of our customers, which are always our greatest interest and concern, have required serious retrenchment. This has affected the amount of our business to varying degrees everywhere. But I am decidedly optimistic on the subject of an early return to increased business and renewed prosperity.

In addition to the financial and business stress, the interests which we represent have been subjected to the natural and logical results of an agitation having an indefinable source, but extending practically all over the country. This agitation, wearing the cloak of reform, has for its objective the creation and establishment of a multiplicity of commissions, national, state and municipal, and seeks not only a reasonable regulation and control, as stated in some of the arguments in favor of the movement, but it actually prevents progress by unreasonable interference with private interests, stifles individual initiative, and in many instances favors acts which are no less than actual confiscation.

We are all, I hope, law-abiding citizens, and yet if commissions or unreasonable legislation of any kind are thrust upon us, I see no reason why we should not be free to protest and endeavor by all reasonable means and to the best of our ability, to defeat the enactment of measures designed for political purposes and tending to undermine the very foundations of our investments.

Conceding, for the sake of argument, that certain corporations have in the past adopted policies or schemes of financing which have been contrary to public policy, there are undoubtedly many companies, and I think a large majority of them, whose capitalization and investments represent dollar for dollar, whose rates have been equitable and reasonable, whose treatment of customers and the public has been fair, whose system of accounting has been adequate to local requirements and has shown sufficient details of operating and financial transactions for all practical purposes; and yet, under some of the proposed schemes of regulation and control, every such company, no matter what its history, its rates, or its standing with its customers, is to be subjected to various kinds of supervision and regulation, the details of which are very largely left to the discretion of a commission whose members, in most cases, are not familiar with the subjects in hand and have never had actual experience in the particular business over which they are given so much power.

Take, for instance, the case of rate regulation; the most conspicuous example is found among the enactments of our more recently constituted commissions in the establishment of a uniform maximum rate for a given locality. Such action has never been justified from an engineering or operating standpoint. I claim that the establishment of an arbitrary maximum rate, without other qualification, such as time, quantity, or hours of service, is entirely contrary to the fundamental principles governing the cost of the service, and can only be justified on the law of averages, in which the loss from one customer must be added to the cost of supplying others. It is self-evident that the lower the maximum the higher the minimum.

The question of municipal ownership, which has been agitated for some years, has been less prominent of late, owing to the financial stringency and the inability to sell bonds readily. I am firmly of the opinion that if the status quo can be maintained for a short while the great majority of municipal lighting plants will be declared failures, only those being retained which have exceptional local facilities permitting reduced operating costs.

Let me call especial attention to and urge the necessity of a closer relation with the several state associations.

Suggestions have been made from time to time toward forming sub-organizations to take up special subjects and holding separate meetings. The present administration, however, has always looked with disfavor on such separate or interior organizations as being unnecessary and tending to sap or undermine the association. In response to a genuine request to hold separate meetings, and in [illegible] separate organization.

On the invitation of the President of the United States, I attended a conference at the White House, held May 13th, 14th, and 15th, to consider the conservation of natural resources. While at the conference I joined with the presidents of four of our leading engineering associations in urging the appointment of a suitable committee of engineers to investigate the subject thoroughly and recommend such action as would be best adapted to accomplish the desired object in a seasonable manner, and avoid the errors of too hasty action. I would therefore recommend the appointment of a representative by this association to take part in such further conferences as are quite sure to be held.

I want to thank the members for the many courtesies and words of encouragement received during the year, and the officers and members of the executive committee, not only for close attention to the interests of the association, but to the prompt response and hearty co-operation in all matters where it has been suggested that they could be of assistance. I want to acknowledge especially the effective co-operation and wise counsel in many ways of our secretary and treasurer, Mr. W. W. Freeman, who, in addition to his regular duties, has met with your president in the offices of the association at least once each week during the year. No statement would be complete, however, without giving proper credit to our assistant secretary and treasurer, Miss Billings, and the members of the office staff for the ability and conscientious efforts throughout the year in the interests of the association and its members.

Opening Business.

Secretary Freeman made several announcements and presented letters of regret from a large number of men in public life, including the vice-president of the United States, and also Past-president M. J. Francisco of Rutland, Vt., President Henry G. Stott of the American Institute of Electrical Engineers, Secretary Calvin W. Rice of the American Society of Mechanical Engineers, President Louis Bell of the Illuminating Engineering Society, Prof. A. F. Ganz of Stevens Institute, Secretary T. S. Young of the Canadian Electrical Association, B. Gherardi of New York, Prof. G. W. Patterson of the University of Michigan, Charles F. Brush of Cleveland, Dr. H. W. Spangler of the University of Pennsylvania and many others.

The secretary called attention to the unique feature resulting from the fact that the entertainment committee had prepared especial and elaborate engraved invitations to the entertainment events. He urged the members to respond by filling out the acceptance cards enclosed.

Progress of the Year.

Next following was the presentation in abstract of the report of the committee on progress by T. Commerford Martin of New York city.

In his report as the committee on progress Mr. Martin began by noting the fact that the number of central-station light and power plants in the country would appear to be 5,037 (80 per cent. private owned), with 396 in Canada and 62 in Mexico.

Referring to rates, the reporter mentioned the new system of charging of the Union Electric Light and Power Company of St. Louis. The fundamental principle of this system is that the customer's rate is based on the minimum monthly guarantee he is willing to make per horsepower or per 50-watt lamp connected. The rate is also lower the larger the connected load. For example, the customer having less than 100 lamps pays 12 cents per kilowatt-hour if he guarantees only 10 cents per month per lamp. If he guarantees 65 cents per month per lamp, he need pay only eight cents per kilowatt-hour. Between these guarantees there are 15 intermediate steps. By guaranteeing 45 cents per month per lamp the customer gets a rate of 10 cents per kilowatt-hour. The rate is also made lower as the number of connected lamps increases. For example, a customer guaranteeing 10 cents per month per lamp and having less than 100 lamps pays 12 cents per kilowatt-hour. This is reduced by steps until, for 3,000 lamps or over, the rate is six cents per kilowatt-hour, with a 10-cent per lamp guarantee. For the 45-cent per lamp guarantee the customer with less than 100 lamps pays 10 cents per kilowatt-hour, while the customer with 3,000 lamps

pays 5.2 cents per kilowatt-hour. All these rates are subject to further discounts based on hours' use and quantity.

Referring to billboard lighting, Mr Martin noted that in Chicago, Kansas City and Indianapolis a large billboard concern has begun to sell day and night service, purchasing energy from the local central-station companies and billing the customer for the total cost of the billboard and lighting. The Commonwealth Edison Company of Chicago has been giving service for billboard lighting at the same rate as for signs, turning the current on and off at stipulated hours by means of a regular patrol service.

In relation to labor questions, it may be remarked that the Scranton (Pa.) Electric Company has entered into an agreement with its firemen and engineers covering a period of 10 years in the case of firemen and three years in the case of engineers. The agreement with the firemen, however, provides that every three years there may be a discussion looking to an adjustment of the wage scale. The agreement includes a stipulation that there shall be no discrimination between union and non-union men. Bonuses for increased efficiency will be paid on a basis that has been mutually agreed upon. It is also provided that firemen who pass an examination equivalent to that of the Scranton Correspondence Schools shall receive an increase of $5 a month.

The reporter mentioned the development of metallic-filament incandescent lamps. Turning to arc lighting he said that Mr. L. J. Auerbacher stated that practically all the commercial arc lighting in Berlin is accomplished by flaming arcs. They are very liberally used, some store fronts of moderate size having as many as 15 to 20 lamps hung about five feet apart. The most interesting and novel feature of arc work is the new Jandus "regenerative" enclosed flame arc just brought out in England. If an ordinary flame arc were enclosed, the heavy fumes evolved from the impregnated carbons would soon form a deposit on the globe, thus obscuring the arc. In this new lamp, which is due to Mr. A. D. Jones, special means are provided for obtaining a circulation of the gases past the arc, and the light is produced mainly by raising such gases to the temperature of incandescence and not by the combustion of chemicals in the arc.

A striking example of motor development is the completion of the electrically operated, high-pressure water systems in New York and Brooklyn for fire protection, the city having appropriated over $5,000,000 for the whole work. The pumps are operated by induction motors, the aggregate rating for those installed in the four stations being 15,000 horsepower. The readiness-to-serve charge is $24 per year of the kilowatt rating of the motors and 1½ cents per kilowatt-hour for energy actually used.

Attention was directed to the prepayment meter for electric current, which appeals to a large class of people accustomed to handling small amounts of money. These meters cost about 15 per cent. more than an ordinary meter of the same capacity.

Distribution in Suburban Districts.

The next paper was on "Distribution in Suburban Districts," by George H. Lukes of Chicago, and was read by the author. Following is a condensation:

It is impracticable to give all the parts of an extensive suburban district as good service as should be given in a city where the business is concentrated. An attempt to achieve this result on the part of the suburban company would lead to bankruptcy. A compromise is therefore usually necessary. In scattered districts, where the income is small, the investment is kept down to the minimum consistent with a fair quality of service, and enough money is expended in the thickly settled portions to insure good regulation and reliable service. In large city distribution systems reliability of service is the paramount consideration and the engineer is justified in making his plans with the idea of being always on the safe side. In the country a finer line must be drawn, and abundant opportunity is offered for the exercise of good judgment in deciding just what expenditures are justified.

Distribution of electricity for commercial lighting and power in suburban districts is now almost entirely by alternating current at 60 cycles. Small direct-current installations covering limited areas, combined with alternating current for scattered districts, [illegible] found in places, but as a rule the [illegible] local conditions [illegible] at 125 cycles are being [illegible] cycles. When suburban [illegible] electric rail[illegible] transmi[illegible] cycles. When suburban systems are operated in connection with [illegible] lighting system [illegible] at 25 cycles [illegible] the development of the 60-cycle business should justify the erection of 60-cycle stations or the installation of a certain proportion of 60-cycle generating equipment in old stations. In Mr. Luke's paper 60-cycle transmission and distribution alone were considered.

Under various headings the author considered, in an informing, practical way various features of suburban service. The extracts that follow will give some idea of his conclusions:

The three-phase, three-wire system is ordinarily used for transmission, the voltage ranging from 6,600 to 22,000.

Porcelain insulators are now almost universally used for transmission voltages above 6,600. It is noticeable that insulator manufacturers are now rating their insulators more conservatively than they did several years ago. For suburban work the insulator must be able to stand up for a period after being considerably damaged.

The question of single-phase versus three-phase transformers has been pretty thoroughly debated during the past few years. The greater factor of safety secured by the use of three transformers instead of one in the relatively small suburban substations seems to warrant their use even at some extra cost. In the matter of air-blast and oil-insulated transformers experience seems to indicate that for the voltages under consideration the air-blast transformer with properly insulated end turns is as reliable as the oil-insulated type. The use, however, of air-blast transformers is confined to the larger sub-stations, where there is an operator present at all times.

Distribution for commercial lighting and power may be by single-phase, two-phase or three-phase systems, the ordinary voltage being approximately 2,200 volts. The four-wire, three-phase system seems to have many advantages over other systems for suburban work. In this system the generator or transformers are Y-connected, the neutral being brought out and connected to a grounded fourth bus-bar. The voltage between any phase wire and neutral is 2,200 and between any two of the phase wires is 3,800.

Secondary distribution for lighting is almost universally from three-wire secondary mains or buses at approximately 110-220 volts, customers being supplied at 110 volts for installations up to 20 or 30 lights, and at 110-220 volts for larger installations, on account of the scattered nature of the business.

In relation to distribution losses, Mr. Lukes said that a comparison between total output generated and total output sold may indicate excessive losses, but in order to run them down it is usually necessary to make this comparison on each feeder. If individual meters on each feeder cannot be afforded, the station wiring should be so arranged that meters can be conveniently installed for periodic tests on each feeder.

Accurate pole-line records are a convenience to all departments of a company and a positive necessity to the operating department if good results are to be obtained. In starting a system of records it is wise not to attempt to make it too elaborate. A simple system, which the organization is able to keep up to date, is better than a very complete system that has to be neglected now and then in the press of other work and is apt to be six months or a year behind.

The discussion was opened by Farley Osgood of Newark, N. J. He said the adoption of 60 cycles as the standard frequency was good practice even where there was some direct-current railway load, as rotary converters are now operating quite satisfactorily at this frequency. However, where the railway load becomes a very large part of the total load, 25 cycles may be regarded as the better choice. The use of brown porcelain insulators for transmission lines has proved to be a desirable plan, as they are much less conspicuous as a target for pernicious marksmen. He believed the transmission line should be built extra well, as it results in economy in the end. The needs of the future should be carefully studied so that sufficient sub-station capacity may be provided for. In the East single-phase, two-wire distribution is very extensively used for residence and small motor loads. For large motors the four-wire, three-phase system is used. A warning should be given against the use of single-phase motors for elevator service, as they affect the line voltage too much on starting. Pipes driven into ground were not found to be satisfactory connections to ground except in certain soils. Water-pipe grounds are the only ones to be relied on in all cases. It is often desirable to run a ground wire over several spans, in order to get a water-pipe ground connection. Where such connection is not available, buried copper plates form the next best ground. Records of breakdowns should be carefully kept, as they are extremely valuable in determining where additional protection is needed. Lightning arresters should be judiciously installed. Their indiscriminate use is not warranted nor is a lack of them judicious economy. Companies should be careful to see that consents for pole lines are authentic and properly made out, so as to avoid trouble from future protests. For this and other obvious reasons reliable records of pole construction should be kept.

P. Junkersfeld of Chicago called attention to the marked difference in most suburban districts from those prevailing in cities and towns. Frequently a duplication of street and alley poles is justified to prevent too great a number of lines on street poles. In this way the nearly fourfold expense of underground construction may be avoided or considerably deferred. To keep down the expense of underground work in sparsely settled districts the cheaper forms of construction are worthy of much study. The use of armored cable presents a distinct advantage for this service. In regard to four-wire, three-phase distribution, it should be noted that this system has been in successful use in and near Chicago for over nine years.

H. B. Gear of Chicago declared that grounding with galvanized-iron pipe has been found better here than the use of copper plates and is quite satisfactory where water-pipe grounds are not available. It has been found advisable to put in two grounds to guard against a break in a single ground. An interesting transmission on the four-wire, three-phase system is that to South Chicago from the Fifty-sixth Street sub-station seven miles away. Excellent regulation is obtained at the remote sub-station without any attention at that point, although the lines are frequently considerably unbalanced. No disturbance has been experienced on grounded circuits due to railway currents, because the secondary circuits are not interconnected.

Dr. Charles P. Steinmetz of Schenectady, N. Y., referred to the construction shown in Mr. Lukes' paper (provision for two transmission circuits on the same pole line) as being fairly good, but not reliable for all conditions, because not protected against lightning. In high-potential transmission lines a grounded overhead wire is best. With regard to the relative advantages of one three-phase against three single-phase transformers for three-phase lines, each has its good points, but a decided warning must be given against the plan tried in some cases of using only two transformers connected as an open delta on three-phase lines. While this may work in low-voltage installations, it is extremely dangerous on high voltage, due to unlooked-for disturbances in the system.

H. M. Edwards of New York introduced a new trend to the discussion by asking, in connection with the general remarks being made on high-tension lines, When does a line become a high-tension line? What is the dividing line? The question had recently presented itself before some of the public-service commissions, who wish to be informed.

Dr. C. P. Steinmetz said that the common lighting transformers with voltages of 2,250 and 4,500 on the primary represented a standard practice with ordinary insulation. With transformers of 6,600 volts, the next common value, an exceptionally good insulation is required. An intermediate value, say, 5,000 volts, may be regarded as the limiting value of medium tension, above which we enter the high-tension field.

Arthur Williams of New York called attention to the fact that the Underwriters have adopted 5,000 volts as the dividing line. It was therefore desirable for this association to adopt the same value so as to have a uniform definition.

Alex Dow of Detroit indorsed these views by referring to the varied experiences of linemen working on 4,500 and 6,600-volt lines under similar conditions.

Dr. Steinmetz declared further, in answer to a question on the status of series arc circuits, that these circuits are not to be classed with the constant-potential circuits to which the 5,000-volt limit should be confined. Arc circuits are constant-current lines whose power is limited and whose insulation is not exceptional even for about 6,000-volt lines. They should therefore be regarded as medium-tension circuits.

Harold Almert of Wichita spoke of the advantages that had been found by a number of companies in adopting varied colored porcelain insulators for lines of different voltages. Linemen from other companies soon understood the significance of this plan and were much more cautious about indiscriminate cutting of high-voltage lines.

President Farrand stated that while this was no doubt a good plan, it might easily be taken up by uninformed lawmakers to compel the buying of a multitude of insulators.

Arthur Williams, reverting to the discussion of what was high tension, moved that the association adopt the Underwriters' regulation of 5,000 volts as the minimum pressure of constant-potential high-tension lines.

Paul Spencer of Philadelphia moved the adoption of an amendment referring the subject to a committee to be appointed by the president. The amendment and the amended motion were then carried.

Mr. Lukes then concluded the discussion (in which J. F. Dusman of Baltimore and others not mentioned in this brief summary had taken part) by stating in effect that porcelain potheads have been found very satisfactory and are rapidly replacing metal potheads on lines in this vicinity. He also urged the careful consideration of the high-tension question, as the tendency is to increase distributing voltages, and since 6,600 is now a quite common value, it may be desirable to include it in the medium-tension class.

"Tape."

The next paper on the programme was one entitled "Tape," prepared by Paul Lüpke of Trenton, N. J., and read by T. C. Martin:

Mr. Lüpke's short paper had as its title the single word "Tape." "Red tape" is a necessity, yet rules must be designed to assist individual judgment not to stifle it. Use sober reason persistently. Thoroughness does not mean indiscriminate attention to an agglomeration of petty details; it means the intelligent elimination of nonessentials and a firm grasp on matters of vital importance. The company man needed and wanted is he who can stoutly and with ability defend his own opinion while a matter is under discussion and open to argument, and who, if overruled, is broad enough to bring his best efforts, with true loyalty, to bear upon making an unqualified success of the opinion that prevailed; in short, a company man must be able to abide by the decision of the court and go to work. Concerted action of men who have minds of their own must always be based on a compromise. Though we cannot all get what we think is best, we must nevertheless all do the best we can with what we get.

Like all of Mr. Lüpke's contributions to the proceedings of the association, this paper was distinguished by good sense, good humor and good literary style—a pleasing combination.

Grounding of Secondaries.

W. H. Blood, Jr., of Boston, past president, presented the report of the committee on the grounding of secondaries. He offered this resolution, which was adopted:

"Resolved, that it is the sense of this meeting that it is desirable to have inserted in the National Electrical Code a rule making mandatory the grounding of alternating-current secondary circuits up to and including 150 volts, and a provision making prohibitory the grounding of secondary alternating-current circuits carrying in excess of 150 volts."

The committee realizes that the rule as at present worded may not be perfect, yet it believes that a step in advance has been made, and that by protecting, as the rule will, over 99 per cent. of the lighting circuits (which ordinarily run at 150 volts or less), the number of fatalities will be greatly reduced. The only serious point at issue seems to be whether the limiting voltage shall be 150 or 250. The proposed rule to be inserted in the National Electrical Code is as follows:

Rule 13A—The following regulations in regard to the grounding of low-potential circuits apply only when, under normal conditions of service, there will be no passage of current over the ground wire. If, under normal conditions of service, there would be a passage of current over the ground wire, the use of such ground wire is prohibited.

Direct-current Systems—

1. Direct-current systems must be permanently grounded when the difference of potential between the ground and any part of the circuit would be less than 150 volts, but must not be grounded when the difference of potential between the ground and any part of the circuit would exceed 150 volts.

2. When ground connection is to be made under the above rule, it must be made with the neutral when accessible; otherwise, to one side of the circuit.

3. At central stations the neutral of a three-wire system, or one side of a two-wire system, must be permanently grounded to all available underground water and other sub-surface piping systems (except that gas-piping systems must not be used), or to a grounded railway return system or to a metal plate buried in coke below permanent moisture level, or to pipes driven into permanently damp soil.

4. Additional grounds may be made on the neutral of a three-wire system or on one side of a two-wire system, but they are not required.

Alternating-current Secondary Systems—

1. Transformer secondaries of distributing systems must be permanently grounded when the difference of potential between the ground and any part of the circuit would be less than 150 volts, but must not be grounded when the difference of potential between the ground and any part of the circuit would exceed 150 volts.

2. When ground connection is to be made under the above rule, it must be made with the neutral when accessible; otherwise to one side of the circuit.

Methods of Grounding—

1. The ground connection may be made on each building service, on the transformer, on a common neutral or ground connecting a number of transformers or at central or sub-stations.

2. All ground wires must be of copper, and must be kept out of building as far as practicable (except for central and sub-stations), but any ground wire which is inside of any building or attached to any building or pole must have an approved rubber insulating covering. National Electrical Code standard for from 0 to 600 volts. (See No. 41.)

3. No wire smaller than No. 4 B. & S. gauge shall be used for ground connections.

4. Ground wires may be attached to poles or buildings by porcelain cleats or knobs. Staples must not be used. The wire must be run in as nearly a straight line as practicable, and where exposed to mechanical injury must be protected by a wooden molding or by an iron pipe, which does not require grounding when the pipe contains the ground wire only.

5. Ground connection for transformers in central and substations, for transformers in banks or connected by common neutrals or grounds, and for individual transformers, must be made to all available underground water and other subsurface piping systems (except that gas-piping systems must not be used), or to a grounded railway return system, or to a metal plate buried in coke below permanent moisture level, or to pipes driven into permanently damp soil. Additional grounds may be connected, but they are not required.

6. When each building service is grounded, ground connections on transformers are not required. This ground on the service wire must be made on the transformer side of the main switch and cut-out, and the wire should, as far as practicable, be kept out of the building, but should be run into the cellar and connected to the water-piping system running into the building, on the street side of water meters, main cocks, etc.

When the ground wire is run through any part of the building it shall be [illegible] conduit. Where water pipes are not available, [illegible]

[illegible]

8. Connection to grounded railway return shall be made by means of a bolt or rivet passing through the rail [illegible] the wire [illegible] and [illegible] shall be carefully soldered together, and the joint painted with waterproof paint or some equivalent.

When a railway return circuit is used for ground connection to a transformer, or to a bank of transformers where the secondaries are interconnected [illegible], the use of more than one ground is prohibited.

9. When a ground plate is used it shall consist of a No. 16 Stubbs' gauge copper plate with an area (two sides) of never less than 10 square feet, and must be increased proportionately when the capacity of the generator or transformer to which it is directly connected exceeds 500 amperes with about two feet of crushed coke or charcoal about pea size both under and over it, or in place of copper a cast iron plate of approximately the same area and at least one-half inch thick may be used. The joint between the plate and the ground wire should in all cases be soldered and thoroughly protected against corrosion by painting it with waterproof paint or some equivalent.

10. When driven pipes are used they shall be of iron and not less than one inch in diameter (preferably larger).

When used for the ground connections of central and sub-stations, and for a number of transformers, the area of the driven portion of the pipe must never be less than 20 square feet and must be increased proportionately when the capacity of the generator or transformer to which it is directly connected exceeds 500 amperes.

When used for the ground connection of individual services or for single transformers, the conductivity of the ground must be tested by blowing a two-ampere fuse at 110 volts, and the number, size or length of pipes increased until this occurs, when connection is made between the ground and a neighboring ground of any kind, or this test may be made by blowing the primary fuse in the transformer at the primary voltage.

11. In central and sub-stations and transformer installations of large size it is recommended that more than one ground wire be used, and that if ground plates or driven pipes are depended upon the area be materially increased.

62. Transformers. (For installation rules see Nos. 11, 13, 13A and 36.)

a. Must not be placed in any but metallic or other non-combustible cases.

b. Must be provided with a secondary neutral connection when designed for use on distributing systems exceeding 150 volts.

c. Must be constructed to comply with the following tests:

1. Shall be run for eight consecutive hours, etc.

2. The insulation of transformers when heated shall withstand, etc.

Consideration of the committee report on the grounding of secondaries was taken up at the afternoon session. The discussion was opened by H. B. Gear of Chicago, who did not see why the committee had recommended 150 volts instead of 250. By this rule a large number of consumers using 220-volt motors would be affected, as it would require rewiring them on the Y three-phase system. He also thought that No. 6 wire was amply large enough, electrically and mechanically, and fully as good as a No. 4 ground wire.

J. W. Cowles of Boston said that all new customers in Boston have grounded connections and the old ones are almost all so provided. Water-service grounds were used almost entirely and pipe and ground plates to only a small extent. The requirement of iron-pipe protections for ground wires was an excellent one, as practice showed that more satisfactory mechanical protection is needed than that afforded now in most cases. He found that the approved ground clamps without iron bolts were highly desirable.

Mr. Blood, in defending the finding of the committee, said that the limitation of voltage had been very carefully considered. With 200 volts death is liable to ensue. The new requirement takes care of all but one large and two small cities of the country. The greatest trouble with present grounds has been caused by mechanical injury. No. 4 wire was much stronger mechanically than No. 6 wire and was none too large. He therefore moved that the report of the committee be adopted as the standard practice of the association.

The motion was carried without a dissenting vote.

New Plan of Organization Proposed.

Henry L. Doherty of New York, past-president of the association, read the report of the committee on organization—a subject to which he has given much attention. Mr. Doherty said:

"Our present organizations have grown up more or less indiscriminately, and no comprehensive plan has ever been proposed for a thorough organization of the industry throughout the country. The problem of proper organization may at any time become one of vital importance, and it is greatly to be desired that the National Electric Light Association should be the basis for a complete organization of the entire business of the country before new organizations have been formed or before existing organizations can extend their scope of operations or inaugurate plans that will make the eventual consolidation of the central-station industry in one organization an impossibility."

Mr. Doherty then submitted a very elaborate plan of reorganizing the association, by changing the constitution, which may thus be very briefly summarized:

It is recommended that the constitution be changed to permit the formation of —

(1) Geographic Sections.—These sections will correspond to the present state or territorial organizations, and will represent new organizations to cover districts that now have no state or territorial organization.

[illegible]

[illegible] central-station work.

(4) [illegible]

(5) That exhibits be provided for, whereby electrical shows or exhibits may be held under the auspices of the National Electric Light Association.

(6) That contests be provided for, whereby the relative merits of competitive apparatus used in the central-station industry can be demonstrated under the direction of an impartial tribunal and by an organization of sufficient authority and prestige to make such contests well worth their expense.

Mr. Doherty presented a set of amendments and additions to the constitution designed to carry out his ideas.

After the reading of this report W. H. Blood, Jr., of Boston moved that the incoming administration appoint a committee on this subject to report to the next convention. He said the proposed changes were radical and should be carefully examined. This motion was amended, on motion of E. H. Davis of Williamsport, Pa., to have the committee appointed at once and instructed to report, if possible, to the present convention. The amended motion was carried and later in the afternoon the president appointed as this committee W. W. Freeman, Brooklyn, chairman; F. M. Tait, Dayton, Ohio; L. A. Ferguson, Chicago; W. H. Blood, Jr., Boston, and Arthur Williams, New York.

Power Development in Small Stations.

Charles Robbins of Pittsburg read the paper written by J. R. Bibbins of Pittsburg and himself on "Power Development in Small Stations." Following is an abstract:

The question of power rate is, and perhaps always will remain, a complex one. The subject has been thoroughly discussed at previous meetings, and it is not our intention to here advance suggestions as to what the power rate should be, but rather to show the influence of long-hour service as a factor in decreasing cost per kilowatt per hour.

To obtain a true idea of the cost of power in a central generating plant it is not sufficient to examine the average cost over a considerable period of changing loading; there should also be available two distinct sets of data, each reduced to the form of representative curves: (a) The hourly cost of fixed charges; (b) the hourly cost of operating expenses. From this information a composite curve may be drawn showing the cost for any hour of the day or night of each kilowatt generated at 100 per cent. loading factor. But, as commercial conditions are such that a 100 per cent. loading factor is in most stations unattainable, it is necessary to provide data showing the cost per hour of each kilowatt generated at various station load factors.

The authors show the application of this method in the study of a typical case, and conclude with some practical suggestions as to methods that will develop a central-station power load. Some of these suggestions follow.

An important step, and perhaps one of the most necessary, is to see that each power prospect is fully advised that you are ready to serve his requirements. This may be done by general advertising and personal solicitation, with the reasonable expectation that a high average of results will lead to a satisfactory load curve. Another method, and one that is used by manufacturers of other commodities, is to classify all the possible purchasers into related groups and then to plan a separate sales campaign adapted to each of the classified lists of prospects.

To adopt ordinary commercial methods to the sale of central-station power it is desirable to classify each prospect, not only in reference to related or similar lines of manufacture, but also as to the effect their power load will have upon the station load curve.

To some classes of power users the convenience and flexibility of central-station service far outweigh the question of economy, while to others the problem of cost of power is the first consideration. A study of each case will always place the solicitor in possession of the necessary facts, enabling him to approach the user from the point of view of the results that may be accomplished by the use of motors operated by central-station service.

Many instances have occurred where the desired operations could only have been accomplished by the use of an electric motor, the prime considera-

tion in these cases being the flexibility with which the operation of electric motors may be controlled. Automatic pumping is an excellent example; so also is the driving of the modern newspaper press. The overhead electric traveling crane and many other present methods of handling materials could not be so economically accomplished by any other means.

The problem that confronts the electrical manufacturers of today is, to a great extent, the proper selection of the right characteristics required of a motor and the method of controlling its operations together with the proper combination and operation of the electrical unit with the machines it is intended to drive.

Experience with the use of electrical motors and the results accomplished by their proper use has to a great extent revolutionized the design and productive capacity of machines used in present manufacturing processes. It is because of its intrinsic merit that the use of the electric motor has grown to such an enormous extent. It is also because those men who are combining the motor with many different types of machines are becoming familiar with the capability of a properly arranged unit, where due consideration is given to motor, controller and machine.

The practice of today is not simply to belt a motor to the line shaft or gear the motor to the machine, but it is to give the most minute consideration to the selection of the controller and its location, to the characteristics of the motor and the method of applying it, and to the effect the combination will have on the cost of the product.

The term "load factor" is one that is familiar to you all, and your experience is such that you know the average consumption in any given installation is an extremely variable quantity. It will vary with the kind of service and may be from five per cent. to 85 per cent. of the connected load. It depends upon several things—the proper selection of motor, the time of operation and the class of material being worked upon, or the service of the machine.

In some classes of work the load factor will be high if the machines are of the automatic type and the motors are properly selected. The load factor may be lowered or raised if the motors are not properly proportioned to the work. To make assurance doubly sure when considering motor drive, the time factor as well as the average load on the machine must be carefully considered. From these two elements an estimation may be made of the load time factor of any installation.

The most successful basis upon which a central-station company can develop power users is when its solicitors are in a position to show in all its advantages the resulting economy of the use of motors. As motors are the consuming power device, a better control might be had of the business should the management of the station undertake to sell the motors and install them ready for operation. They would then be able to advise with the consumer concerning the most desirable selection of units, the method of their control, and to assure the users the many advantages resulting from their use. Where the purchase and selection of motors are left to the consumer he may often fail to realize the benefits of your service to the fullest extent.

Many power consumers fail to understand the effect on cost that low load factors will have, and consequently need to be educated to a proper method of determining their power cost at the point of application and not, as is usually the case, from the engine indicator card.

In the discussion of the paper Mr. Dame of New York said that few power solicitors appreciated the importance of power factor in alternating-current work.

Harold Almert of Wichita, Kan., said that the manufacturing companies should assist the small central stations in planning campaigns for power business; they should not merely pick out the easy examples and leave the "tough nuts" to the local company. The load conditions of the customer should be investigated by actual test. In the case of a desirable customer the motor might possibly be furnished free. With less desirable but still fairly good load the motor might be furnished at half price; and so on.

Paul Spencer of Philadelphia called attention to the fact that practically every power installation is over-motored. He recommended that in some way a penalty be put on the size of the motor itself, so that it will be kept down to the smallest possible size. Mr. Hawks of Goshen, Ind., also spoke briefly.

A southern member, who created some amuse- [illegible] town of 2,500 [illegible] and that small [illegible] small [illegible] on our [illegible]

Mr. Crosby of Boston remarked that some in- [illegible]

"G E" meant "Get Everything." He suggested co-operation with the live electrical contractors of the town.

Design of Small Stations.

The excellent paper of J. T. Whittlesey of Newark, N. J., and Paul Spencer of Philadelphia on "The Small Station and Its Economical Operation" was then read by Mr. Whittlesey. The authors outlined a plan for a station in a city of 20,000 population or less. The paper was of practical value and will be presented in full in a later issue of the Western Electrician. It was discussed by C. M. Young, Columbus, Ga.; C. A. Howlett, Chicago; E. L. Brown, Elmwood, Ill.; T. W. McNamee, Wabash, Ind.; Mr. Almert, Wichita, Kan.; R. S. Searle, Rochester, N. Y.; John Campbell, Boston; E. F. McCabe, Lewistown, Pa.; W. G. Carroll, Beaumont, Tex., and Paul Spencer.

Question Box.

Alex. J. Campbell of New London, Conn., spoke about the Question Box of the National Electric Light Association. He recommended that the association publish a handbook and also urged that the publication of the Question Box should be continued in the monthly Bulletin. At the conclusion of the reading of the paper President Farrand spoke highly of the efficiency of Mr. Campbell's work as editor of the Question Box in the Bulletin. The recommendations were referred to the incoming administration.

Uniform Accounting.

H. M. Edwards of the New York Edison Company presented the report of the committee on a uniform system of accounting for electric-lighting companies. He said that the proportion of small companies is so great that uniformity in accounts can only be accomplished in essentials. He presented tentative classifications of expense and income accounts, too long to be given here. The main classification, however, is as follows:

Expense—Production, transmission, storage battery, distribution, municipal street lighting, commercial expense, new business, general.

Income—Sale of electric current, profit on merchandise, sales, rents from real estate, interest, and dividends from investment.

Mr. Edwards reported that since the last meeting of the association the public-service commissions of the state of New York had completed their organizations, and through their respective bureaus of statistics and accounts have been preparing a classification of accounts to be followed by all the companies within their jurisdictions. For the street-railway business the commissions have adopted the system of the Interstate Commerce Commision, but for the gas and electric-light industries they will formulate systems of their own. The accounting committee of the National Electric Light Association has kept in touch with this work of the commissions, has tendered its aid, and this aid the commissions have been good enough to accept and have consulted the committee on all features of their plan. Tentative classifications have been adopted by the commissions, and Mr. Edwards' committee desired the instruction of the association as to its attitude toward them.

J. B. McCall of Philadelphia thought the classifications of the New York public-service commissions so theoretical as to be impracticable. He would be sorry to see the state of New York adopt them, as it would be an unfortunate precedent, particularly burdensome to the small companies. Mr. McCall offered the following resolution:

"Resolved, That the association adopt the classification of expense and income accounts as proposed by the committee on uniform accounting as the association standard."

Mr. McCall explained that the adoption of the resolution did not necessarily mean that each company must adopt the classification for its own use, but rather that the committee's classification reflects the best thought of the association on the subject.

R. S. Searle of Rochester, N. Y., urged the adoption of the report. The Commission of the Second District of the State of New York is willing to receive suggestions and honest criticism on the accounts as arranged by its expert. It is important at this critical moment that the system of accounting, as adopted by the association, be adopted by the commissions of the state of New York.

Mr. McCall's motion was adopted unanimously. This sanctions the committee's classification. The further question of the relation of the association to the public-service commissions of the state of New York, in the matter of accounts, was discussed at the parallel session of Wednesday morning.

Concluding Business of Tuesday.

Secretary Freeman announced that additional letters of regret had been received from George Westinghouse, Pittsburg; Gen. G. H. Harries, Washington; P. G. Gossler, Montreal; L. H. Scherk, Birmingham, Ala., and S. J. Glass, Milwaukee.

The committee, with reference to the question of high tension, authorized previously, was announced [illegible] follows: Paul Spencer, Philadelphia; G. H. Lukes, Chicago; Dr. Charles P. Steinmetz, Schenectady; Ernest H. Davis, Williamsport, Pa., and I. E. Moultrop, Boston.

The secretary appointed as the committee on the president's address H. L. Doherty of New York, J. B. McCall of Philadelphia and Percy Ingalls of Newark, N. J.

Candlepower Standard.

A set of resolutions sent by Dr. A. E. Kennelly, secretary of a joint committee of the sub-committee of the American Institute of Electrical Engineers, American Gas Institute and the Illuminating Engineering Society on the question of the adoption of an international standard candle unit, was presented and read. There is a growing need of a common unit of candlepower for both electric and gas interests, and it is desirable to have such a standard international. The resolutions, in which the National Electric Light Association concurred, on motion of Arthur Williams of New York, approve of a common candlepower unit and refers the matter to the United States Bureau of Standards, to formulate a standard of about the average value of the government laboratory standards of the United States, Great Britain and France. No recommendation of the definite value of the candlepower standard is made.

Adjournment was then taken until Wednesday.

Entertainment Features of Tuesday.

In the afternoon the ladies were instructed and entertained by an illustrated lecture on "The Philosophy of the Cartoon," by John T. McCutcheon, the noted Chicago cartoonist, delivered at the Art Institute. The speaker said that at Purdue University he expected to become an electrical engineer, but having no gift for mathematics he turned his attention to drawing. He told how the cartoonist gets his ideas and illustrated his methods by drawing pictures, working with remarkable rapidity and ease. He closed by drawing clever portraits of several officers of the association, concluding with the picture of a lady (which many of the ladies present declared to be a portrait of Mrs. Insull) pointing to a large T. This was the signal that the lecture was at an end, for it was followed by a dainty five-o'clock tea. The occasion was greatly appreciated and enjoyed.

Both ladies and gentlemen were the guests of the association on the visit to White City on Tuesday evening. Special trains were provided on the South Side Elevated Railroad, and the visitors were supplied with little packets containing five-cent detachable coupons of the total value of one dollar for each person, in addition to the railroad tickets. These coupons were exchanged at the gate and at the various shows for tickets admitting the holder to any attraction on the grounds. The electrical men and their wives not only admired the electric-lighting display at White City, but enjoyed the County Fair, Scenic Railway, Social Whirl and other amusements to the utmost.

Wednesday's Proceedings.

The second day's session was opened at 10:10 a. m. The president announced that the parallel session of the accountants was scheduled to begin at 10:15 a. m. in the banquet hall on the sixth floor and asked Mr. Alex Dow, first vice-president, to take the chair so that he could address the other meeting.

Photometric Precision.

In the absence of the authors, Prof. A. E. Kennelly and Mr. S. E. Whiting, their paper on "Some Observations on Photometric Precision" was read by Preston S. Millar of New York.

The authors of this technical paper say that the literature of photometry contains very little on the precision of measurements made with one and the same photometer, or on the relative precision of measurements made with differernt types of photometer. It was their object to describe measurements, made by several observers, to determine the precision of four different types of photometer for one homochrome (and also for one heterochrome) pair of luminous intensities compared. The investigation was elaborate, and results are given in the form of tables. One of the conclusions is as follows: "It seems desirable to have the probable error either of a single balance, or of a corresponding single ratio of luminous intensity, determined and recorded with every important set of photometrical measurements. The probable error of any photometrist should be determined, recorded and compared both in homochrome and in heterochrome tests, at suitable intervals, when accurate work is expected from him."

J. B. Klumpp of Philadelphia opened the discussion by stating that the Bunsen photometer was the one most universally used in commercial work, and the proficiency readily obtained with it by any skilled operator is such that the average results are much better than those stated in the paper.

Mr. Millar admitted that this might be true. In fact, in some very recent experiments conducted at the Electrical Testing Laboratories, New York, the average error was only 0.4 per cent. with the

grease-spot photometer a record of accuracy much higher than the results given in the paper.

LOW-PRESSURE TURBINES

The paper on "Low-pressure Steam Turbines," by John W. Kirkland of Schenectady, was then read.

The purpose of this paper is to draw attention to an engineering scheme that will effect a remarkable gain in central-station capacity and economy without involving the abandonment of existing apparatus, and with a minimum of additional investment. The low-pressure turbine affords a means of increasing the capacity of existing central stations that are equipped with reciprocating engines, and of at the same time reducing coal consumption. Furthermore, the increased capacity will be in every case secured at a less capital cost than by installing additional high-pressure generating apparatus. These advantages are such as to warrant the serious consideration of low-pressure turbines in connection with plans for increasing the capacity or improving the economy of any engine-driven plant. In a great many instances these turbines will be found to offer the best solution of the particular engineering problem.

The reciprocating engine is a highly efficient apparatus for utilizing the available energy of steam between boiler pressure and atmospheric pressure; but for certain reasons it is a very inefficient apparatus for lower pressures. The steam turbine is, on the contrary, especially efficient when worked in the lower pressure range (below atmospheric). The combination, therefore, of a high-pressure engine exhausting first into a suitably proportioned turbine and the latter exhausting into a condenser affords as efficient means of utilizing the available energy of steam as can be designed. This system will improve the performance of many existing steam-engine stations that have heretofore been uneconomical to such an extent as to make them compare to advantage with many more modern and larger stations. While the best net economy of a combination of engine and turbine will naturally be gained when the engines used are most efficient, the gain by the use of low-pressure turbines will be such as to produce very satisfactory saving in connection with engines of poor economy. The possible gain in capacity is greater with inefficient engines than with more efficient; therefore instances can easily be foreseen where it will even be advantageous to produce artificially uneconomical conditions in an engine (by altering valve setting) so that it will pass an excess of steam to be utilized by a low-pressure turbine for the sake of extra peak capacity.

Since the place of the low-pressure turbine is between the engine exhaust and a condenser, it may be considered as an improved method of compounding. It most satisfactorily secures the economies sought for by a multiplication of cylinders as in triple and quadruple-expansion engines.

Curves of performance are given. It is stated that by compounding a good existing engine with a low-pressure turbine a gain of about 50 per cent. is effected in steam economy. This is to be compared with 25 per cent., which is generally accepted as the maximum gain possible by simply taking the steam from a compound engine into a condenser in which a 28-inch vacuum is maintained. The first cost of the additional peak capacity secured by low-pressure turbines is much less than that involved by additional high-pressure generating apparatus. Several existing installations are mentioned, one at the Thirteenth and Mount Vernon Street plant of the Philadelphia Rapid Transit Company.

W. S. Barstow of Portland, Ore., started the discussion of the paper by stating that the majority of condensing-engine plants are now running at a maximum vacuum of 25 to 26 inches mercury, while the low-pressure turbine requires a much higher vacuum to give its best results. Therefore new condensing equipment must be included in the investment for such turbines in practically all cases. There are many plants, however, that could be materially improved by the addition of low-pressure turbines. He cited a case of a cement plant in Virginia where a stream running some three-fourths of a mile around the plant was tapped in such a way as to act as a cooling tower. The use of low-pressure turbines is a condensing proposition entirely. If condensing equipment cannot be provided, the non-condensing steam engine will remain without the turbine adjunct.

W. L. R. Emmet of Schenectady agreed with Mr. Barstow as to the necessity of condensers, but thought that condensing equipment could be installed with resultant economy in more cases than is generally believed. At the Fisk Street station power is produced on the largest scale and at the lowest cost anywhere. High-pressure steam turbines run with best results in the large sizes. Small turbines of this type would give equal economy if run at very high speed, too high for driving electric generators. Low-pressure turbines do not vary much in economy whether in large or small sizes. Consequently engines can always be improved by the addition of low-pressure turbines. Increase of vacuum pays for all steam-turbine work on account of the increased economy attainable. Mr. Emmet cited the [illegible] units, obtained largely by building sub-base condensers [illegible]

[illegible] will exhaust into low-pressure turbines.

J. R. Bibbins [illegible] increase of output was obtained by the use of low-pressure turbines than the instances given in the paper. He spoke of the conditions prevailing in rolling-mill work. The direct connection of the turbine and condenser referred to by Mr. Emmet was being carried out successfully in the many double-deck plants now being put in.

A delegate from Montreal declared that in his belief steam engines would be employed for a great many years to come, notwithstanding the prophecies to the contrary. He asked about the cost of the plant in Virginia.

Mr. Barstow said the cost of the tunnel alone was $18,000, but that the total cost of the added equipment was about $55,000 less than it would have been if additional boilers and engines had been provided.

GAS ENGINES

W. C. L. Eglin of Philadelphia next read, in abstract, the exhaustive "Report of the Committee on Gas Engines." An abstract is given elsewhere in this issue.

A large number of lantern-slide views were shown illustrating details of various American-built engines.

Prof. C. E. Lucke of New York opened the discussion. He said the gas engine is as reliable and economical a prime mover as any in use. It is not to be considered as the universal power producer of the immediate future. In certain fields it has marked advantages. In general, a gas-engine installation does not vary as much with size in cost per horsepower as is true with steam engines. Hence in large plants a gas-engine installation cannot be expected to operate as economically as its steam-engine rival, but in small plants undoubted economy results from its use. A point of importance not to be overlooked is the readiness with which gas engines can be started and stopped; they can generally be started and put under load inside of one minute. This makes it particularly advantageous to use small units and run them at maximum efficiency.

J. R. Bibbins of Pittsburg stated that American gas engines do not have the refinements of European machines, as the aim here has been simplicity of construction. The rating of American engines has been very conservative. Troubles from back-firing are not serious. Attention was called to the great range in the quality of gas that is used successfully, this running from 85 to 2,000 British thermal units in heating value. Producer plants should be perfected so as to run continuously. Various things must be brought about to permit this, such as automatic removal of ashes, perfection of scrubbers, etc. Gas holders are generally undesirable except to insure a uniform quality of gas rather than to hold a reserve supply. Repairs in well-installed and properly operated plants are now very small and the outages likewise, thus resulting in practically continuous operation.

Arthur S. Ives of Poughkeepsie, N. Y., declared that the question of coal economy was not of paramount importance compared with that of depreciation and antiquation. This fact should be borne in mind when considering the relative advantages of gas engines.

H. Almert of Wichita stated that operating success with gas engines varies greatly in different places, due to the sources from which the gas is obtained as well as the personnel of the operating force. He has found that steam engineers generally do not seem to know how to operate a gas-engine plant properly. The high efficiency attained with the internal-combustion engine in Europe should force more attention to this prime mover by engineers here. A great many features of the gas engine and gas producer bear investigation further, and he therefore urged the continuance of the committee.

Mr. Freund of the Illinois Steel Company, Chicago, said simplification of gas engines has been carried too far in this country to obtain the many marked advantages to be derived from slight complications that have been very successfully introduced in Europe. He spoke of a number of markedly satisfactory plants in Germany, and was convinced that the gas engine was the power of the future, notwithstanding that in performance it will have to compete with the best steam engines and steam turbines.

Mr. Davis, of Allis-Chalmers Company, Milwaukee, stated that stratification method was used because results in Europe indicated this to be best. Where lean gases are used back-firing has been frequently stopped by adding a little larger proportion of air.

Participating briefly in the discussion were Dr. Steinmetz and Messrs. W. L. R. Emmet, J. R. Bibbins, [illegible] and others. Points brought out were that simplification [illegible] engineers are necessary from the gas production to [illegible] the highest salaries to get the advantages in economy possessed by the gas engine. This is particularly true in small plants. It had been found frequently that better results could be obtained from teaching an ordinary skilled machinist how to run the entire producer and engine plant than from the employment of an expert steam engineer.

METERS

The next number on the programme was the reading of the report of the committee on meters. It was presented in abstract by its chairman, Louis A. Ferguson. The conclusion of the report is at follows:

"Your committee cannot urge too strongly the very great importance of thorough study and vigorous attention on the part of each company to the entire subject of metering. From the viewpoint of first cost, the meter forms a very large part of the total investment for each of the many very small consumers. From the viewpoint of operating expense, the care, maintenance and reading of the meter and billing is a large part of the expense for these same very small consumers. From the viewpoint of income, an average difference of a very few per cent. on the whole output of any one company is a very serious matter, indeed, all of which indicates that the complexity and importance of this matter is such as to require judicious and expert attention from every company.

"Your committee further believes that the association should take up at once the matter of meter-regulating ordinances which might serve as a basis for member companies, to the end that such ordinances when and where enacted be uniformly just and equitable to the consumer and to the public."

The discussion was conducted briefly by Messrs. George A. Sawin, O. J. Bushnell, Alex Dow, Louis A. Ferguson and others. The features emphasized were that meters should be tested in service position, as otherwise there was no way of telling just what they were doing under actual service conditions. The effect of temperature variation alone was so marked that laboratory or shop tests are not to be ultimately depended upon.

The morning session adjourned shortly after one o'clock.

ACCOUNTANTS' PARALLEL SESSION.

An experiment was tried at this convention in the holding of special or parallel sessions at the same time the regular sessions were in progress. The first of these was held on Wednesday morning in the banquet room on the sixth floor of the hotel and was devoted to the subject of uniform accounting, with special reference to the classification of accounts as proposed by the public-service commissions in New York state and elsewhere. H. M. Edwards of New York, chairman of the committee on uniform accounting, presided. President Farrand opened the meeting with a few words explaining its object.

Mr. Edwards abstracted a paper by Professor Adams of the Interstate Commerce Commission, which showed the reason why the government wanted a universal system of accounts in effect with the steam-railroad companies. One of the principal motives was shown to be the placing of responsibility on one person in a corporation as to the propriety of all the entries in the books. This paper also went to show about how far back corporate bodies were created, and some instances were cited so as to indicate that such organizations were in existence in the sixteenth century.

After this paper was finished the chairman stated that the subject was open for discussion, and quite a number took part in it, among them Messrs. Young, Carter, Freeman, Mathes, Dame, Fisk, Wallace, Little, Sweet and Thos. N. McCarter. Mr. McCarter, who is president of the Public Service Corporation of Newark, N. J., cited his experiences at Washington in connection with street railways, he having spent several days going into the details, and he gave his hearers the impression that neither Professor Adams nor the commission itself wished to lay down any hard and fast rule, but gradually came to the way of thinking of those materially interested. He encouraged those present by saying that he thought the same experience regarding the electric-light companies and the state commissions would be encountered.

The question of depreciation was shown to be an all-important one, and one to be agreed upon between the state commissions and the electric-light companies, and it developed that it seemed impossible to fix any rate as a method of depreciation, but it was generally believed that it should be left to each company to take care of its own depreciation, as no two companies with the same local conditions exist.

Mr. Wallace of Boston suggested that the members present might state their opinions as to the methods of depreciation that were employed. This

brought forth several statements, which further showed that there is no fixed rule of depreciation.

It was generally agreed that the tentative scheme of accounts, as prepared by the New York Public Service Commission, Second District, would create a great deal of unnecessary expense.

Wednesday's Entertainments.

The ladies' tour of inspection of Marshall Field & Co.'s store took place on Wednesday forenoon. Trained young-lady guides met the visitors and escorted them through the large establishment in parties of ten, explaining the various features of interest. An elaborate luncheon was served in the South Grill Room at noon. Mrs. Louis A. Ferguson, whose husband was chairman of the entertainment committee, was present, and received many congratulations on the success of this and all other features of the entertainment programme.

There was no convention session on Wednesday afternoon, and the men were taken on a visit of inspection to the Fisk Street station of the Commonwealth Edison Company. Special street cars were provided, and Mr. Samuel Insull, president of the company, was waiting at the door of the great power house to greet the first installment of his guests, who were piloted from the hotel by Mr. Louis A. Ferguson, second vice-president of the company, with a party of officers of the association, in an automobile.

"Fisk Street" has been often described—several times in the Western Electrician, the most recent article appearing only last week—but it has to be seen to appreciate its magnitude, its thorough and complete equipment, its massive beauty and its airiness and cleanliness. It is the first and largest steam-turbine power plant in the world and withal the most economically operated. Handsome souvenir booklets were handed to the guests on entering, and the gentlemen were taken through the boiler and turbine rooms of the main power house and then conducted through the switch house, the route leading to a large tent on the grounds, where a bountiful collation was served. A fire drill was given for the benefit of the visitors, who departed with the heartiest expressions of admiration for the appointments of the great 100,000-kilowatt plant and for the enterprise and acumen of the men who guide the destinies of the company which owns it.

Street Lighting by Tungsten Lamps.

At Wednesday evening's session the first feature was the reading (in abstract) of the paper on "Series Incandescent Systems with Tungsten Lamps," by P. D. Wagoner of Schenectady. Dr. C. P. Steinmetz and others discussed the paper.

Only in recent years has the development of the Gem high-efficiency unit at 2.7 watts per candle and the tungsten lamp at 1.25 watts per candle placed the series incandescent system on a basis to compete effectively with other systems of street illumination.

Indications of most satisfactory tungsten life have been obtained in actual practice; for example, in one installation of 172 lamps an average life per lamp of 1,350 hours has been obtained. A test conducted on 18 lamps of this type resulted in 12 lamps running over 2,000 hours without breakage or perceptible decrease in efficiency. It therefore would seem reasonable to expect an average life of 1,500 hours at 1.25 watts per candle. The initial of efficiency seems to be maintained pretty generally throughout the life of the lamps, while with the carbon lamp it decreases from 25 to 50 per cent.

The series incandescent system with tungsten lamps makes possible, satisfactory and uniform illumination of sections that, on account of cost, would otherwise be indifferently illuminated with arcs placed a considerable distance apart or left entirely without artificial illumination.

Generally speaking, there are two types of street lighting—the one employing a lighting unit of high candlepower and the other a unit of low candlepower. Each of these systems has its proper field, and it is difficult to define where the field of the arc ceases and the incandescent begins, for between the two extremes there is a field of indefinable limits, the lighting of which is dependent upon local conditions. Certain localities require illumination of high intensity—for instance, the business center of a city—and for this purpose the electric arc is best adapted. On the other hand, there are sections of a city, such as alleys, residence and [illegible] districts, which may be more or less [illegible], and where the houses may be a considerable distance from the street, where the arc is not the ideal illuminant. Should a unit of high candlepower, such as the arc, be used in such a locality, the cost of illumination would be such as to necessitate a wide spacing of the lamps, resulting in illumination of widely varying intensity. It is in such places that the use of the tungsten lighting unit becomes important—in fact, a necessity. The introduction of the tungsten lamp permits of increasing the intensity of uniform illumination of such an installation without increasing the [illegible] filament lamps. The practical operation of such a system is simplicity itself, as the arcs for high [illegible]

The arc lamp is well adapted to streets requiring a sufficiently high intensity of illumination to permit of their being spaced at comparatively short intervals.

The incandescent lamp is best adapted to streets requiring a lower intensity, where arc lamps to compete economically would have to be placed so far apart that the intervening space would be practically unlighted, though an unnecessary intensity would be provided in the immediate vicinity of the lamps.

In the case of an arc lamp hung in the middle of a 30-foot suburban road, its rays of maximum intensity being (in case of the magnetite or luminous arc) about 10 degrees below the horizontal, a large portion of the light will be wasted beyond the fences in the surrounding fields, where it is of no value whatever.

The lighting of intermediate districts between the principal business districts and the outlying districts depends upon local conditions. In the residential section of cities having wide streets and long blocks it may be found economical to place arc lamps at intersections of the streets and light the intervening spaces by incandescent lamps.

Various arrangements for the suspension of street lamps have been devised. The ideal arrangement is to suspend the lamp in the center of the street, though this is seldom practical. More often the poles are placed on one side of the street or an equal distance apart diagonally across the street; the lamps themselves being suspended by a suitable bracket attached to the pole so as to project several feet over the edge of the curb, minimizing the shadows from foliage, etc. This arrangement is not practicable with the ordinary Welsbach street lamp.

As to the height of suspension, this depends to some extent upon the intrinsic brilliancy of the unit and the distance between units. In the carbon-filament lamp the height is usually from 10 to 12 feet, but with the tungsten, where the higher candlepower will be more popular, it should be higher, probably from 15 to 18 feet. In all cases the lamps should be suspended at such a distance above the sidewalk or roadway as to avoid the rays shining directly in the eyes of a person approaching, but not so high that tree foliage will intercept the light rays.

Executive Session.

The report of the secretary and treasurer and executive committee was made by W. W. Freeman of Brooklyn at the Wednesday evening meeting, which was an executive session. Although the expense of the last year was heavy, the association is in excellent financial condition. Sixty-three new members have already been admitted this year and other applications are on hand to be considered. Invitations were read from commercial and trade bodies in Buffalo, Columbus and Seattle as places for the 1909 meeting.

Insurance Report.

W. H. Blood, Jr., of Boston, insurance expert for the association, read his report. Mr. Blood has already accomplished work of great value for the good of the member companies, and the feeling between the Underwriters and the association has been made more harmonious. But some of the rules promulgated in the interest of safety from fire are perhaps unnecessary and tend to decrease the use and popularity of electricity. These need to be modified. A committee consisting of Mr. Blood, three representatives of the Underwriters and one from the electrical contractors is now at work and may rearrange the entire National Electrical Code. Most plans of co-operative insurance have failed in their purpose; however, the principles of the plan originated by Mr. Staats of Cleveland have much merit. There was a brief discussion of the report and Mr. Blood was complimented for his effective efforts in the interest of the lighting companies.

Public Policy.

Great interest centered in the report of the committee on public policy presented Wednesday evening. In the discussion the members were treated to a flow of oratory which conveyed the reasoning of some of the best minds in the association.

Arthur Williams of New York, chairman of the committee, arose to make the report, but he saw fit to request Mr. Samuel Insull to make the report. There was prolonged and earnest applause as Mr. Insull took the stand. Mr. Insull chose to preface the report with a few general remarks, in which he included reference to the Chicago situation. He said the traction settlement ordinances now in force in this city are the best in the country as alike protecting the interests of the companies, the people and the city. Mr. Insull showed clearly the injustice being done public-service corporations in comparison with other large private industries by the agitation for unreasonable public regulation and control. The municipal-ownership craze is waning through the experience of many of these ventures. But the general public still favors closer regulation, and under the circumstances it may be better to welcome an authoritative, business-like and expert legislative controlling body.

Mr. Insull then read the report. The more important work undertaken by the committee during the last year consists of a comparative codification and analysis of the three public-service statutes of those states now having public-service commissions—Massachusetts, New York and Wisconsin. This has been done under the personal direction of the secretary of the committee, Mr. W. H. Gardiner, whose report to the committee was presented to the convention in connection with the main report. The committee's report says that at present the drift of public opinion seems favorable to closer regulation and control of public-service corporations occupying non-competitive fields. Each company must decide for itself and must be guided by local conditions, yet where this tendency is active it will undoubtedly be found desirable to co-operate with the legislative authorities in securing public-service measures which, fair to the public at large, will also adequately safeguard the interests of the corporations.

It cannot be denied, the report says, that where companies occupy a given territory exclusively, the feeling is almost inevitable on the part of the public that for the utility desired, whether in the nature of a necessity or luxury, the public is "in the power" of the corporation. Where this feeling exists a spirit of resentment is bound to follow, which, many times unfair on the part of the public, is no less harmful to the corporation. "Our opinion is that in matters of this kind the material interests of the corporations are conserved by having an authoritative body, standing high in the community, before which any cause for dissatisfaction may be placed and from which a fair expert and decisive answer may be received."

The report is an exhaustive one and contained much of value to the members. The committee consisted of Arthur Williams (chairman), New York; Everett W. Burdett, Boston; Walton Clark, Philadelphia; Henry L. Doherty, New York; Alex Dow, Detroit; Samuel Insull, Chicago; J. W. Lieb, Jr., New York; Joseph B. McCall, Philadelphia; Samuel Scovil, Cleveland, and Charles L. Edgar, Boston. W. H. Gardiner, New York, is the secretary, to whom the committee gives credit for his faithful work.

The discussion of the report was enthusiastic and participated in by some of the leading men of the association. Thos. N. McCarter, president of the Public Service Corporation of New Jersey, did not sanction some of the recommendations of the report and he expressed the views of his company eloquently and forcefully. Henry L. Doherty and Alex Dow also made excellent addresses, and Mr. Insull closed the discussion with an instructive and interesting speech. The association then adopted the report.

High-efficiency Lamps.

The paper of W. W. Freeman entitled, "The Status and Commercial Possibilities of High-efficiency Lamps," was read in abstract by the author. Because of the late hour discussion of this paper, and also the reading of the report of the committee on rates and costs, of which R. S. Hale is chairman, was put over to a later session.

Mr. Freeman's able and valuable paper will be published in full in the Western Electrician. The first part is given elsewhere in this issue.

[The conclusion of the report of the convention will be given in the Western Electrician next week.]

Convention Notes.

The shocking death of Mr. R. C. P. Holmes, as mentioned elsewhere, cast a gloom over the last two days of the convention.

An enthusiastic and well-attended rejuvenation of the Sons of Jove was held in the banquet room of the Auditorium on Wednesday evening.

The wide geographical classification of the delegates was noticeable. Men were present from Maine to Oregon and from Minnesota to Texas.

A special train brought 108 visitors from New York and other eastern points, arriving in Chicago on Monday morning. It was in charge of George F. Porter, master of transportation, who reported a pleasant journey.

Mr. Ferguson's able and obliging lieutenants on the entertainment committee, Messrs. J. J. Schayer, E. A. Edkins, O. R. Hogue and W. H. Ott of the Commonwealth Edison Company, were among the hardest worked men at the convention. But they were always courteous and attentive.

Mr. F. H. Gale, chairman of the exhibition committee, says that much of the credit for the arrangement and success of the display should be given to Mr. H. E. Niesz, local member of the committee, who was indefatigable in his efforts to have everything ready for the opening night. A word of praise is also due Mr. C. A. Tupper of

Milwaukee for his faithful performance of the arduous task of installing and removing exhibits.

Before the opening of the convention on Tuesday a picture of the delegates seated in Assembly Hall was taken for the Convention Daily. It was an "electric photograph," not a flashlight. The extra light was provided by two open arcs held by two attendants. A few seconds' exposure was necessary.

Grand Rapids Electrical Show.

The Grand Rapids Electrical Show was held during the week beginning May 11th. The attendance was excellent, and Mr. A. D. Rathbone, treasurer of the Electrical Show Association, was well pleased with the outcome, and is already looking forward to next year, when he can give the people of Grand Rapids a more elaborate exposition. The show was held in one of the large display rooms of the Furniture Exhibition Building. One of the noticeable features was that the exhibits were to a great extent made up of home products. The [illegible]

[illegible] incandescent lamps were used.

An interesting feature of the show was the electrical sign display of the Neuman Electrical Sign Company of Grand Rapids, Mich. This display occupied the entire east wall of the exposition building, and consisted of electrical signs of all descriptions. Several of the larger signs were operated by flashers. In this display alone over 2,000 incandescent lamps were used.

The display of the Fort Wayne Electric Works, in charge of A. L. Searles, manager of the Grand Rapids office, included a number of 30-cycle induction motors, the [illegible] Grand Rapids-Muskegon Power Company. The also showed eight and 10-inch fan motors, etc. The Grand Rapids Electric Company being the agent for the Fort Wayne motor, also occupied this booth and exhibited other Fort Wayne apparatus.

Among the other exhibits was seen, carefully preserved in a glass case, in the booth of the Michigan State Telephone Company, the first and original telephone used in Michigan. It was presented [illegible]

always attracted a throng. The Bryan-Marsh Com- [illegible]

[illegible] and exhibitors for their hearty support. Of the Electrical Show Association, M. B. Wheeler is president, A. D. Rathbone treasurer and W. J. Fenton secretary. The Furniture City Orchestra rendered many good selections, both morning, afternoon and evening.

The Western Electrician was the only electrical journal making an exhibit at the show.

Fostoria Lamp Company. Collective Exhibit of the M. B. Wheeler Electric Company.
Another View of the M. B. Wheeler Exhibit. Rathbone-Panigot Company's Electric Fireplaces.

EXHIBITS AT THE GRAND RAPIDS ELECTRICAL SHOW.

management had electric fans and ventilators installed at every available place throughout the room, and succeeded in keeping the air pure and in motion, which added much to the comfort of the visitors.

A striking decoration was that of Pearl Street, where, for several blocks, festoons of incandescent lights were strung. These festoons led to the main entrance, and branching off on the side streets were hung arches of incandescent lights, crossing the street, at intervals of 30 feet. The slogan was "Follow the Lights to the Electrical Show."

The Grand Rapids-Muskegon Power Company's exhibit consisted of an electrical house of seven rooms. In the dining room lunch was served beneath a beautiful fixture dome, and the whole house was electrically equipped.

The Adams & Hart Company of Grand Rapids exhibited a Babcock electric phaeton, which was much admired.

The Citizens' Telephone Company had a set of automatic telephone apparatus on exhibition which was capable of operating 50 telephones. With this it demonstrated the principle upon which the automatic telephone is worked.

The exhibit of the Fostoria Lamp Company made one of the brightest booths of the show. Hanging from the draped ceiling were 30 tungsten lamps, ranging in capacity from 40 to 100 watts. The photograph of the booth was taken with less than a 30-second exposure, without the aid of any other light than the tungsten lamps themselves. There was also exhibited in this booth a line of Conneaut tungsten illuminiers of various sizes, fitted with Holophane bowl reflectors.

The International Correspondence Schools of Scranton, Pa., had an attractive booth, displaying the bound volumes of its various courses of instruction. Each afternoon and evening there was a student at work on a mechanical-drawing course, which is an essential feature of any engineering course.

by Professor Bell to J. M. Converse of Boston. The instrument was afterward brought to Grand Rapids.

Erwin & Co. of Chicago exhibited their modern method of water supply, which is operated and automatically controlled by electricity. The exhibit showed four types of electric pumps in running order. O. R. Erwin and Henry Erwin were in charge of this exhibit.

The Grand Rapids Railway Company exhibited all the different types of rails in use in Grand Rapids, together with cross-section of pavement and rail, just as laid in the streets.

The Holophane Glass Company's exhibit consisted of several new productions in that well-known line, including the new tungsten luminiers. Several other exhibitors, including the Fostoria and Bryan-Marsh companies, also showed a line of Holophane shades.

The exhibit of six electric fireplaces manufactured by the Rathbone-Panigot Company of Grand Rapids, was attractive and created much interest. The manufacturer says that this electric fireplace can be operated at a cost of three cents an hour. Heat is diffused from the luminous radiators in the fireplace. Owing to the low cost of maintenance and the fact that there are no offensive fumes or dirt such as are caused by coal or gas grates, the electric fireplace bids fair to become popular. This fireplace was exhibited by the General Electric Company at the Chicago Electrical Show of last January.

The exhibit of the M. B. Wheeler Electric Company of Grand Rapids was a large one, including the varied electrical appliances that the company handles and the specialties of a number of the companies that it represents. The Clark Wireless Telegraph Company showed one of its standard sending stations, such as are used on the Great Lakes stations. This exhibit at all times created a great deal of comment, and was in charge of a special attendant. The Kewanee Water Supply Company had in active operation one of its country-home water-pumping equipments, demonstrated by

Storage Reservoirs to Prevent Floods and Aid Navigation.

A plan has been proposed to stop forever the costly spring floods at Pittsburg and other places along the rivers which drain the Appalachian Mountains. All the efforts of the government with dams, restraining walls and other engineering works have proved inadequate to control the streams when they have been swollen with the melting winter snows. On the other hand, the government projects have proved unavailing to maintain the same rivers at a depth great enough to permit unhampered navigation later on in the year, when the flood waters have spent themselves.

It is now proposed to go to the headwaters of the rivers and apply there two remedies: First, the maintenance of a forest cover which will keep the ground porous so that it will not shed all the water from its surface at once but will soak it up and release it gradually; second, to establish storage reservoirs at strategic points which will retain surplus flow when it is not useful but only does damage by being allowed to run free, and will pay it out little by little later on when it is sorely needed.

Experts from the Geological Survey, with the storage reservoir scheme in mind, have made a careful study of the rivers which flow from both sides of this watershed. The results of this study are published under the title "The Relation of the Southern Appalachian Mountains to Inland Water Navigation," as circular 143 of the Forest Service, and can be obtained free by writing to the forester at Washington.

An Edison Lamp Improvement Made Public.

A newspaper dispatch from Pittsburg says that in an opinion handed down a few days ago in the United States Circuit Court, Western District of Pennsylvania, Judge Buffington finds a patent issued to Thomas A. Edison on January 13, 1901, which resulted in great economy in the manufacture of incandescent lamps to have been void, and directs that a decree be drawn for the dismissal of a suit in equity brought by the Edison Electric Light Company against the Novelty Incandescent Lamp Company of Emporium, Pa.

Platinum, which has a coefficient of expansion nearly the same as that of glass, has been the only substance discovered by which the electric current can be led into the bulb through the glass seal without destroying the vacuum.

Mr. Edison made a bulb with two copper-platina joints within the seal, although it was previously thought that this arrangement would affect the vacuum. In his decision Judge Buffington finds that, although this was a valuable correction to the false notion prevailing, it was mechanical rather than inventive in character. The General Electric Company manufactures the incandescent lamps patented by the Edison Electric Light Company, which was the plaintiff in this suit for infringement. The Novelty Incandescent Lamp Company of Emporium, Pa., which is an independent organization, claims this as a decided victory.

Mr. Ferguson Elected President of the Institute.

Mr. Louis A. Ferguson, the directors' nominee, was declared elected president of the American Institute of Electrical Engineers by an almost unanimous vote at the annual meeting, held in New York on May 19th. Mr. Ferguson is second vice-president of the Commonwealth Edison Company, Chicago, and past-president of the National Electric Light Association and of the Association of Edison Illuminating Companies. His standing in the engineering profession, particularly in central-station circles, is of the highest, and he is as well known also as a capable man of business. The announcement was made during the Chicago convention of the National Electric Light Association, and was received with much enthusiasm.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker.

Part VIII.

The Test Room (Continued)

[illegible] For testing meters and instruments in the test room some kind of laboratory switchboard or testing rack is needed. The switchboard usually consists of a structure of wood, or of iron or brass and slate, comprising lamp-bank frame and meter bench.

For small companies, the board may consist of a simple wooden table or rack equipped with binding-post terminals, and switches for making testing connections, and arranged to take two or three meters at a time. For larger companies, where a considerable number of meters have to be tested daily, the board may become very large and elaborate, approximating in arrangement the testing switchboards that are employed in the testing and calibrating department of a large meter-manufacturing company.

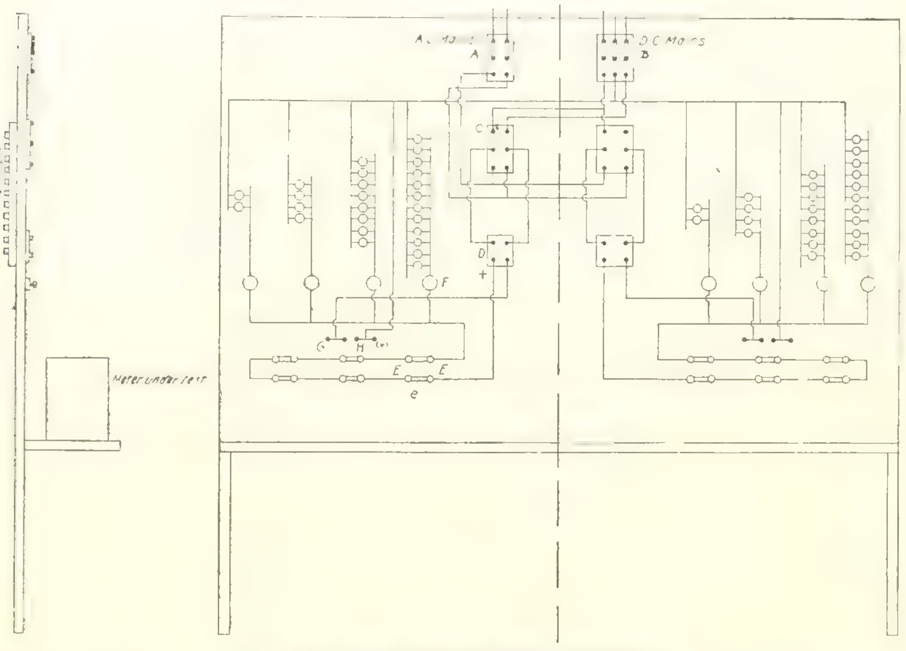


FIG. 9. ONE FORM OF TESTING RACK FOR METERS.

Fig. 9 is a drawing (front and side elevations), showing the construction, equipment and wiring of one form of testing rack, adapted for testing alternating-current and direct-current meters. This testing rack is double in arrangement; i. e., is divided into two similar parts controlled from the same main switches. The arrangement of apparatus comprises a double-pole, single-throw main switch (A) with fuses, and a triple-pole, single-throw main switch (B) with fuses, through which alternating current and direct current, respectively, are led to the board.

Considering now the left-hand side of the board, (C) is a double-pole, double-throw switch connected to the above main switches and to the quick-break switch (D), as shown, for throwing either 110-volt and 220-volt alternating current or 110-volt and 220-volt direct current on to the wiring of the board through the last-mentioned switch. The grounded neutral of the three-wire alternating and direct-current systems is not carried through the switches, but is wired solid to one side of [illegible] of lamps in the lamp bank, and to potential binding-posts (H), as to be described. The main circuit from the left-hand side of (D) goes through the six pairs of current binding-posts (E), which serve as terminals for the series fields [illegible] for measuring the load current; the pairs which are not in use to cut in a meter under test or to cut in the ammeter being connected across by copper [illegible]

snap switches (F) for connecting the lamp bank load on the meter or meters under test.

The right-hand side of the quick-break switch (D) is connected (through a three-ampere fuse plug) to a pair of potential binding-posts (G), which, with the pair (H), connected with the neutral (also through a three-ampere fuse), serve as voltage terminals for the meters under test and for the testing voltmeter; there being 110 volts between binding-posts (G) and binding-posts (H) or between binding-posts (H) and current binding-posts (E), and 220 volts between (G) and (E).

This arrangement, duplicated for the right-hand side of the rack, as shown, makes a convenient [illegible] three-wire systems laboratory testing board for a medium-sized central-station system. All switchboard wiring carrying load current is heavy, in order to eliminate appreciable fall of potential, especially in the wiring between the current binding-posts. The bench, or shelf, provides room for several meters and for instruments and tools. The lamp banks are mounted back of the board, as shown, to get the glare out of the eyes of the meter testers and to leave the front of the board clear for mounting meters that cannot be accommodated on the bench.

For the sake of making a clearer diagram, only a part of the equipment of the testing board is shown in Fig. 9. The actual board from which the foregoing description was prepared contains a total of 16 pairs of current binding-posts and 22 individual groups of lamps, each controlled by a snap switch, whereby any desired load, from a single eight-candlepower lamp up to over a hundred amperes, may be put in circuit with the meter or meters under test. To obtain heavier loads a current transformer or a storage battery may be used, for testing alternating-current and direct-current meters respectively, as described elsewhere.

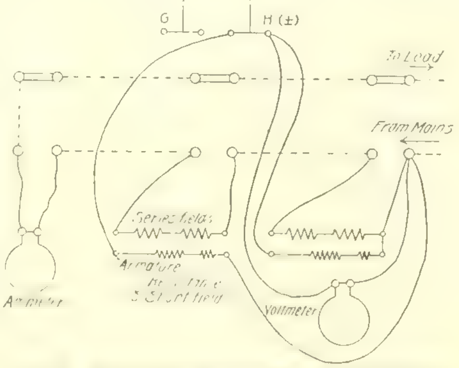


FIG. 10. DIAGRAM OF CONNECTIONS FOR TESTING METERS.

In the side elevation in Fig. 9 is indicated a meter placed on the testing bench ready for connection to mains and load for testing. The diagram, Fig. 10, shows the current and potential binding-posts on the left-hand side of the board, with a couple of meters connected for testing with indicating instruments, consisting of voltmeter and self-contained ammeter. This diagram should be compared with Fig. 9, of which it is a detail. Note that the voltmeter is connected so as to indicate the true voltage impressed upon the meters under test, while the ammeter is cut in between the meters and the load.

It is to be noted that in testing direct-current service meters at the laboratory the armature circuits should be connected to the source of potential for at least 20 minutes before beginning the test for calibration, in order that its temperature may reach a constant value; otherwise, "heating losses" will be introduced. This procedure is of course unnecessary in testing a meter at its place of installation, where the armature circuit is permanently bridged across the supply mains.

[To be continued.]

Southwestern Electrical and Gas Association.

The Southwestern Electrical and Gas Association has been unusually active during the last year. At its recent convention in El Paso, Tex., the fourth annual meeting, 36 new companies were admitted to membership. For this and other excellent work performed for the association the officers and committees received the hearty thanks of the members.

The sessions of the fourth annual convention were held in the St. Regis Hotel, May 7th, 8th and 9th, and there was an attendance of 140, the largest in the association's history. President H. T. Edgar of Fort Worth, whose energetic efforts for the good of the association are appreciated by all the members, called the meeting to order on Thursday morning, and with a few pleasing words introduced Joseph U. Sweeney, mayor of El Paso, who welcomed the delegates.

R. B. STICHTER,
President Southwestern Electrical and Gas Association.

In responding to the address of welcome, Col. H. S. Cooper of Galveston, on behalf of the association, extended thanks for the friendly attitude of the city of El Paso, expressed by its mayor. He said that it was gratifying to know that El Paso was one of the cities which had learned that the delegates to the convention were not the enemies of the state and of good citizenship, even though most of them represented corporations. Getting down to business, the association passed favorably on the application of 36 new members.

President Edgar's Address.

In the annual address President Edgar gave a resumé of the work done during the last year and made recommendations for the good of the association. He said that the most important incident of the last year of interest to the association was the situation at Austin. It was proposed to establish a municipal lighting plant in that city and also to compel the street-railway companies to charge only two cents to passengers unable to get a seat. The proposition also embodied the appropriation of $50,000 toward the erection of the municipal plant. These measures were opposed by the mayor, board of commissioners, the two commercial clubs and many business men, and when put to a vote all the propositions were overwhelmingly defeated. This, Mr. Edgar considered, a decided victory for conservatism and fair dealing with public-service corporations, and it had a good effect throughout the association's territory.

The president did not fail to recognize every effort made for the good of the association, and especially did he commend the excellent work and untiring efforts of Secretary R. B. Stichter.

In accordance with the recommendations of President Edgar, the committee to whom his address was referred made the following recommendations:

"That the association heartily approves of the work done in the last year by the secretary in collecting and classifying information regarding taxes, donations, etc., made by the member companies, and desires not only to have this work carried on in the future, but also that other matters which may, in the opinion of the president, be worthy of classification, shall be investigated through the secretary's office, either by a committee appointed by the executive committee of the association or by the secretary direct, and, in order to assist in this work, the president is authorized to appoint an assistant secretary to maintain an office

in Dallas and to be paid by th[illegible] the association.

"That a [illegible] the association shall [illegible] association be printed [illegible] also that the records of this convention be printed and sent to the members [illegible] money derived from the programme.

"That this convention realizes the value and importance of suitable exhibits in connection with conventions, and recommends that in the future free exhibit space be furnished to associate members at all future annual conventions.

"That the secretary be authorized to have printed and delivered to members of the association certificates of membership, signed by the president and secretary.

"That the badge used for the convention badge this year be adopted as the standard badge of the association.

"That a committee of four be appointed by the president to act as a committee on closer relations with the other technical and engineering societies in the country, for the purpose of arranging for interchange of information and co-operation in work between this association and other allied associations.

"That a committee of four be appointed by the president to act as a committee on the municipal ownership, said committee during the coming year to investigate the past and present conditions regarding municipal ownership in connection with the members of this association, and report at the next convention."

Track Construction.

The first paper of the convention was on "Track Construction," and was prepared by Mark Lowd of Stone & Webster. In the absence of Mr. Lowd the paper was read by C. H. Ladd of Fort Worth, who is connected with the same interests. The paper dealt briefly with the T-rail construction in paved streets, this being the type of construction which Mr. Lowd believes to be the best for operating companies from the viewpoint of first cost and economy of operation. Rails should be 60 feet in length; these cost $2 per ton more than the 30-foot lengths, but the advantage of elimination of one-half the joints and bonds fully warrants the increased cost.

The discussion of the paper was participated in by Messrs. Cooper of Galveston, Ladd of Fort Worth, Kellogg of El Paso, Edgar of Fort Worth and Brown of San Antonio. Upon the suggestion of Mr. Cooper, the chair appointed a committee to take up the matter of standardization of the high T rail and prepare a communication to be presented to the American Street and Interurban Railway Association at its meeting in October, in regard to the desirability of having a standard high T rail. The committee later reported, recommending to the national association a standard high T rail.

Nominating Committee.

Following the discussion several committees were appointed, including the following nominating committee: Fred M. Lege (chairman), Galveston; Frank Duffy, Beaumont; Thos. Cook, Waxahachie; Samuel Kahn, San Antonio; W. B. Head, Stephenville.

Meters.

J. A. Myler, Jr., read an instructive paper, entitled "Proving and Testing of Gas Meters." The paper was a good one and the discussion was participated in by the electrical men as well as those representing the gas companies. The ground was thoroughly covered and many exchanges of experience in regard to meters, their care and attention, and the best way to number and record them, were brought out. Those who took part in the discussion were Messrs. Moore, Nudge, Myler, Cooper, Conant, Davis, Duffy, Stichter and Professor Scott of Austin.

Discussion of Policy and the Question Box.

The session of Thursday afternoon was given over to the Question Box and a discussion of the question, "What policy should be pursued by public-service corporations in making extensions?" This latter question was divided as follows: For the gas companies, H. M. Moore, C. H. Dunbar; for electric-light companies, E. T. Moore, J. A. Porter; for street-railway companies, H. S. Cooper, F. E. Scoville; for telephone companies, J. E. Farnsworth. Others who took part in the discussion were Messrs. Jones of El Paso, Wells of Marshall, Kellogg of El Paso, Head of Stephenville, Stichter of Dallas, Edgar of Fort Worth, Storm of Amarillo and Lege of Galveston.

The Question Box was in charge of Samuel Kahn of San Antonio, the editor, and it held the closest attention of the convention. Mr. Kahn presented the Question Box in the form of a substantially bound book of nearly two hundred pages, in which all kinds of questions with answers by experienced men were given. The discussion brought out the experiences of members and was of much benefit.

[illegible] quested that everyone present spend as much time [illegible] success from an exhibit standpoint the assurances of the delegates that their presence and endeavors were appreciated in a substantial way.

[illegible]

[illegible] Producers and Gas Engines," by W. B. Tuttle. Samuel Kahn of San Antonio read the paper in the absence of Mr. Tuttle. The paper did not go into gas-engine operation except as necessary to deal with the action of producer gas in gas engines. Tables were given showing the comparative consumption of coal and gas and the coal consumption in producers; also leading data on results of economy tests. Mr. Tuttle concluded by saying: "The reliability of the service of gas engines operating on producer gas has been pretty well established, but in this connection it is well to call attention to the fact that all gas engines require greater care on the part of the operators than do steam engines. Steam engines, if they are supplied with steam and oil, will run in some sort of fashion as long as the load is not so great as to stall them; but gas engines will not run at all unless every part is in good working order, and while careful attention should be given to a steam plant, it must be given to a gas-engine plant."

Wood Preservation.

One of the most interesting papers of the convention was a review of the present practice and economies of timber preservation, by Prof. Eugene P. Schoch of Austin. Mr. Schoch told of the different methods and solutions for treating timber and showed the cost and economy. He proved that it pays to treat timber and said that the only question is "Which treatment is the most economical?" This is a question which every timber user must figure out for himself, and the examples given in the paper will go far toward reaching a conclusion. Professor Schoch extended somewhat on the written paper, his additions being principally in the form of further elucidations of some of the statements contained in the paper. The paper was discussed for fully an hour by the following-named gentlemen: Lee of Houston, Logan of Texarkana, Cooper of Galveston, Kellogg of El Paso, Gerhard of Austin, Ladd of Fort Worth, Carpenter of Corsicana, Edgar of Fort Worth, Stichter of Dallas, Brown of San Antonio, Professor Scott of Austin.

Later in the convention Professor Schoch, at the recommendation of the executive committee, was made an honorary member of the association.

At the afternoon session of Friday the Question Box was again taken up, in charge of Editor Kahn. The subject of automotineers was discussed thoroughly, the various members giving their experience with them. This discussion was participated in by Messrs. Duffy, Cooper, Kahn, Peel, Ing, Scott and Turner. The subject of arc headlights was then taken up and discussed by Messrs. Peel, Kellogg, Cooper, Kahn, Edgar and Turner. The next question was the discussion of meters. This was participated in by Messrs. Cooper, Kellogg, Moore, Conant, Scott and Kelley.

Supply Men Take Charge of Meeting.

In the middle of Friday afternoon's session the supply men took charge of the meeting, Mr. Sam Hobson of Dallas taking the chair yielded by President Edgar. This proved to be a most happy number on the programme, and Mr. Hobson showed skill and training in conducting a meeting. Addresses were made by Messrs. Bonner of Houston, Mann of New York, Rice, Cook, Gumm, McMakin, Arnold and Grayson. The addresses were all expressions of good-will toward the active members. Mr. Bonner insisted that the next convention should go to Houston. Before yielding the chair, Mr. Hobson stated he would like to see some action taken whereby the supply men could utilize their time granted them by the association for purposes that would be beneficial to them as well as amusing.

The meeting then adjourned until 10 o'clock Saturday morning.

Electric Illuminants and Their Efficiency.

On Saturday morning C. W. Kellogg, Jr., read an instructive paper on the various forms of electric illuminants and their efficiency. In order to approach the subject intelligently he stated briefly the general physical principles underlying all lighting. He said that when the first incandescent lamps were made the question of efficiency was hardly considered in the struggle to obtain a filament which would not burn out after a few hours' use, and it was only after the carbon filament had been more or less perfected that the problem of saving in the power required to operate the lamp was taken up. The improvements in incandescent lamps have followed the only line where success

[illegible] siderations which have to be taken into account, [illegible] ity of light means its appearance to the customer [illegible] factors to be so important that they are the con- [illegible] particular case, that is, that illumination is the thing the customer buys, although electric power is what the company sells, and that the sale of electric power will be proportional to the satisfaction which that power can be made to give in illumination to the customer. It is this consideration which has led to the use of frosted, instead of clear globes for incandescent lamps; spherical, instead of pear-shaped globes; opalescent, instead of clear arc-light globes, and the like. The various forms of Holophane reflectors are a movement along the same line, and one and all are designed to make a desirable impression on the human eye.

The advent of the high-efficiency incandescent lamps has opened up a wide field for speculation as to what the policy of the electric-light companies will be or should be regarding lamp renewals. Mr. Kellogg stated that most electric-light companies at the present time renew ordinary incandescent lamps free and furnish arc and Nernst lamps free and maintain them free for customers. He gave a table showing how the cost per kilowatt-hour for lamp renewals varies, from which he deducted that the free-renewal costs for the new lamps are prohibitive. Some of the larger companies have adopted the system of charging for the high efficiency lamps the difference in cost between the high-efficiency lamp and the same candlepower of carbon filament.

The speaker said that in spite of some people being able to cut down their bills thereby, it is good policy for the companies to help to introduce every possible improvement in the art of lighting as rapidly as possible. It shows the people how satisfactorily the art is developing and helps to keep them actively interested in the question of more light and better light. It also gives the impression that the company is not interested solely in keeping its meter disks spinning, but also in furnishing the best lighting service which the times and the progress of the art will permit, and that is a question of fundamental importance.

The discussion of the paper was largely on the advisability of furnishing free renewals to customers, and was participated in by Messrs. Cooper, Kellogg, Rice, Moore, White and Gumm.

Remarks of B. V. Swenson.

The announcement by President Edgar of the presence of B. V. Swenson, secretary of the American Street and Interurban Railway Association, was greeted with applause. On being invited to address the convention Mr. Swenson talked along the lines of association work, and urged the members of the Southwestern association to affiliate more closely with the national organizations. He gave an interesting review of the work and functions of the national association and its auxiliaries and commended the Southwestern association for its ability to handle local matters in a way impossible in the general organization.

Closing Business.

The call for invitations for the next meeting place for the convention received responses from Houston, Beaumont, Amarillo, Fort Worth, Yoakum and Dallas. The executive committee will name the place.

Secretary Stichter read the report of the finance committee and the preliminary report of the 1908 Question Box. Upon the suggestion of Mr. Head a committee was appointed to prepare a new system of accounting for the association. Several other reports were made, among them that of Treasurer Judge, which showed a balance to credit of the association on May 9, 1908, of nearly $900.

The election of officers resulted in the selection of the gentlemen named in the Western Electrician last week, viz.:

President—R. B. Stichter of Dallas.
First vice-president—W. B. Tuttle of San Antonio.
Second vice-president—W. B. Head of Stephenville.
Third vice-president—J. E. Carroll of Beaumont.
Secretary—J. A. Myler of Dallas.
Treasurer—A. E. Judge of Tyler.
Executive committee—H. T. Edgar of Fort Worth, H. M. Moore of Austin, E. L. Wells of Taylor, Fred M. Lege, Jr., of Galveston, A. E. Judge of Tyler.

The associate members of the association, composed of supply men, made a creditable exhibit at the convention, and they co-operated heartily in the interest of the association.

The members and guests were well taken care

[illegible] and the arrangement was [illegible] did not interfere with the work of the association. On Thursday afternoon there was a tally-ho ride through El Paso and Juarez, Mexico; on Thursday night a visit, by special cars, to one of the largest smelters in the United States, and on Friday afternoon there was [illegible] luncheon at the Country Club. On Saturday [illegible] reception and band concert was given at Fort Bliss, the courtesy of Col. J. F. Huston. Entertainments were given by the El Paso Electric Railway Company. Many ladies were present. On Friday night the Sons of Jove [illegible]

The association deserves credit for the handsome souvenir programme, which contained a history of the association, with portraits of officers and much historical interest about Texas and El Paso.

The Status and Commercial Possibilities of High-efficiency Lamps.[1]

By W. W. Freeman

Part I.

The several types of high-efficiency lamps which the noteworthy developments of the past year or so have evolved are now commercially available in limited quantities, and the best means of utilizing the possible supply of such lamps is a matter of peculiar interest and importance to every member of our association at this time.

It is not the intent of this paper to treat the lamp situation exhaustively or in detail, but merely to outline the principal characteristics and commercial values of the different lamps and offer some suggestions as a basis for discussion of the subject.

The leading types of high-efficiency lamps now commercially available are, in the reverse order of their efficiency, as follows:

Gem—Efficiency, 2.5 watts per candlepower; sizes, 50, 100, 125, 187 and 250 watts; probable useful life equal to standard 3.1-watt carbon lamp.

Tantalum—Efficiency, two watts per candlepower; sizes, 40, 50 and 80 watts; probable useful life double that of carbon lamp.

Tungsten—Efficiency, 1.25 watts per candlepower; sizes, 40, 60 and 100 watts; probable useful life double that of carbon lamp.

All of the above types of lamp produce a whiter light than the carbon lamp, and the quality of the light is generally regarded as superior. The filaments of the tungsten and tantalum lamps are much less sensitive to voltage fluctuations than the carbon lamps, and their candlepower performance is practically constant throughout life. The tantalum lamp, however, is best adapted to direct-current operation, the life being considerably shortened on alternating current.

The tungsten filament, when not heated, is very fragile, and the lamps must be handled with great care. Even with every possible precaution, the breakage in shipments and deliveries promises to be substantial, for some time at least, and this factor must not be overlooked in making calculations as to probable costs. The first lamps had to be used vertically, but, with reasonable care, it seems practicable to use the present lamps (except 100 watts) in any position. On account of the intensity of the light, it is desirable to use frosted-tip lamps with suitable glass shades almost invariably.

The relative values of these lamps for equal illuminating power may be seen from the following table, assuming the cost of current at 12 cents per kilowatt-hour (the Brooklyn retail rate), including carbon lamps as free renewals:

illumination at relatively, but not actually, reduced cost.

In regard to the policy which central stations should adopt, it seems to the writer that every improvement should be encouraged and offered to the public upon reasonable terms at the earliest moment practicable, and that the first reliable information concerning lamp developments should reach consumers through the lighting companies. If they do not promptly give their customers the facts, others will make erroneous and extravagant statements which will lead to misunderstanding and dissatisfaction.

It is evident that tungsten, or even tantalum, lamps cannot be thought of for free renewals, because of their extremely high cost. Furthermore, in any plan of distribution, the very limited supply must be recognized. In the United States in 1907 the demand for incandescent lamps exceeded 80,000,000 lamps, of which 20,000,000 were for increased business. To date, only about a half million domestic tungsten lamps have been manufactured, and, with the utmost factory expansion possible, not over 2,000,000 such lamps will be produced this year, or 2.5 per cent. of the lamp demand of 1907. While the supply of these lamps will increase rapidly, it is certain to be a matter of years before they can be obtained in sufficient number largely to displace the carbon lamps. Therefore the only question at issue now is the best use to make of the relatively small supply that will be available during the next year or so.

While it might seem that the natural demand for these lamps should come first from present customers, it must be recognized that the difference in the unit sizes and the substantial charge that must be made for the lamps, as compared with the free-renewal policy with carbon lamps, will tend to retard the substitution of these high-efficiency lamps for the less efficient lamps, especially where 16-candlepower and smaller units are now used. For many classes of lighting the new lamps would be entirely unsuitable. In new work, however, where the wiring can be arranged especially for the new units, they can be used at once to great advantage, and in competition with the large gas units they should prove very effective. Thus, without failing to meet the normal requirements of present customers, lighting companies should be able to make immediate and very successful use of the new lamps in obtaining new business that has hitherto been most difficult to secure.

To refer to the several types of lamps specifically, it does not seem that the Gem lamps can be sold successfully at any excess price over the carbon lamps generally supplied as free renewals, for, while the lamp is more efficient, the gain is not sufficiently noticeable to the customer to make him willing, much less anxious, to pay a premium for the Gem lamp.

The unsatisfactory performance of a considerable proportion of the early lamps has also been discouraging, although probably such experiences should not be surprising in the development of a new product. Undoubtedly, the present lamps are improved and should give satisfaction. At present prices, however, they would materially increase renewal costs of companies, if furnished free, and they apparently cannot be used to any large extent upon any other basis.

The tantalum lamps, on account of their much better efficiency, appeared to possess great advantages until followed so closely by the tungsten lamps. Whether as intermediate units their use will be very general is a matter of differing opinion. Being a smaller lamp, both in bulb size and candlepower, than the present tungsten lamps, they can, of course, be used in many places where tungsten lamps are impracticable and where a more efficient lamp than the carbon lamp is desirable.

[illegible]	400 Hours' Life.	800 Hours' Life.	800 Hours' Life.	800 Hours' Life.	800 Hours' Life.	800 Hours' Life.
[illegible] lamps	$60.00	$720.00	$720.00	$720.00	$720.00	$720.00
[illegible] Gem lamp	288.00					
[illegible]		460.80				
[illegible]			460.80			
[illegible]				288.00		
[illegible] lamp					288.00	
[illegible] lamp						288.00
[illegible]	$72.00	$259.20	$259.20	$432.00	$432.00	$432.00
[illegible]	$0.60					
[illegible]		$2.16				
[illegible]			$2.[illegible]			
[illegible]				$5.76		
[illegible]					$8.64	
[illegible]						$14.[illegible]

[illegible] that the lamps would not sell generally at the prices above indicated, [illegible] from such [illegible] the [illegible] cost of electric service through the use of the new [illegible] with [illegible] it [illegible]

It seems probable that if the tantalum lamps are to attain much use at present their sale must be pushed by the companies at prices involving a modest charge over the carbon lamps, say, 25 cents each. With the life promised, companies can afford to put out these lamps in lieu of free carbon renewals with such an excess charge, and they will prove distinctly profitable to customers upon such a basis.

When we consider the tungsten lamps, there ought to be no question of the demand, even at relatively high cost prices, and the expressions of opinion of [illegible] companies, which are reproduced hereafter, show conclusively that the companies are well aware of the effective use to which they can be put in competition with other illuminants.

At last it seems reasonable to believe we have an incandescent-lighting unit that can compete successfully with gas on even terms as to cost, and with all the superiority of electric service as a premium.

As different types of fixtures are developed, beginning already with single units, clusters, economy diffusers, etc., the effectiveness of the tungsten lamps will correspondingly increase.

Many companies have already made noted progress in obtaining business hitherto difficult or impossible of securing with electric service, and this work has just begun.

The only fear expressed from any source is that the demand for tungsten lamps from present customers may equal or exceed the present possible supply, and that the first effect of their introduction will be loss of revenue without compensating gains. The writer does not share this fear, but believes that tungsten lamps can be made immediately and increasingly useful to every company.

The sizes of the units and other limitations previously referred to will necessarily offer restrictions in substitutions for other lamps in present installations.

Furthermore, customers who are satisfied with their present electric service will not rush to purchase even high-efficiency lamps at $1 to $2 each in place of free carbon lamps, and there is no occasion for companies trying to persuade present customers to change to the new lamps. Such customers are entitled to a fair announcement about the types of lamps available to them and an opportunity to purchase them at reasonable and non-discriminating prices. Then the lighting company should feel free to bend all its energies unhesitatingly to securing new business and increasing old business, in both of which tungsten lamps can be used at once with very pronounced success.

While, doubtless, there will be instances where customers now using the larger incandescent-lighting units can, and will, substitute tungsten lamps promptly, and, as a result, obtain as good, or better, lighting service for much less money, yet for every such case there should be found scores of customers who are willing to pay something more than they are now paying in order to obtain a great deal more light. There are also hundreds of stores in every city, the tenants of which are now using electricity sparingly in conjunction with gas, where all the lighting business should be secured with tungsten lamps without increasing the investment of the lighting company on account of services already installed.

Possibly, however, the most inviting field for immediate exploitation of the large tungsten units is in competition with the hundreds of thousands of gas-arc lamps now in use and which type of lamp, in the opinion of the writer, can be rendered practically obsolete through intelligent and aggressive campaigning with tungsten lamps.

The form of high-efficiency lamp notice used by the Brooklyn Edison Company is given herewith by way of illustration:

IMPORTANT LAMP ANNOUNCEMENT

During the last two years a number of remarkable developments have occurred in the manufacture of electric incandescent lamps.

The filament of the lamp that has been used for the past twenty years is made from carbon. The filaments of the new lamps are made from metals. This constitutes the principal difference in their construction.

The first of the metallic-filament lamps to be placed on the market was the tantalum lamp, the filament of which is made from the metal tantalum. Developments have since culminated in the advent of the tungsten lamp, the filament being made from the metal tungsten.

In the carbon-filament lamp now in general use, 3.1 watts of electrical energy are used to produce each candlepower of light.

In the tantalum lamp, two watts produce a candlepower.

With the tungsten lamp, the energy consumption per candlepower is 1.25 watts.

Thus, it will be seen that the tantalum lamp furnishes 50 per cent. and the tungsten lamp 150 per cent. more light than the carbon-filament lamp of corresponding current consumption.

The metallic filaments cannot, for the present, be produced in as small units as the carbon filaments, and the benefits of the new lamps can, therefore, be realized only through the use of larger units of light, except where carbon filaments of 32 candlepower or higher are now employed. The tantalum lamps are now manufactured in sizes of 20 and 25 candlepower, and the tungsten lamps in sizes of 32, 48 and 80 candlepower.

On account of the new methods of manufacture of these lamps and the limited quantity in which they can be produced at present, the prices are necessarily high, and it is manifestly impossible for this company to furnish them upon the same basis as the carbon lamps. The policy of the company, however, is to furnish such special lamps at cost, after allowance covering the present cost of the carbon lamp furnished without charge to free-renewal customers. In this way the customer will secure all the benefit of the economy of the new lamps.

The 50-watt, [illegible]-candlepower tantalum lamp has been furnished to free-renewal customers of this company at an extra charge of [illegible] cents each.

This lamp, as also the 40-watt tantalum lamp, will be supplied hereafter, until further notice, to free-renewal customers at [illegible] cents, subject to the return of the burned-out lamp.

The following special prices have also been fixed, until further notice, for the several types of tungsten lamps to free-renewal customers, all subject to the return of the burned-out lamp:

[illegible]-watt, [illegible]-candlepower $1.00
[illegible] " [illegible] " " 1.25
[illegible] " [illegible] " " 1.50

To customers who are not entitled to free carbon renewals, [illegible]

the [illegible] per cent, respectively, [illegible]
The [illegible] lamp [illegible] hours [illegible] of about 800 hours, and [illegible] level that 800 [illegible]
The [illegible] are specially recommended [illegible] supplied when required. [illegible] shades with [illegible]
The [illegible]
This company [illegible] endeavors [illegible] of the new [illegible] possible [illegible] its customers [illegible] the lamps from the manufacturer.
This announcement [illegible] to the public the benefit [illegible] rapidly as is practicable.

[*To be continued.*]

Gas Engines.[1]

By W. C. L. E[illegible], J. F. Kl[illegible] and I. E. Moultrop.

Your committee appointed to investigate the gas-engine situation and report at this meeting concerning the progress that has been made in the development of gas engines and producers for power purposes, particularly their application to driving electric generators suitable for central-station purposes, has held a number of meetings since its appointment, and has visited the more important works of the manufacturers and some of the plants which have been installed. It has also considered at its meetings numerous papers that have been presented before the technical societies, and which have appeared in the technical and semi-technical press. It has also been in communication with the users of engines, and has endeavored to obtain the results of their operating experience with engines of this type. The committee has gathered a large amount of data, much of which has been condensed, although all of it is available to the members who are interested in this subject. It is our desire at this time to present with this report descriptions of the various engines, as furnished by the manufacturers.

Mr. Klumpp, a member of the committee, has given special attention to the gas side of this question, and has prepared some data, which are here published for the first time, concerning the analyses of the various gases useful for power purposes, and information concerning their use. There is also presented a brief account of all gases useful for power purposes.

Mr. Moultrop, of the committee, has been in active correspondence with most of the users of large gas engines, and the committee, either individually or as a committee, will be glad to supply in the discussion any information that may have been omitted from the report.

General Conclusions.

Efficiency.—The high thermal efficiency of the combined gas engine and producer must command the attention of all companies using fuel for power purposes, and the development of the gas engine and gas producer should, therefore, receive the careful study of all power users.

The efficiency of the combined gas engine and producer is higher than that of a combined steam plant of boilers and steam engines or boilers and steam turbines, although the committee at this time is unable to present any definite figures which it has had an opportunity to verify. Comparisons at this time between the gas-engine and steam-engine plants actually in operation would be more or less misleading, on account of the conditions under which most of the large gas-engine plants are operating.

Many of the large gas-engine plants recently installed are operating with blast-furnace gases, and there have been no data available for determining the exact efficiencies and economies of these engines. Other installations operating with natural gas, in a majority of cases where they have been in operation for a time long enough to obtain definite data, have been on other than electric-power generation, and no accurate details of operating cost were kept or obtainable. Nor would it be fair to consider a comparison of the operating costs of a steam-engine plant and a gas-engine plant using illuminating gas purchased from illuminating-gas companies. Many of the installations that we may look to for definite operating costs have been put into operation within the last year, and the short time of service does not yet warrant accepting any figures obtainable as accurate operating data. There should be available, within the next year, however, information as regards the operating expenses of large gas engines that will enable comparisons to be made with the operating expenses of steam engines or steam turbines.

Development.—The rapid development of the large gas engine, especially for use in the steel industry, has been shown by the lists of installations in the previous pages of the report. The fact that in [illegible] ators of this class consider the reliability of the gas engine. Large engines have been used long enough to demonstrate that continuous service is assured, and that the design today is well enough established to convert commercial gases, practically of all kinds, into power by the selection of the best types and arrangements to suit the individual installation. The mechanical features have been, from [illegible] operation can be expected with no more attention than that given to steam engines of equal capacity.

The question of repairs has as yet not been thoroughly determined, and, while apparently high in some reported cases, this item should be materially reduced as the design of the engine is simplified.

Capacity.—Gas engines for power purposes are now available in sizes ranging from the minimum size required up to about 5,000 horsepower. There are today in this country at least five reliable engine builders who have built, or are building, engines of the latter capacity, while there are probably at least a dozen other firms which are ready to contract for engines of approximately 500 horsepower. There has been some variance in the rating, by the builders of gas engines, and the electric operator is at sea at times in making comparisons between the various makes. The capacity rating of the engine should, in the minds of the committee, be standardized and expressed in a manner that will give some definite relation as to the actual power produced. This might be expressed in piston displacement or in some convenient form of measuring the maximum power developed under prescribed conditions. The rated capacity should bear an approximately fixed ratio to the maximum capacity, which would determine the uniform percentage of overload. This standard rating should be based on the character of the gas to be used, as the capacity of the engine depends upon both the character and thermal value of the gas used.

Installation Cost.—The cost of gas engines is at present very much higher than that of either steam engines or steam turbines of equal capacity. This is natural in the introduction of any new appliance. It is, in great measure, due, in the first place, to the increased pressures carried, necessitating greater weight and strength of various parts of the machine. It is also undoubtedly due to the cost of experimentation and to the continual changes in design and construction. With the increased demand and the standardization of parts, these prices will undoubtedly be reduced, although it does not seem reasonable, owing to the increased weight and strength, that the price of gas engines can be reduced to that of steam engines of equal capacity. While at present the committee believes that the cost of gas engines is much in excess of that of steam engines of the same capacity, it also believes that it is possible to build a combined producer and gas-engine plant for costs approximately that of the combined boiler and steam-engine plant, when all auxiliaries and buildings are included. However, every installation is modified by its local conditions and should be considered individually.

Operation.—The adaptability of the gas engine to practically any form of power has been demonstrated, and engines today are being operated in nearly every field occupied by the steam engine. As the application which interests the association is principally that of current generation, the committee is confident that the gas engine may be used with increasing satisfaction in central-station work. The speed regulation has been perfected so that the most reliable manufacturers are willing to guarantee parallel operation of either 25-cycle or 60-cycle generators, and this when operated in conjunction with waterpower steam engines, or other gas engine units.

Producer.—The gas producer today does not seem to have reached the stage of development that has been attained by the gas engine, and there are yet to be designed producers that are suitable for all commercial grades of coal. It is not to be inferred that one design of producer must be suitable for all quantities of coal, but the committee believes that before the gas-engine power plant can be generally accepted and be compared to the steam-engine plant in adaptability, a type of bituminous producer must be developed which will successfully utilize the cheapest and poorest forms of commercial fuel.

Fuel.—That the gas producer and engine may receive general recognition, it is necessary that the gas producer be so developed that practically every grade of fuel may be utilized. With the present apparatus there is no doubt whatever of making an economic, commercial power gas from anthracite coal and other fixed fuels, nor is there any doubt [illegible] iliaries.

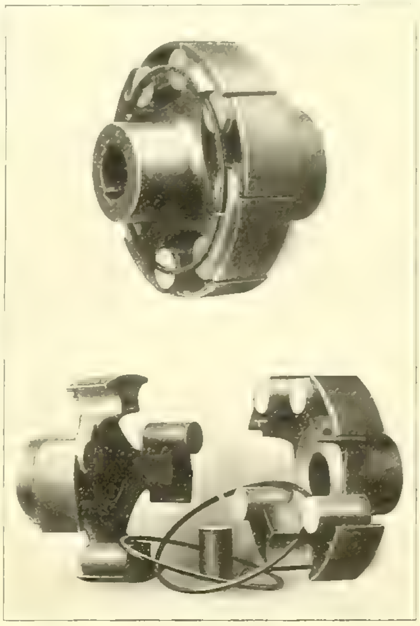
[illegible] the fuel available; and the increased economy [illegible] investment for the gas installation.

The committee [illegible] of the many courtesies extended to it by the gas-engine builders and users, and wishes to acknowledge the assistance it received from the engineers [illegible] investigations, the committee was met in the most open and candid manner; all of the difficulties were discussed frankly, and from its observations in these investigations the committee expects to see a rapid development of this most important industry.

1. The opening paragraphs and general conclusions (slightly abridged) of an elaborate and valuable engineering report presented to the National Electric Light Association at Chicago on May 20, 1908, by a committee of which Mr. Eglin of Philadelphia is chairman.

A New Flexible Insulated Coupling.

The illustrations [illegible] flexible insulated coupling manufactured by the R. D. Nuttall Company, Pittsburg, Pa. The coupling consists of two interlocking spiders of cast-iron construction



A NEW FLEXIBLE INSULATED COUPLING.

which are insulated by means of solid rubber cylinders. Outside of these the only other parts are two steel rings used to hold the rubber cylinders in position. The rubber members provide ample insulation and at the same time give the desired flexibility. The coupling is furnished in sizes from five horsepower up.

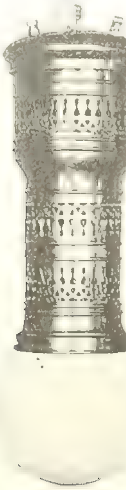
This flexible coupling is especially desirable where electric motors are direct-connected to machinery which is subject to vibration, as, for example, a tube mill or a coal pulverizer in a cement plant, where the coupling relieves the motor from the shocks and jars of the machine. In addition, the end thrust of the crusher is overcome and the motor bearings run without heating.

Opposes Written Train Orders.

In the opinion of F. W. Brooks, general manager of the Detroit United Railway, control of interurban cars by written orders from the dispatcher is not the ideal system. His belief is that the system of printed time cards reinforced by telephonic orders from the dispatcher's office is the safest manner of handling electric cars. It is the contention of Mr. Brooks that errors are likely to creep into the written orders, and that they do not make the impression on the car crew that the verbal orders do when some break in the time of the cars causes a change in the routine of the runs.

Economic Miniature Arc Lamp.

The [illegible] the "Economic" miniature arc lamp, which is put on the market by C. A. Herrmann & Co., 79 Dearborn Street, Chicago. The lamp is put out as one of the highest standard, and the statement that it gives 500 candlepower at a consumption of 330 watts shows its



ECONOMIC MINIATURE ARC LAMP.

value for commercial use. The mechanism is a fine example of compactness, serviceability and finish. A positive-acting clutch of new design, combined with other new features, reduces the possibility of getting out of order to a minimum. This miniature has been adopted by leading companies East and West. The Herrmann company says that, compared with the standard six-ampere arc lamp so extensively used, its three-ampere miniature will give more actual candlepower and has no obstruction caused by wandering shadows. The lamps are made for 100 to 125 volts, both for direct and alternating current, and for inside and outdoor use. A demonstration will be cheerfully given by the company. The illustration is one-fifth the actual size of the lamp. Ninety of these lamps may be seen in service at Chas. A. Stevens & Bros'. store on State Street, Chicago.

Marconi Company Reports Progress.

Directors of the Marconi Wireless Telegraph Company have issued a report covering the period up to September 30, 1907 (the period appears to be two years), and with the report is the balance sheet of September, 1907. The transatlantic service from Connemara, Ireland, to Glace Bay, Nova Scotia, was inaugurated in October, 1907, and the results after six months' continuous working are declared to be satisfactory and encouraging and to justify the confidence with which the directors have regarded the feasibility of direct wireless communication with America. These stations are expected to cope with a much larger volume of messages when the necessary enlargement and duplication of machinery has been carried out. The service between Poldhu, in Cornwall, G. B., and Cape Cod, U. S., is to be brought up to the same state of efficiency as that of the Irish-Canadian stations.

Up to the present the service has been conducted at speeds varying up to 20 words a minute, but with a comparatively inexpensive modification of certain parts of the existing apparatus a speed of 30 words per minute is expected. Working the four stations 12 hours a day, at an average net wireless rate of 4d. per word, and at a speed of 20 words a minute, a net revenue approaching $750,000 per annum is said to be possible from these stations. Besides the total earnings of the Poldhu and Clifden stations, the company will receive the greater part of the profit from the stations on the American side in the shape of dividends, as the company holds the majority of the stock of the American and Canadian companies. The maritime business is said to be progressing satisfactorily. The net receipts of the Marconi International Marine Communication Company and its associated companies from this source are placed at $180,000 in 1907, compared with $137,500 in the year previous, and $15,000 in 1905. The Poldhu station supplies a daily press service to liners on the Atlantic, and the receipts during the last two years amounted [illegible]

[illegible] On Wednesday, Ocober 7th, there will be a great "in- [illegible]

CORRESPONDENCE.

Continental Europe.

Paris, May 5.—Mr. Carpentier, the well-known instrument constructor of Paris, and successor of Ruhmkorff, has just completed a photograph-transmission apparatus on Dr. Korn's system. The apparatus consists of a combined transmitter and receiver for each of the stations, and each instrument has the form of a table having mounted upon it the main part of the apparatus, while the motor and gearing are placed underneath. At one end is a Nernst lamp which sends a beam of light upon a cylinder which carries the image in the shape of a positive photographic film. The light passing through the image is sent up along the axis of the latter by means of a reflecting prism and falls upon a selenium cell which is mounted above in a dark box. The receiving apparatus at the other end has a lamp which sends a beam past a galvanometer shutter and thence upon a cylinder moving in synchronism with the former, carrying the sensitive film. In the present case the light beam is stopped off more or less by the current by means of a small square of aluminum foil mounted on a double vertical wire in the field of a strong electromagnet. The aluminum screen is shifted horizontally and does not turn about. On each table is mounted a receiver and transmitter placed side by side in the same case. It requires about 12 minutes to send the image, and the result is very good, as I had occasion to observe. The mechanism for driving the cylinders is of a remarkably fine construction and at the same time is very solid, so that it does not require a skilled operator to handle it.

A series of experiments is to be carried out at the radio-telegraph post, which is located at the port of Toulon, with a view of finding out whether the electric waves sent from the apparatus are not likely to cause the explosion of the torpedoes of the port. The torpedoes which are used for the defense of the harbor are placed in different lines under water and at the entrance of the port so as to protect the latter in case of war. Such experiments will be of great interest in determining whether there is any danger from the electric waves.

The Ganz company of Budapest has lately constructed a new type of three-phase electric locomotive, which was ordered by the Italian state railway department for use on the Valtellina railroad lines. The new locomotive resembles the type which this firm built some years ago, but differs also from the latter in several points. The main difference lies in the use of three speeds instead of two for operating the locomotive. Heretofore this has been difficult to carry out in the case of the three-phase system. The chassis now only carries two motors, one of which has eight poles and the other 12 poles. Both motors are designed to work at 3,000 volts maximum voltage. Two speeds are obtained by using one or the other motor alone, while for the third speed the two motors are coupled in series, also changing the connections of the field coils of the motors upon a new system. A water resistance is used with the motors, changing the water level by means of compressed air. The latter is used also for working most of the switching apparatus as well as the trolley.

It is likely that the German army will take measures to use the field telephone for the artillery corps on a large scale, as the need has been felt for this for some time; and it will be a great advantage to have all the corps equipped so as to give a good practice with the apparatus before the commencement of the annual artillery firing maneuvers of this year.

News comes from Hamburg that rubber from New Guinea is beginning to sell at a reasonable price. The administrators of the colony are taking measures to promote the rubber industry and this appears to be promising. However, the natives do not show much aptitude for this work and labor will no doubt have to be secured elsewhere, probably from Java. An expedition is organized to make researches upon the growth of rubber plants in these regions, and the experiments will be carried on for a period of three years. A. DE C.

Great Britain.

London, May 9.—Once more Parliament has under consideration the London Electric-power problem, and the position is now very much that of 1905, when the Administrative County of London and District Electric Power Company proposed to inaugurate a new and comprehensive scheme of electric supply over the heads of the companies and local authorities already supplying. The new company, in the present instance, is called the London and District Electricity Supply Company and the consulting engineer is Mr. H. F. Parshall, who has today been giving his engineering evidence. From it, the following has been extracted: It is proposed to erect one large generating station on the banks of the Thames at Barking having an initial capacity of 60,000 kilowatts and ultimately 120,000 kilowatts. Three-phase current will be generated at 15,000 volts and a frequency of 50 cycles. From this power house a duplicate ring main will be laid to 14 control stations, which in turn will supply the transforming stations from which the individual consumers will be supplied.

The promoters' case is that the existing authorities have grossly underestimated the potentialities of the power problem in London and have made no effort to meet it, and, further, even if they had properly estimated the demand, they would, by their parliamentary restrictions, be unable to provide for it. Consequently the hopes of the promoters of doing business with the existing authorities rest upon an endeavor to induce them, with a sufficiently low price, which is scheduled to the bill, to take the whole of their normal supply from the power company and deal with the peak of their load from their own power stations, thus avoiding the necessity for further capital expenditure and obtaining current, at the same time, at a cheaper rate than they would be able to generate it for themselves. This is exactly the same point of view put forward by Mr. Merz in 1905 and again in 1906, and it must be said that in the only fair and square fight there has been Mr. Merz carried the day with two committees of Parliament. "Tactics" prevented him from the reward of his efforts.

Mr. Parshall draws an analogy between the position in London and that in Chicago 10 years ago, where there were a number of small stations supplying different districts, but that on the advent of a large power company it was more profitable to them to take their normal supply from it at a cheaper rate than they could generate for themselves and to deal with the peak of the load by their own plant. Similarly, he points out, the Niagara power plant supplies many horse-power-hours to a number of steam-driven generating plants. From this, he argued, the same beneficial result could be obtained in London. In addition, the new power company proposes to supply railways, tramways and canals and all large power users taking in excess of 250 kilowatts. Following the fashion set by Mr. Merz, the promoters of the present bill have based their estimates upon figures quoted by responsible firms who would be willing to take contracts at the prices. Thus the possibility of criticism upon this part of the finance of the case is avoided. The total capital cost per kilowatt is $60, a figure which Mr. Parshall said was attained at the best modern American stations. The bill will occupy the attention of the committee for many days yet.

After several attempts to organize an electrical show at the Franco-British Exhibition to counteract that of the gas companies, and after it had been announced that the attempt was to be abandoned, the London electric-lighting companies have taken the matter upon their own shoulders and will erect a pavilion. This will be divided into several departments, in which the various applications of electricity will be demonstrated.

A new 6,000-kilowatt turbo-generator has been put into service in the generating station of the Manchester Corporation. It is said to be the largest of its kind at work in this country.

At the annual meeting of the British Westinghouse Company last week, when the satisfactory report and accounts mentioned in my last notes were adopted, strong evidence was given of the considerable economies which have tended to this end. The accounts of each department are being kept as a separate concern and the cost of manufacture had been so reduced that an output of 10 per cent. more had been obtained with a wages bill of two per cent. less. G.

New England.

Boston, May 16.—The decision of the Massachusetts Supreme Court in the trolley merger case places the New Haven road in an embarrassing position, with 16 electric-railway lines on its hands and no legal right to hold them, under the laws of Massachusetts. There is a possibility of loss in the process of disposing of these holdings unless the road is given adequate time in which to make the deals, in compliance with the court's decision.

At the dinner, May 22d, of the Electrical Engineering Society of the Institute of Technology, Prof. Elihu Thomson will be the speaker. The society has had as its speakers, at intervals during the past year, Dr. Charles P. Steinmetz of the General Electric Company, Henry A. Morse of the Simplex Company, N. J. Neall and Profs. D. C. Jackson and Harrison W. Smith. The new president is John Mills, who came to the Institute from the University of Chicago.

The meeting of the New England Street Railway Club is to be held at the Worcester Polytechnic Institute, May 28th. B.

New York.

New York City, May 16.—At the Public Service Commission investigation of electric-lighting companies, on Thursday, representatives of the New York Edison, the United Electric and Power and the Brooklyn Edison companies announced that they were preparing to supply consumers with tungsten

[illegible] 25 per cent and upward.

The Pennsylvania R[illegible] proposed electric rapid [illegible] rison and New York, [illegible] year. [illegible] been completed. [illegible] York terminals will not be completed within the year, they will be in shape to be used. The line will connect with Newark, with a terminal in the central part of the city. There will be six large buildings in connection with the Harrison yards, as well as several smaller ones. These will include, it is said, a modern [illegible] of the rapid-transit electric line, which will be the largest building of its class in this section. All of the structures will be of corrugated steel and concrete. The sheds covering the train platforms are to be 1,100 feet [illegible].

A franchise has been granted for a four-track electric trolley line to run west of the Palisades from Coytesville to Homestead, with connections not only with the One-hundred-and-thirtieth Street Ferry and the Manhattan Subway, but also with the McAdoo tunnels, both uptown and downtown. The road is said to be backed by ample capital, and will be completed as soon as possible. It will run through Central Avenue, Leonia, and will have two local and two express tracks.

Many of the leading electric-light men of this city are leaving to attend the annual convention of the National Electric Light Association in Chicago. There will be a large representation from this city, some of them officers of the association.

Controller Metz has made public a letter of criticism, written at his request, by John B. McDonald, subway builder. The subway builder says the plans of the proposed subways ought to be modified so future extensions of subways in Manhattan, The Bronx and Brooklyn shall not be discouraged. Construction, equipment and easements of the Broadway-Lexington Avenue line as planned by the commission, he says, will cost more than $127,000,000, and the Fourth Avenue subway more than $44,000,000. Construction by sections, he thinks, will increase those amounts. "At this enormous cost," Mr. McDonald asserts, "the lines would not be able to carry enough passengers under any conditions to meet their fixed charges, and would become a heavy burden on the city."

At a hearing before the Public Service Commission General Manager Headley of the Interborough raised objections to the side doors for Subway cars recommended by Bion J. Arnold. Mr. Headley said the New York public could not be trained to maintain the regular movement essential to the success of the type of cars suggested by Mr. Arnold. W.

Indiana.

Indianapolis, May 16.—Keen interest is being taken in the information given out by the Bureau of Statistics concerning the number of industries along White River, and the value of products of the farms in the counties which border on the river. There are 1,912 factories on the west fork of the river and 595 on the east fork. This is 32 per cent. of all the factories in the state. A number of companies have been organized with a view of promoting and constructing hydraulic plants along the river to furnishing electric power to these factories.

H. S. Dickey, general superintendent of the Winona Interurban Railway Company, has filed a complaint with the Indiana Railroad Commission charging two steam roads with having entered into an agreement not to exchange business with the Winona interurban road.

The Indiana Union Traction Company and the Chicago, Cincinnati and Louisville Railroad have entered into a traffic agreement. The Indiana Union Traction Company is now constructing a track so as to enable the exchange of traffic between the two lines. This is taken as an indication that the electric company intends to use the steam-road depot in Peru and a portion of the steam lines.

The Simplex Motor Car Company of Mishawaka has increased its capital stock from $50,000 to $100,000. The company proposes to increase the capacity of the plant.

The contract for wiring and lighting the coliseum at the State Fair Grounds has been awarded to the Standard Electric Machine Company of Indianapolis. This completes all plans for night entertainments during the next State Fair. S. S.

Northwestern States.

Minneapolis, May 16.—The Mankato Electric Traction Company, Mankato, Minn., has filed a trust deed for $400,000 to secure an immediate bond issue of $75,000 for construction and equipment.

The Union Engineering and Construction Company of Chicago secured the contract for completing the electric-power dam at Fergus Falls, Minn.

The Stillwater Power and Railway Company of Forsyth, Mont., has been incorporated to con-

[illegible] Hinckley, Minn.

[illegible] in Edgeley, N. D. Fairbanks, Morse & Co. have the contract for dynamos, switchboard and power-house machinery. The Aberdeen Electric Light [illegible]

Pacific Slope.

San Francisco, May 14.—The City Electric Company has just received a Westinghouse-Parsons turbo-generator which is capable of supplying 6,000 kilowatts on overload. It is announced that about all of this additional capacity is already engaged. The United Railroads now takes nearly all of the output of the two 4,000-kilowatt generators now in operation at this plant.

The San Francisco Gas and Electric Company ran all of its local generating stations to their utmost capacity during the first two weeks of the Atlantic fleet's visit. All four of the 4,000-horsepower gas-engine units at Martin Station, just below the city, were in operation at one time, although the plant was originally built for a reserve station. The only serious trouble that occurred as a result of the overloading was the burning out of one of the large engine-type three-phase generators in the main power station in the Potrero district. The officers of the combined Atlantic and Pacific battleship fleets have been very generous in making lavish electric displays from the 27 large warships nearly every night since they arrived at this port. The ships were completely outlined with incandescent lamps. It is probable that that number of fully illuminated American warships never before were together to engage in searchlight drills, etc.

The Snow Mountain Power and Water Company, in which Charles Felton, W. W. Van Arsdale and Geo. W. Scott of San Francisco are interested, has awarded the contract for the construction of its 58-mile pole line from the hydro-electric plant, near Preston, to Ukiah, to the United Construction Company. The latter company has already commenced work on the new three-phase transmission line. The waters of Eel River are used for generating. The machinery, consisting of two units, is ready for operation.

The Northern California Power Company has commenced construction on a 60,000-volt line from its sub-station at Palo Cedro, Cal., to Kennet, Cal. At Kennet another sub-station will be constructed, with a capacity of 7,000 horsepower, to accommodate the mammoth mine and smelter. The new transmission line will be a feeder also for the electric-process iron smelter at Heroult. This line will have a capacity to transmit 20,000 horsepower and will be 16 miles in length.

Plans for a new sub-station at Northern Hill, near St. Johns, Ore., for the Portland Railway Light and Power Company have been completed. The plant will furnish electricity for St. Johns, Ore., and Vancouver, Wash., and for the draws for the new bridges.

The Weidenthal-Gisliner Electric Works has been incorporated with a capital stock of $100,000 at San Francisco, Cal., by S. H. Weidenthal, Herbert Gisliner and S. M. Samter.

Articles of incorporation have been filed by the Carquinez Electric and Construction Company with a capital stock of $20,000. The place of business is Martinez, Cal. The directors include E. W. Jensen.

The Keystone Electric Company has been incorporated with a capital stock of $10,000 by S. H. Foster, Geo. Nolan and Wm. W. Goldnamer. The place of business is San Francisco.

PERSONAL.

Mr. J. V. Young of Eau Claire, Wis., succeeds F. L. Schuman as manager of the La Crosse (Wis.) exchange of the Wisconsin Telephone Company.

Mr. B. J. Kearney, president of the Mitchellville Telephone Company and the Farmers' and Merchants' Telephone Company, died at his home in Grinnell, Iowa, recently.

Following the election of Mr. B. E. Sunny to the presidency of the Chicago Telephone Company the stock of the company advanced to 124, a decided compliment to Mr. Sunny.

Mr. Louis M. Featherston has been appointed secretary to President Sunny of the Chicago Telephone Company, with the title of subscribers' agent. His duties will be to investigate complaints of poor service made to city officials by subscribers. In this way the company expects more quickly to co-operate with the city in improving the service.

[illegible] district.

[illegible] nois University on May 14th. Mr. Abbott is chair- [illegible] trip.

[illegible] will be greatly regretted. The announcement was [illegible] Electric Light Association, and a committee was [illegible]

ELECTRIC LIGHTING.

The city of Clinton, La., contemplates purchasing the electric-light and ice plant.

The Stilwell (Okla.) Public Service Company has been incorporated with a capital stock of $50,000.

Bonds to the amount of $12,000 are to be issued by Kiowa, Kan., for the establishment of an electric-light plant.

The Algonquin Light and Power Company of Oklahoma City has been incorporated with a capital stock of $100,000.

The Union Gas and Electric Company of Bloomington, Ill., has been purchased by a syndicate headed by Edwin Witherby of Elmyra, N. Y. The price is stated to be $400,000. The stock was held by Chicagoans.

The Oklahoma Gas and Electric Company of Oklahoma City suffered the loss of two armatures by burnout during a recent electric storm which reduced the supply of current to the Oklahoma City Street Railway Company about 700 horsepower.

By arrangement, the differences which for a long time have caused litigation between the city of Toledo and the Toledo Railways and Light Company have been satisfactorily adjusted. More than half a million dollars has been in dispute, including a claim by the city for one per cent. of the earnings of the company under the franchise.

ELECTRIC RAILWAYS.

The Oklahoma City, Lexington and Sulphur Interurban Railway Company has leased the control of its property to the Chickasha Interurban Railway Company, which company has been offered the following bonuses if it will extend the line to the following points: Sulphur, $30,000; Wynnewood, $20,000; Davis, $20,000.

The Oklahoma, El Reno and Shawnee Rapid Transit Railway Company has been incorporated with a capital stock of $1,500,000. Among the incorporators are Charles A. Huber of Oklahoma City and Charles E. Davis of Lugert. The proposed line will be built from El Reno to Oklahoma City, through Yokon and Dixon, thence to Shawnee via McCloud.

A license has been issued to incorporate the Wood River, East Alton and Bunker Hill Traction Company. The principal office is in East St. Louis, and the capital stock is nominally $150,000. It is proposed to construct and operate an electric railroad from Wood River, Madison County, Ill., to Gillespie, Macoupin County, paralleling the Cleveland, Cincinnati, Chicago and St. Louis Railroad. The board of directors includes J. T. W. Rudesill of East St. Louis and D. R. Maxey of Wood River.

A strike of the motormen and conductors of the Municipal Traction Company of Cleveland was called on May 16th and some violence followed. The strike grows out of the agitation which has resulted in one company, the Municipal Traction Company, taking over all the street railways of the city and operating on a three-cent-fare basis. The Cleveland Electric Railway Company, the big company, promised employes an increase of two cents an hour if it secured an extension of its franchise. Now that the situation has been changed by the city-controlled company taking over all the lines, the men demand the same consideration from the Municipal Traction Company.

PUBLICATIONS.

Dated April, 1908, Vol. I., Part 1, of the Post Office Electrical Engineers' Journal has made its appearance. It is well printed with a good cover and is to be the organ of the British Institution of Post Office Electrical Engineers, to which branch of the industry it will be especially devoted. H.

[illegible] are the publishers.

[illegible] has been absorbed by the [illegible] of New York, and the combined papers, under the name of the Railroad Age-Gazette, will be issued from the New York office.

Pass & Seymour, Solvay, N. Y., have published an attractive little booklet devoted to P & S standard brass sockets. These sockets are said to be the best and are the result of a knowledge of the wants of men who use the best, the exercise of the greatest care, use of the best material and knowing how.

The Electric Railway Review of Chicago has been purchased by the McGraw Publishing Company, and it will be combined with the Street Railway Journal of New York, the consolidated paper being known as the Electric Railway Journal and issued in New York. It is announced that, for the main part, the personnel of both the existing papers will be retained.

SOCIETIES AND SCHOOLS.

It has been decided to postpone the annual convention of the Canadian Electrical Association one week. The new dates are June 17th, 18th and 19th. Mr. G. S. Young of Toronto is secretary. The convention will be held in Toronto.

Denver, Washington and Atlantic City are being considered as the place of holding this year's convention of the American Street and Interurban Railway Association. It is thought that if the convention is held in a western city, Denver will be chosen.

A handsome invitation has been received from the Portland Rose Festival Association to visit the Rose City (Portland, Ore.) during the week of festivities concurrent with the celebration of the arrival of roses, June 1st to 6th. Mr. Bury I. Dasent of the Portland Railway, Light and Power Company is secretary of the association.

The president of the Board of Trade, London, has appointed a committee consisting of Mr. G. R. Askwith, K. C.; Sir John Gavey, Dr. R. T. Glazebrook, Major P. A. McMahon, Major W. A. J. O'Meara and Mr. A. P. Trotter to prepare a programme for the consideration of the delegates to the International Conference on Units and Standards, to be held in London this fall, and to make arrangements for the reception and assembly of the delegates attending the conference.

The National Society for the Promotion of Industrial Education has established permanent headquarters at 546 Fifth Avenue, New York. An active campaign will be carried on from this office to promote an interest in industrial education the country over. The society has just issued its bulletin No. 5, consisting of the first part of the proceedings of the annual meeting held in Chicago. Among the addresses printed in full is that of W. B. Prescott, secretary of the Supplemental Trade Education Commission of the International Typographical Union. The apprenticeship system of the New York Central Lines is treated by J. F. Deems, general superintendent of motive power, and by C. W. Cross, superintendent of apprentices. The co-operation between the University of Cincinnati and some of the manufacturers of that city is the subject of the paper by Prof. H. Schneider, dean of the college of engineering. The bulletin also contains the address of Dr. Henry S. Pritchett, at that time president of the society, and the full text of Dr. Eliot's speech which has been the subject of much discussion among educators. Future bulletins will include the balance of the proceedings of the Chicago meeting and the reports of the various committees which are investigating special phases of industrial education. James P. Haney is secretary of the society.

A dispatch from Reno, Nev., says that Clarence H. Mackay of the Postal Telegraph Company, in addition to $100,000 for the Mackay School of Mines, $30,000 for the John W. Mackay statue, and $50,000 for campus improvements at the University of Nevada, has announced further benefactions for the furnishing of the School of Mines and an annual contribution of $6,000 for maintenance of the school. The regents of the university have accepted the gift and a public holiday will be declared by the governor on the occasion of the unveiling of the Mackay statue, at which Mr. Mackay and many other noted men will be present.

The National Fire Protection Association will hold its twelfth annual meeting in Chicago May 26th, 27th, 28th. The meetings will be held in the assembly room of the Chicago Board of Underwriters, 159 La Salle Street. The programme contains 37 numbers, 21 of which are committee reports on as many different subjects dealing with fire protection. There will also be interesting reports by delegates from a number of member associations. Among the 61 active members of the National Fire Protection Association are the American Institute of Electrical Engineers, the American Street and Interurban Railway Association, the Fire Underwriters' Electrical Bureau, National Electric Light Association, National Electrical Contractors' Association and the Underwriters' Laboratories. W. W. Dudley is president and W. H. Merrill of Chicago is secretary.

MISCELLANEOUS.

Two wireless-telegraph stations have been established in the vicinity of Vancouver, B. C., one at North Vancouver just across from Burrard Inlet and the other at Point Gray, a peninsula seven or eight miles distant. These stations are expected to be of great service to the coastwise trade between Vancouver, Puget Sound ports and Alaska.

A Pittsburg dispatch says that the United States Steel Corporation has begun making cement. A plant costing $1,000,000, with 3,000,000-barrels-a-year capacity, is said to have been opened between the Homestead and the Duquesne mills on the Monongahela. The corporation will convert its slag piles into cement. The slag in the past has been so much waste. Gas from the Duquesne and Homestead furnaces will be used to run the cement plant. It is estimated that the United States Steel Corporation uses 2,000,000 barrels of cement a year.

L. W. Hawley, expert on wood distillation for the Forest Service, has just left for Oregon, Washington, Montana and Idaho, to investigate the possibilities of a future turpentine industry in the northwestern portion of the United States. There are at the present time in the Northwest several wood-distilling plants, which are producing various grades of turpentine, wood-preserving oils and materials of a similar nature. It is believed that a careful study of existing conditions in this section will yield results which will give an accurate idea of the possibility of utilizing the enormous quantity of sawmill refuse now going to waste.

Before a committee of the British House of Commons interesting details were given of the scheme for establishing in Ireland a new electric supply generated by peat gas, the first of the kind in Great Britain. The Dublin and Central Ireland Electric Power Company is seeking powers to supply electricity to portions of Dublin, Kildare, Queens and Kings counties, and has arranged to purchase 500 acres of peat bog in the district. The promoters propose to use a process by which it is advantageous to retain 50 per cent. of moisture in peat, thereby obtaining by-products, such as sulphate of ammonia, which alone would pay the cost of the peat, it is said.

The United States Civil Service Commission announces an examination on June 17th to secure eligibles from which to make certification to fill a vacancy in the position of electrician-elevator conductor, $900 per annum, in the Custodian Service, at Tampa, Fla., and vacancies requiring similar qualifications as they may occur in the Custodian Service in that city.

TRADE NEWS.

The Commercial Battery Company of Chicago has certified to a change of name to Commercial Battery Electric Company, and increased the capital stock from $15,000 to $30,000.

The Washington commercial representative of a foreign government advises the Bureau of Manufactures (File No. 2222) that a firm in his country would like to obtain the agency of an American electrical automobile manufacturer for the sale of his goods.

The Central Electric Company of Toledo, Ohio, has been incorporated with a capital stock of $25,000. The company will make a specialty of refilling burned-out incandescent lamps by a new process. It is said about 50 people will be employed to start.

A neat aluminum card has been prepared by the Kuhlman Electric Company of Elkhart, Ind., manufacturer of transformers. On the reverse side a convenient wire table has been printed giving the weight per 1,000 feet area in circular mils and safe current of conductors from No. 0000 to No. 18.

The Novelty Incandescent Lamp Company, with general offices at Emporium, Pa., and factories at St. Marys and Emporium, Pa., is proceeding with the erection of a western factory to handle the company's western business. The demand for lamps manufactured by this company requires additional manufacturing capacity, and it is understood that the new high-efficiency lamp will also be manufactured in this new plant.

At the office of the supervising architect, Washington, D. C., sealed proposals will be received until June 4th for the installation of an interior-conduit and wiring system for vacuum-tube lighting in the basement of the United States Courthouse and Postoffice building in New York city, in accordance with the drawing and specification, copies of which may be had at the above office or at the office of the chief engineer and superintendent, No. 727 United States Custom House Building, New York.

DATES AHEAD.

Central Electric Railway Association (regular meeting), Hoody House, Toledo, Ohio, May 26th.

Oklahoma Electric Light, Railway and Gas Association (annual convention), Guthrie, Okla., May 25th, 26th and 27th.

Canadian Electrical Association (annual convention), Toronto, Ont., June 10th, 11th, 12th.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

Michigan Electric Association (annual meeting), Grand Rapids, Mich., August 18th to 21st.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay Island, August 25th, 26th and 27th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 12, 1908.

[illegible] Thermostat. George H. [illegible], Boston, Mass. Application filed June [illegible] 1907.

[illegible] material intermediate the fixed terminals and connected [illegible]

[illegible] W. Dean [illegible] Ill. Application filed [illegible]

[illegible]

887,077. Sleet Cutter and Scraper. Frank L. Dye, Springfield, Ill. Application filed January 28, 1908.

[illegible] trolley pole is an insulating [illegible] and pivot connection with the trolley pole and cutter and scraper devices connected with the insulating pole.

887,087. Electric Thermostat. Harry G. Geissinger, New York, N. Y. Application filed May 29, 1907.

A thermal couple consists of elements having different rates of thermic expansion and contraction, the element [illegible] and the other being flexible and normally straight.

887,088. System of Temperature Control. Harry G. Geissinger, New York, N. Y. Application filed July 3, 1907.

In combination with a heater is an electric regulator having differential windings, one winding being included [illegible] means for closing the same, to energize both windings and to connect the heater with a source of heat.

887,096. Electric Interrupter and Intermitter. John R. Kelley, Cincinnati, Ohio. Application filed August 8, 1907.

In this interrupter there is an anode, consisting of a tube made of platino-iridium, and a core within the tube consisting of gold.

887,106. Armature-winding Machine. Charles H. Lewis, New Haven, Conn., assignor to the Acme Wire Company, Hamden, Conn. Application filed June 15, 1905.

This machine has a series of non-rotary brackets, armature holders arranged in pairs, each pair being adapted to grip an armature between them to rotate therewith, the holders having bearings in the brackets, and mechanism for rotating the holders.

887,107. Wire Fastener for Insulators. Fred M. Locke, Victor, N. Y. Application filed November 24, 1905.

A [illegible] element on the insulator is provided with an under [illegible] groove having tapering open ends

and [illegible] inserted in the [illegible] held the [illegible]

887,123. Electrode [illegible] Process of Making the [illegible] Price and Frank [illegible] N. Y. Application filed [illegible] Renewed December [illegible]

[illegible]

887,127. Electric Arc Lamp. [illegible] Herbert W. Rewane, London, England. Application filed March 10, 1906.

A metallic tube through which [illegible] passes has [illegible] gripping device pivoted to the lower [illegible] ture sliding on the outside of the tube and [illegible] connecting the armature to the gripper.

887,157. Electric-alarm Thermometer. Wilhelm Walther, Hamburg, Germany. Application filed March 12, 1907.

In this thermometer [illegible] contacts sealed into the [illegible] which [illegible] complete one or more of the circuits [illegible] an electric-alarm device is provided.

887,166. Electric Push-button. Henry Williams, New York, N. Y. Application filed August 1, 1907.

An insulating back for push buttons has a disk with a smooth, unthreaded edge [illegible] size to fit either the bell portion of a large sized cap or the rim portion of a small sized cap.

887,220. Apparatus for Producing Voltaic High-current Arcs. Harry Pauling, Gelsenkirchen, Germany, assignor to the firm of Salpetersäure-Industrie-Gesselschaft, G. M. B. H., Gelsenkirchen, Germany. Application filed September 30, 1907.

A pair of diverging electrodes is provided with means for blowing a current of gas through the space of greatest proximity of the electrodes and in the direction of divergence thereof. A pair of adjustable auxiliary electrodes is connected to the former electrodes and extends into the space between the latter.

887,221. Lightning Arrester. John Pearson, Somerset, Wis., assignor of one-third to James F. Williamson and one-sixth to Frank D. Merchant, Minneapolis, Minn. Application filed November 24, 1905.

In a lightning arrester having diverging horns of conducting material there is a non-fusible barrier interposed in the air gap between the horns.

887,222. Means for Automatically Controlling Voltage and Power Factor of Generators Operating in Multiple. John Pearson, Somerset, Wis., assignor of one-third to James F. Williamson and one-sixth to Frank D. Merchant, Minneapolis, Minn. Application filed March 1, 1906.

Each station contains a voltage regulator which at one station serves to determine the voltage on the main transmission line. There are means for subjecting the voltage regulator at each other station to the influence of the voltage of the transmission line at the point of junction of the line from the corresponding station with the transmission line.

887,223. Waterwheel Governor. John Pearson, Somerset, Wis., assignor of one-third to James F. Williamson and one-sixth to Frank D. Merchant, Minneapolis, Minn. Application filed December 21, 1906.

A waterwheel is provided with a relay and connections for adjusting the speed-controlling element of the wheel, a relay actuator subject to changes in speed of the wheel, and an anti-racing device comprising a dash pot and piston constituting an extensible connection between certain of the contacts of the relay and a part connected for movement with the speed-controlling element of the wheel.

887,231. Telephone Transmitter. Elmer R. Corwin, Clyde, Ill., assignor to the Corwin Telephone Manufacturing Company, Chicago, Ill. Application filed December 27, 1906.

This transmitter has a flexible metallic secondary diaphragm carrying a front electrode, consisting of a metallic disk faced with polished carbon.

887,233. Call Register for Telephone Systems. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed October 18, 1906.

Signaling and registering devices are located within the transmitter casing and a mounting plate therefor is secured to and behind the front plate of the transmitter.

887,252. Controlling System. William B. Jackson, Madison, Wis., assignor to himself and Dugald C. Jackson, Madison, Wis. Application filed September 16, 1905.

An air compressor supplies a pressure system and is driven by a motor through a magnetic clutch. Rheostat mechanism is controlled by the movements of the piston in a cylinder. A circuit for the magnetic clutch is controlled thereby. There are means for causing the cylinder to be suddenly connected with the pressure system when minimum pressure therein is reached and means for suddenly disconnecting the cylinder from the system when the maximum pressure is reached.

887,253. Valve-operating Mechanism. William B. Jackson, Madison, Wis., assignor to himself and Dugald C. Jackson, Madison, Wis. Application filed October 6, 1905.

Driving mechanism associated with the valve is automatically controlled. There are means upon initial

[illegible]

No. 887,[illegible]

[illegible] tions, a latch plate therefor adapted to lock the actuat[illegible] common to all the plungers, and means carried by the latch plate for actuating the controlling key and to [illegible]

887,[illegible]. [illegible] Signaling and [illegible] Apparatus. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed Jan. 14, 190[illegible]

This is a combined annunciator and springjack. It has [illegible] and the springjack below this.

887,263. Connection Switch. George K. Thompson, Newton Highlands, Mass., and Frank R. McBerty, Evanston, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed December 7, 1904.

In this springjack connector a frame carries contact springs and protective devices that are included in the circuits leading to the contact springs.

887,266. Process for Concentrating Nitric Acid. Harry Pauling, Gelsenkirchen, Germany, assignor to the firm of Salpetersäure-Industrie-Gesellschaft, G. M. B. H., Gelsenkirchen, Germany. Application filed August 13, 1906.

The process consists in electrolyzing aqueous nitric acid, liquefying the nitric oxides originated at the cathode, and in passing such liquefied gases into the acid surrounding the anode.

887,281. Sliver-evening Mechanism for Drawing Frames. Edwin C. Smith, Seekonk, Mass. Application filed January 5, 1907.

Mechanism to vary the rate of feed of the sliver is provided with controlling circuits for setting it in operation, a switch included in the circuits, and means actuated upon the variation of the sliver from a normal weight to effect the opening and closing of the switch.

887,287. Railway Switching Apparatus. John D. Taylor, Pittsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 11, 1904. Renewed March 5, 1907.

This switching apparatus is combined with an interlocking mechanism and operated by an electric motor with a manual and an automatic controller.

887,288. Apparatus Governing the Passage of Cars or Vehicles Along a Railway and the Control Thereof. John D. Taylor, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed September 14, 1904.

Indication mechanism for the switching apparatus above is described. Its main feature is an alternating-current magnet.

887,289. Apparatus for Controlling the Passage of Trains. John D. Taylor, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed October 20, 1904.

Further details of the indication mechanism for the controlling lever of the interlocking machine are described.

887,290. Control of Apparatus Governing the Passage of Cars or Vehicles Along a Railway. John D. Taylor, Pittsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed August 23, 1906.

The circuit controller for the above switching apparatus is described.

887,291. Safety Controller for Electric Switch-operating Apparatus. John D. Taylor, Pittsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed December 8, 1906.

This modified form of the above-described controller is automatic in action.

887,313. Telegraphic Apparatus. Frederick G. Creed, Glasgow, Scotland, assignor to himself, William Arthur Coulson, Nicol Paton Brown and Hugh Taylor Brown, Glasgow, Scotland. Application filed March 2, 1906.

A telegraphic receiving apparatus is provided with a tape-feeding mechanism and a tape-punching mechanism controlled in accordance with the electrical impulses received.

[illegible]

[illegible] can Electrical Heater Company, Detroit, Mich. Application filed [illegible] 1907.

[illegible]

887,3[illegible]. Electric Insulator. Herman Mart[illegible], Vallejo, Cal. Application filed May 29, 1906.

Upper and lower holding [illegible] insulating [illegible] upward and the outer one downward. (See cut on [illegible] page.)

887,357. Wireless Telephone. Nathan B. Stubblefield, Murray, Ky., assignor of 12½ one-hundredths to Conn Linn, five one-hundredths to R. Downs, five one-hundredths to B. F. Schroader, five one-hundredths to George C. McLarin, five one-hundredths to John P. McElrath, 2½ one-hundredths to Jeff D. Roulett and one-twentieth to Samuel E. Bynum, Murray, Ky. Application filed April 5, 1907.

Means for communicating between a number of stations consist of an aerial coil of wire of great magnitude, transmitting and receiving mechanism connected to this coil and including a source of heavy electrical energy, a number of vehicles movable between the opposite sides or stretches of the great coil, coils carried by the vehicles and disposed within the field of action of the aerial coil, and transmitting and receiving mechanism mounted on each vehicle and including a source of electrical energy.

887,358. Wall Bracket. George F. Swortfiger, Newark, N. J. Application filed May 1, 1905.

An insulator bracket has a vertical base for fastening to the wall an arm projecting from the base and at right angles thereto, the arm being divided into three branches for insulators, the branches rising vertically in front of the base and the middle branch standing farther from the base than the side arms.

887,408. Sign. George L. Mason, Newark, N. J., assignor to the George L. Mason Company, New York, N. Y. Application filed April 28, 1905. Renewed August 29, 1907.

In this sign there is a series of separate units united together, incandescent lamps within the units and a sign supported on the front of the box and adapted to be illuminated by the lamps.

887,439. Trolley Wheel for Electric Cars. George C. Stratton, Camden, N. J., assignor to Raymond L. Warren and Florence E. Cramer, Camden, N. J. Application filed July 18, 1907.

A combined trolley wheel and protector consists of a trolley wheel loosely mounted on a shaft between pairs of radial arms fixed to the shaft, and having curved projecting ends and curved shoulders projecting over the periphery of the wheel.

887,442. Controller. Lewis L. Tatum, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed June 28, 1906.

A multiple-voltage controller comprises a rotatable drum arranged to connect a motor armature across different sets of mains, a star wheel on the shaft of the drum and a lever movable by the star wheel to vary the resistance in the field circuit of the motor.

887,443. Dirigible Balloon. Russell Thayer, Philadelphia, Pa. Application filed December 26 1907.

In this balloon there is a rotary body provided with electrical means to rotate it at such speed as to produce a gyroscopic effect, and means supporting the body, so that it has a freedom with respect to an axis eccentric to its axis of rotation.

887,455. Electric-light Fixture. Harry A. Bauer, Lansdowne, Pa. Application filed October 11, 1904.

A wall bracket has means for mounting the lamp which is in the form of a candlestick upon it.

887,473. Telephone Receiver. William Gibson, Danbury, Conn., assignor to the Gibson Mfg. Co., Danbury, Conn. Application filed August 23, 1907.

This receiver is formed in two parts from vitreous material, combined with a screw-threaded metal ring on one part and a screw-threaded metal collar interlocked with the other part.

887,476. Apparatus for Electric Oxidizing of Atmospheric Nitrogen. Demetrio Helbig, Rome, Italy. Application filed January 5, 1906.

In this modification of No. 887,326 there is a body

[illegible] passage and means [illegible] the passage.

887,482. Electrocosmetic Face-mask. Gustave C. Lammers, Oakland, and Sanford Bennett, Alameda, Cal. Application filed August 26, 1907.

A device for the treatment of the face and diseases of the [illegible] consists of [illegible] metallic mask molded and fitting the face and serving as a conductor [illegible] face with which the mask contacts.

887,483. Electrically Propelled Vehicle. Joseph Ledwinka, Philadelphia, Pa. Application filed August 3, 1907.

The motor-field frame has non-rotatable trunnions at its respectively opposite ends, wheels fitted to rotate on the trunnions, independent shafts respectively connected in rigid relation with the wheels and mounted to rotate in the frame in axial alinement and in concentric relation with the trunnions. The armatures are respectively carried by the shafts, and there are distinct and independently controllable magnetic fields for the respective armatures, comprising main shunt field poles and intermediate commutating poles.

887,496. Outlet Box Cover. George B. McBean, Chicago, Ill. Application filed January 4, 1907.

This box has a combined cover and lamp socket fastened to the body with screws passing through holes with metallic bushings.

887,501. Electrical Cut-out. Philip T. McNally, Mandan, N. D. Application filed June 28, 1907.

The cut-out comprises an electromechanical device for turning on and turning off a switch at a distance, the whole forming means for preventing the device from making more than one turn on or turn off of the electrical switch for one closure of control circuit, no matter how long the control circuit may be kept closed.

887,504. Automatic Switch for Trolley Lines. Joseph Nelson, Cape May, N. J. Application filed August 30, 1907.

An operating rod is attached to the switch point and projects into casing. There are two rolls carried by the rod, two cams for actuating the rolls to effect the movements of the rod, two armatures carried by a frame, two magnets in the field of which the armatures are located and means for energizing the magnets.

887,514. Operating Mechanism for Radiator Valves, Etc. William H. Pearce, Chicago, Ill. Application filed June 28, 1906.

A valve-operating mechanism comprises a valve, an armature in operative connection with the valve, an electro-responsive device for moving the armature, means for completing the circuit to energize the device, a contact member supported by the armature, and means for moving the member out of engagement with one of the contact points for breaking the circuit when the armature approximately reaches the limit of its movement.

887,520. Insulator. John W. Rehling, Allegheny, Pa. Application filed September 6, 1907.

A block of insulating material is formed with a central opening and provided on its upper and lower sides with oppositely projecting lugs having serrated surfaces to grip the wires.

887,521. Dynamo-electric machine. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 24, 1903.

A rotating field construction provides a recessed core, [illegible] adapted to enter the recesses, and steps provided at the ends of the recesses [illegible]

887,525. Lightning Arrester. David B. Rushmore, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 5, 1907.

[illegible]

887,527. [illegible] Howard E. [illegible], Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed [illegible]

[illegible]

William H. Locke, Jr., Brooklyn, N. Y. Application filed May 17, 1901.

Arranged at intervals along the line conductors are condensers joined in parallel thereby. There is a grounded induction coil joined to one end of one of the line conductors, a transmitter circuit for affecting the induction coil, and a grounded receiver connected to the remote end of the other line conductor.

887,559. Revolving Multiple-fuse Block. Enoch Westerdahl, Thief River Falls, Minn. Application filed May 27, 1907.

There is a base plate provided with spaced blocks, the inner faces of which have annular recesses formed therein, transversely spaced spring contact plates projecting into the recesses, and a fuse-carrying member rotatably mounted between the blocks and having a number of fuse seats.

887,576. Railway Signal. Sofrony Bayas, Los Angeles, Cal. Application filed April 15, 1907.

The locomotive carries a forked harp with a double trolley engaging two sectional conductors connected with the signal circuit.

887,578. Hanger for Electric Wires. David S. Beyer, Edgewood Park, Pa. Application filed December 11, 1906.

This hanger for suspension wires of incandescent lamps consists of a substantially U-shaped body formed from two hook-shaped members overlapped at their upper ends and a securing and reinforcing member formed from a piece of wire doubled and passed through the overlapped ends.

887,598. Electrical Condenser Suitable for Use in Wireless Telegraphy and Other Purposes. Lucien H. Delloye, Paris, France, assignor to Société Anonyme des Manufactures de Glaces et Produits Chimiques de Saint Gobain Chauny et Cirey, Paris, France. Application filed March 26, 1906.

Two thin electrical conducting bodies are completely incorporated in a mass of glass, and each body has a terminal lug extending beyond the glass.

887,612. Controlling Means for Alternating-current Motors. Augustine R. Everest, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1905.

In combination with the motor are starting devices therefor, a switch arranged normally to cut the devices out of circuit, a magnet winding in series with the motor and means controlled by it for moving the switch to cut in the starting devices when the current in the winding exceeds a predetermined amount.

887,639. Dynamo-electric Machine. Louis R. Hornung, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed February 28, 1906.

There are provided a number of brush studs and straight insulated links joining adjacent brush studs for the purpose of bracing them to prevent vibration thereof. (See cut.)

887,642. Vapor Electric Apparatus. Alexander M. Jackson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 9, 1903. Renewed July 20, 1907.

As a starting means for mercury-vapor tubes, there are electrodes in proximity to each other, and thermal means for bringing them into contact.

887,644. Tool for Connecting Up Electric Fuses. Frank M. Jacobs, Waynesburg, Pa., assignor of one-half to William G. Theurer, Washington, Pa. Application filed September 14, 1907.

This is an automatic screwdriver with a socket wrench in its handle.

887,651. Safety Device for Elevators. William J. Kern, West Hoboken, N. J. Application filed June 20, 1907.

By this device the controlling lever for an electric elevator is locked while any of the doors are open.

887,659. Rectifier System. Osias O. Kruh, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 17, 1907.

[illegible] electrode and [illegible] means for preventing [illegible] them out of the main [illegible] the starting electrode.

887,660. Starting Device for Mercury-vapor Apparatus. Osias O. Kruh, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 14, 1907.

The starting conductor has a surface of oxide and protecting screen or shield.

887,666. Electric Water Purifier. James F. Lester, New York, N. Y., assignor to the Electrolytic Filtering and Purifying Company. Application filed November 28, 1906. Renewed December 12, 1907.

There are provided an electrolytic chamber and a filtering chamber, the first having a series of nickel electrodes connected in multiple, each electrode being in direct contact with the water being treated.

887,681. Electric Signaling. Francis W. Maxstadt and Francis W. Maxstadt, Jr., New York, N. Y. Application filed May 10, 1907.

A number of bells without make-and-break contacts are connected in parallel. An independent push-button is in series with each bell. There is a central battery and circuit-breaker.

887,691. Electrically Driven Vehicle. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 25, 1903.

The vehicle carries a trolley pole with a universal joint connection at its head. A contact shoe is yieldingly held at an oblique angle to the pole and in a definite swiveled relation thereto.

887,723. Electrical Switch. John D. Hilliard, Jr., and Charles E. Parsons, Utica, N. Y. Application filed May 13, 1905.

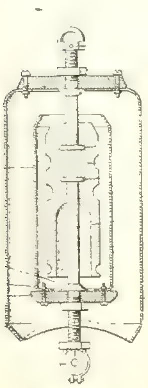
A double-break oil switch is described. (See cut.)

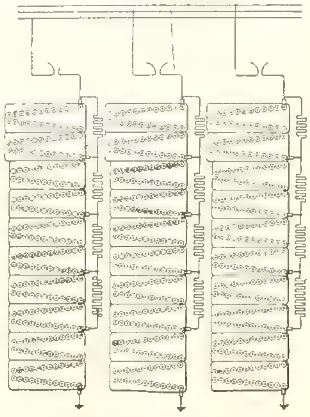
887,735. Process of Recovering Nickel from Silicious Ores. Adolphe Chalas, Philadelphia, Pa. Application filed September 6, 1907.

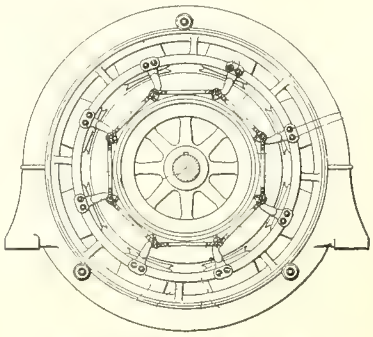
The process consists in smelting the ore and producing ferro-nickel, casting the alloy into anodes, electrolytically dissolving the anodes, continuously precipitating the dissolved iron by nickelic hydroxide and redepositing the dissolved nickel.

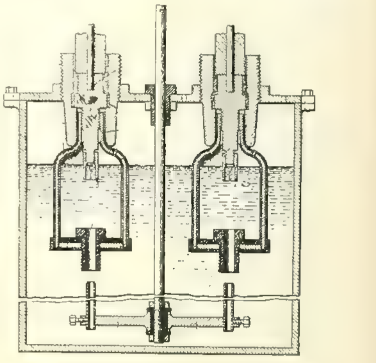
887,737. Magnetic Blow-out for Make-and-break Devices. Stephen D. Field, Stockbridge, Mass., assignor to the Pittsfield Spark Coil Company, Dalton, Mass. Application filed December 12, 1907.

The device has a magnet, a make-and-break mechanism located within the magnetic influence of the poles and forming a portion of the magnetic circuit of the magnet.


NO. 887,336.—INSULATOR.


NO. 887,525.—LIGHTNING ARRESTER.


NO. 887,639.—DYNAMO BRUSH MOUNTING.


NO. 887,723.—OIL SWITCH.

REISSUE.

12,793. Apparatus for the Regulation of Electric Systems. George A. Wells, Jr., New York, N. Y. Application filed June 22, 1906. Original No. 821,909, dated May 29, 1906.

A compensating generator with a heavy flywheel is connected to the line. An auxiliary generator helps to regulate the compensating machine.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 19, 1908.

452,359. Electric Switching Apparatus. G. T. Briggs, Windsor, Conn.
452,420. Dynamo-electric Machine or Motor. F. A. Wessel, Brooklyn, N. Y.
452,422 and 452,423. Controlling Device for Electric Motors. F. O. Blackwell, New York, N. Y.
452,510. Insulated Electric Conductor. J. B. Williams, Oakland, Cal.
452,515. Electric Railway-train Signal and Recorder. F. H. Brown, Chicago, Ill.
452,516. Joint for Electric Conductors. E. Carroll and T. B. Lambert, Chicago, Ill.
452,523. Electric Insulator. B. Jennings, San Jose, Cal.
452,542. Trolley Device for Electric Railways. D. N. Cook, Salem, Mass.
452,546. Wind Apparatus for Generating Electricity and Charging Secondary Batteries. J. M. Mitchell, Lawrenceville, Ga.
452,567. Glass-covered Electric Wire. Wm. Curry, Baltimore, Md.
452,574. Rheostat. C. D. Jenney, Indianapolis, Ind.
452,582. Annunciator Drop. H. C. Shuyler, Brooklyn, N. Y.
452,611. Conductor for Electric Railways. E. W. Mitchell, Spokane Falls, Wash.
452,622. Electric Railway Car. S. H. Short, Cleveland, Ohio.
[illegible] Electric Arc Lamp. [illegible] Buchanan, Lima, Ohio.
[illegible] Telephone Transmitter. P. Fitzsimmons, Birmingham, Ala.
[illegible] Sectional Shade for Incandescent Electric Lights. A. F. Gartner and H. C. Harris, Savannah, Ga.
452,725. Insulated Electric Conductor. J. B. Williams, Oakland, Cal.
[illegible] Electric Motor. C. H. Shatter, Rockford, Ill.
[illegible] Electric Railway System. D. G. Weems, Baltimore, Md.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLII. [illegible]

Sioule River Hydro-electric Power Plant.

By Fran[illegible]

One of the most [illegible] power station in France is that of the [illegible] de Clermont-Ferrand, located on the Sioule River, an affluent of the Allier, which in turn flows into the Loire. The accompanying picture shows the arrangement of the dam and the Sioule power house, located at Queuille, a distance of about 30 kilometers from Clermont-Ferrand. As will be noted, the power station is placed in the gorge below the dam, and [illegible] compact but somewhat unusual arrangement.

The current generated [illegible] which [illegible]

[illegible] meters.

The dam on the Sioule, near Queuille, where the [illegible] 32 meters high and at the crest 120 meters long, with a base 28 meters in thickness and 60 meters [illegible] wide and 7½ kilometers long, having a capacity of 10,000,000 cubic meters of water. In the power house there are six units of 1,200 horsepower each, consisting of horizontal-shaft Francis double turbines, directly coupled to three-phase Westinghouse alternators. There are four units for excitation, [illegible]

[illegible] cent. they operate continuously without the tem[illegible] per cent.

White marble is the material used for the switch[illegible] three of which are provided with instruments and switches for the exciters, while six panels are used for the alternators and four panels for the step-up [illegible]

SIOULE RIVER HYDRO-ELECTRIC PLANT AT QUEUILLE, FRANCE.

board at a pressure of 1,000 volts and is then taken to step-up transformers for raising the pressure to 20,000 volts for use on the transmission line to Clermont-Ferrand and to Royat.

The 20,000-volt lightning arresters and choke coils are of the Wurtz type. After passing the lightning arresters and choke coils in the Clermont-Ferrand sub-station, the current is reduced in pressure to 3,000 volts by step-down transformers in the sub-station. From the sub-station the current is distributed for light and power service.

In order not to depend wholly upon the hydro-electric plant on the Sioule River and the power-transmission line for current for lighting and power service at Clermont-Ferrand and Royat, a supplementary steam plant has been installed at the sub-station at Clermont-Ferrand. This plant includes a vertical compound steam engine of the Willans-Robinson type having a capacity of 450 horsepower directly coupled to a Westinghouse alternator of 315 kilovolt-amperes, with the exciter mounted on the same shaft. This alternator supplies a three-phase current of 3,000 volts pressure with a frequency of 50 periods per second.

A second unit consists of a horizontal steam engine of 1,200-horsepower capacity, directly coupled to a 900-kilowatt Westinghouse three-phase machine

zonal turbines, all of which were built at Zurich, Switzerland, by Escher, Wyss & Co.

At a speed of 333 revolutions per minute and working under a head of from 21 to 25 meters, the turbines show an efficiency of 76 per cent. at full load, 80 per cent. at three-fourths load and 75 per cent. at half load, the speed variation being within two per cent. for ordinary operating conditions. The automatic regulators for the turbines control the speed within three per cent. with a variation of 25 per cent. of the load and within five per cent. with 50 per cent. change of load, while with a variation of load from zero to 100 per cent., or vice versa, the maximum speed variation is seven per cent. Each of the turbines is supplied by a separate penstock having a diameter of 1.6 meters.

The three-phase alternators in this station are coupled to the turbines by elastic couplings of the Zodel type. These generators have a capacity of 1,000 kilovolt-amperes and supply a three-phase current of 1,000 volts pressure. They have 18 poles and when operating at a speed of 333 revolutions per minute supply a current having a frequency of 50 periods per second. The generators have an efficiency of 94 per cent. at full load and 92.5 per cent. at three-fourths load, while at one-fourth

cated under the switchboard gallery and includes several groups of single-phase transformers, each having a capacity of 375 kilovolt-amperes, designed to raise the pressure from 1,000 volts as received from the alternators to 20,000 volts for use in the power-transmission line. These transformers have an efficiency of 97.7 per cent. at full load and three-fourths load and 97.1 per cent. at half load.

Electric and Gas Companies May Not Consolidate in Massachusetts.

An important bill was enacted recently by the Massachusetts Legislature and received the executive signature. It provides that electric-lighting companies may consolidate, subject to specified regulations, and that gas-lighting companies may also consolidate, on similar conditions, but that no gas and electric companies shall thus consolidate in that state hereafter. Companies which at the time of the passage of the bill manufactured both gas and electricity for lighting purposes retain the right to do so.

For all consolidations two-thirds of the stockholders of each company in the compact must assent, and approval of the state Gas and Electric Light Commission must be obtained as a preliminary to the merger.

Receiving Stations Operated from High-tension Transmission Lines.[1]

By S. Q. Hayes.

The design of receiving stations operated from high-tension transmission lines has become of vital importance to those responsible for obtaining the best results, and the main features involved in such station design warrant careful consideration.

The term "receiving station," as used in this paper, covers stations where practically all of the electrical power is received over one or more incoming feeder circuits from other stations where it is generated by steam or waterpower.

In taking up the details of the apparatus used in such stations it will be obviously impossible even to touch on all of the different types, so one particular line of apparatus will be considered and compared with other conflicting designs.

Scope of Station.—This paper deals with receiving stations operated from transmission lines of 22,000 volts and upward, with their equipment of transformers, switching devices, protective apparatus, etc. To secure the most suitable arrangement of a receiving station it is essential that the building be designed for the apparatus that it will contain instead of attempting to arrange the equipment in a building already erected. It is the purpose of this paper to point out the main features of the apparatus required in receiving stations, with particular reference to such points as influence the design of the building.

Type of Transformers.—Transformers may be divided into types determined by the means adopted for dissipating the heat developed in operation. These means may be divided into natural air-cooling, artificial air-cooling, natural oil-cooling and artificial oil-cooling, and these determine the main features of the transformer.

Natural air-cooling depends on the conduction of heat through the air from the transformer to its case, where it is radiated to the surrounding air, and it has been found impracticable to build such transformers in large sizes.

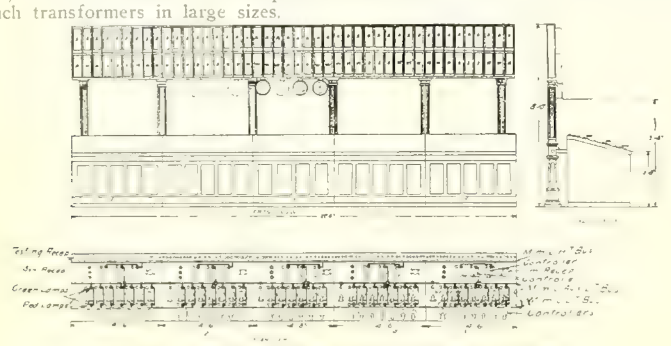


FIG. 1. CONTROL DESK FOR RECEIVING STATION.

Artificial air-cooling is obtained by forcing a blast of air through the iron and the coils of a transformer placed in a cast-iron housing, and ordinarily located over an air chamber, where a pressure of one-half to 1½ ounces is maintained by a blower, usually driven by a motor.

Owing to the difficulty of securing satisfactory insulation without the use of oil, air-blast transformers are not built for pressures above 33,000 volts, and are not recommended for more than 22,000 volts.

Natural oil-cooling takes place when a transformer is immersed in oil and provided with a case having sufficient radiating surface to dissipate the heat brought to it by the oil. Transformers of this type have numerous ducts extending through the opening in the iron from one end of the coil to the other, and similar ducts between the laminations permit a circulation of oil throughout the interior of the transformer.

Artificial oil-cooling is adopted for larger sizes, and two methods are in general use for cooling the oil, these being known as forced-water and forced-oil circulation. In the former method one or more coils of seamless brass tubing are placed [illegible] the top of the transformer case [illegible] and water is circulated [illegible] to remove the heat from the oil and to promote the circulation of the oil.

The circulation of oil in such transformers depends on the difference in weight between the hot [illegible] the transformers are of large capacity this natural circulation is not vigorous enough [illegible] the heat developed, and it is necessary to resort to artificial circulation. [illegible] removing the oil from the [illegible] passing it through cooling [illegible] condenser [illegible]

[illegible]

units can be built if required. The limit of size is largely a question of shipping facilities or of building up the transformer at destination.

The question of three-phase or single-phase transformers has been ably summed up by Mr. J. S. Peck in stating that three-phase transformers, when compared with three single-phase units of the same total capacity, have the advantage of lower cost, higher efficiency, smaller floor space, less weight, simpler wiring, reduced freight and erection charges;

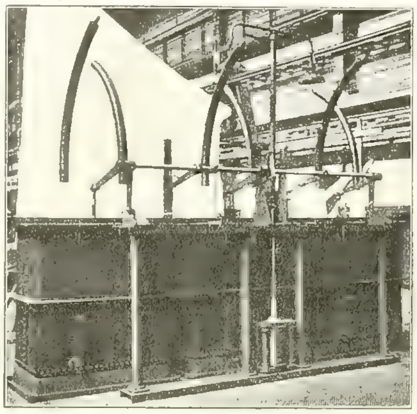


FIG. 2. 60,000-VOLT OIL CIRCUIT BREAKER.

while the main disadvantages are the greater cost of spare units and repairs. Allowing a spare unit in each case for one or two circuits, the single-phase units have the advantage in price of transformers, while for three or more circuits the three-phase units have the advantage.

The relative advantages of star and delta connections have been pretty thoroughly discussed at various times, and seem to be reduced to these features: With delta connections one set of coils on a three-phase transformer or one of a bank of three single-phase transformers can be cut out of circuit and the remaining two can then be connected in open delta and deliver 173/300 of the output with the same heating. With star connections the voltage on any one transformer is only 0.577 the amount between lines, and a neutral point is available for grounding or other purposes.

The question of using star connections and a neutral grounded solidly or through a resistance is a mooted one, but the general practice, particularly for very high voltages, favors the star connection with neutral grounded through a resistance that will limit the current that flows through a grounded line.

The use of small transformers operating from

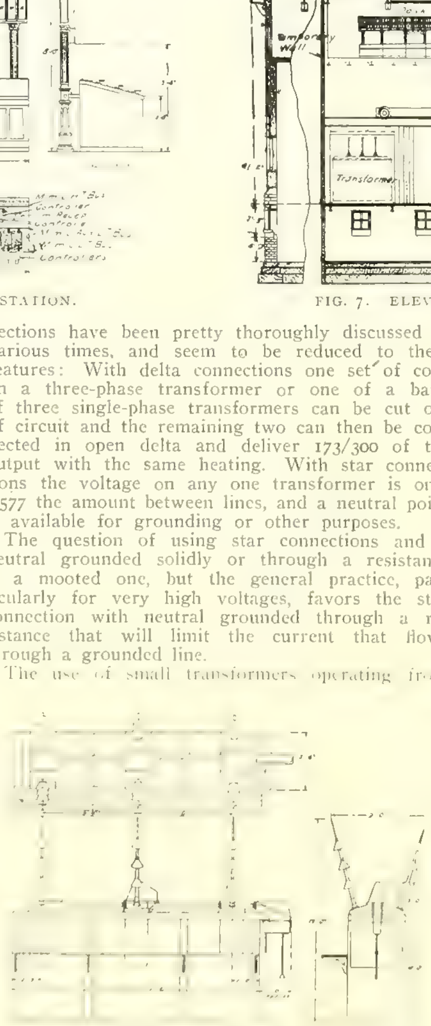


FIG. 3. [illegible]-VOLT OUTDOOR-TYPE OIL CIRCUIT BREAKER.

extremely high-tension lines is complicated by the fact that a power transformer cannot be economically built for a smaller capacity than about 0.5 kilowatt per thousand volts. As the voltage of the line is raised, the size of transformer that can be economically built for operation at that voltage goes up, and it occasionally happens that a small customer located near a transmission line of 60,000 volts or higher, desires an amount of power

less than that for which a transformer can be furnished suitable for that voltage.

On some of the larger transmission circuits, such as those of the Niagara, Lockport and Ontario company's lines in New York, transformer stations are installed for lowering the line pressure from 60,000 to 11,000 volts, and various customers are then supplied at 11,000 volts.

Main Connections.—For switching stations located along a transmission line the main connections are very simple, and as a rule simply allow for the opening up or connecting together of the various lines. For receiving stations with transformers the main connections will depend on the number and capacity of incoming lines, step-down transformers, outgoing feeders, local circuits, and so forth, and the proper arrangement of the bus-bars, and so forth, is a matter of great importance. With one incoming line and a transformer circuit of the same capacity as the line, no high-tension bus-bars are needed, as the line will connect through suitable switching devices direct to the transformer circuit.

If the one line feeds two or more transformer circuits, or two or more lines feed one transformer circuit, a single set of high-tension bus-bars will be required. If there are two or more lines and two or more transformer circuits, a single set of bus-bars is sometimes used; but, as trouble in this bus involves a complete shutdown of the station, a more flexible system is advisable. This flexibility is obtained by using a sectionalized bus, double bus, ring bus, or relay bus, depending on the number of lines and circuits and the amount of the flexibility desired. With three or more lines, the best results can usually be obtained by having the transformer circuits of the same number and capacity as the lines, and arranging so that, normally, each line will feed its own transformer circuit, but in case of necessity can be connected to any transformer circuit.

Switchboards.—In some switching and transformer stations various knife-switches, circuits, breakers,

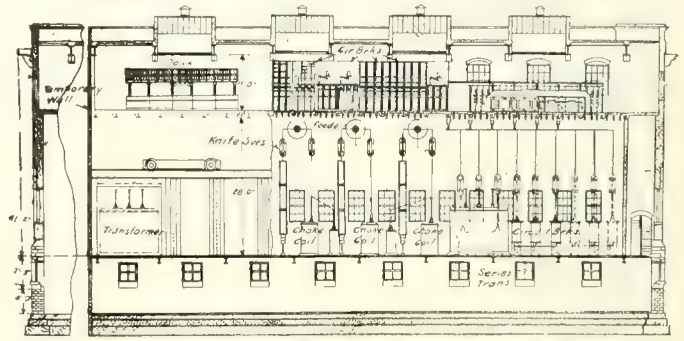


FIG. 7. ELEVATION OF 60,000-VOLT TRANSFORMER STATION.

etc., are provided, and no switchboard, properly so called, is used. In other stations, particularly where electrically operated oil circuit-breakers are used, some central point is usually chosen from which to control the station. This central point is ordinarily a switchboard on which are mounted the controlling devices, relays, etc., as well as various meters for the transformer and feeder circuits. These switchboards for receiving stations are usually made of the panel type, although occasionally a control desk or bench-board is supplied.

The switchboard panels or the top slabs of the control desk are ordinarily made of polished marble or slate with oil or marine finish. While polished marble has been used in many installations, marine-finish slate is growing in favor more and more, owing to its being somewhat cheaper, and far easier to match and to keep in first-class condition.

The panel boards used for receiving stations are simply modifications of standard switchboards, with panels for various line, transformer and feeder circuits, as well as a panel for the control of a small storage battery with the motor-generator set used for charging it.

Where there are a large number of circuits to be controlled and a very compact arrangement is desired, a control desk is often used, with the controllers mounted on the horizontal top of the desk, and the instruments back of and above the desk in such a manner that the operator at the desk will face the switching and transformer room. While operating the controllers and the like, he can watch the meters or look under the instrument frame and over the top of the desk and watch the breakers, etc.

Fig. 1 shows a combined desk and instrument frame of this type, to be used ultimately to control five 9,000-kilowatt, 60,000-volt, three-phase incoming lines; five 9,000-kilowatt, 60,000-12,000-volt, three-phase, step-down transformers, one 12,000-volt local service feeder and 29 12,000-volt distributing feeders.

The general connections of this station are rather clearly shown by means of the miniature bus-bar system on the top of the desk. The general scheme is to normally have each incoming transmission line feed its own three-phase transformer, and each transformer will normally operate on its own auxiliary bus, supplying power to about six 12,000-volt feeders.

[illegible]

FIG. 4. 88,000-VOLT OIL-IMMERSED CHOKE-COIL.

used on the circuits of the Niagara, Lockport and Ontario Power Company to cut off the individual transformers, and fused breakers of this same general design have often been used in sub-stations for single-phase railway prop sitions, as shown in Fig. 5.

This fused circuit-breaker is essentially a single-pole device, and for special applications, such as cutting off individual transformers in the manner used by the Niagara, Lockport and Ontario Power Company, or in transformer stations of single-phase railways, they have given great satisfaction. For the three-phase work it is usually advisable to have all three of the main circuits opened at the same time, and oil switches and circuit-breakers are used for this purpose.

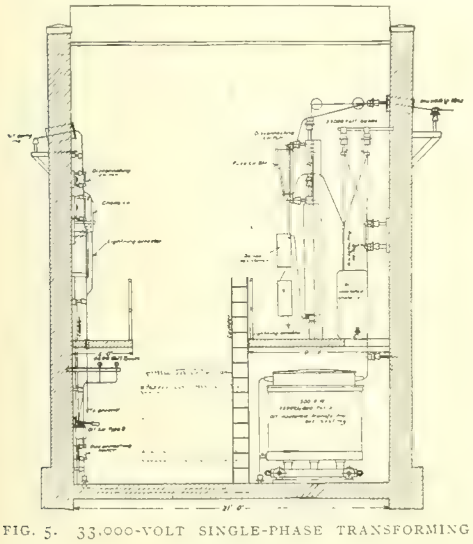


FIG. 5. 33,000-VOLT SINGLE-PHASE TRANSFORMING STATION.

The essential feature of an oil switch or breaker is that the circuit is ruptured under oil, and designs have been perfected for all classes of service, from the small-capacity, low-voltage apparatus to the 60,000-volt breakers used on the circuits of the Ontario Power Company, which are guaranteed to operate satisfactorily under any condition of overload or short-circuit that might exist in a plant of 200,000 kilowatts capacity. Breakers have been built and designed for circuits up to 132,000 volts, and higher limits can be reached if necessary.

Owing to the amount of power required for operating large oil circuit-breakers, motors or solenoids are usually employed, although practically any type of solenoid-operated breaker can be arranged for hand operation.

The amount of current available momentarily at the point of trouble in large stations operating at pressures of 12,000 volts or less is something enormous, and every precaution must be taken to prevent the spread of trouble. The problem of suitable distances and insulation is a simple one for such voltages.

[illegible]

[illegible] metal parts submerged in oil, with the tanks, framework, mechanism, etc., thoroughly grounded and the breaker entirely self-contained, while with break- [illegible]

The top-connected breaker can be built suitably for outdoor service in the manner shown in Fig. 3, which shows the outline and overall dimensions [illegible] tions have been taken for rendering the operating mechanism, terminal bushings, etc., impervious to severe weather conditions.

In order to furnish automatic protection to alternating-current circuits, relays of various types are used for closing the tripping circuits of the oil breakers. These relays can be made to operate instantaneously or with a time limit, either adjustable or inverse, and to give protection against overload, reverse current or other troubles.

Protective Devices.—For high-tension circuits, choke-coils and lightning arresters are provided to furnish protection against lightning and static disturbances of various kinds.

Choke-coils for such circuits are usually made in the form of a flat spiral for circuits up to about 25,000 volts, while for high voltages either the oil-immersed type or the open helical type can be supplied. As a rule, the strain developed across adjacent turns of a choke-coil in a high-tension circuit is so great that when the coil performs the function normally expected of it, oil insulation seems to be necessary to obtain the best results.

Fig. 4 shows an oil-immersed choke-coil for use on an 88,000-volt transmission circuit where the lightning conditions are particularly severe and where the maximum amount of protection possible was desired, owing to the importance of the circuits to be protected.

Lightning arresters for these receiving stations are made of the low-equivalent multi-gap or of the electrolytic type, and as these have been often discussed and described there is no necessity of taking them up in this place. The electrolytic type of arrester seems to be growing in favor, largely due to the fact that it is suitable for outdoor service.

Bus-bars and Wiring.—Practically all large receiving stations enclose the low-tension secondary wiring if between the limits of 500 and 13,200 volts, owing to the enormous momentary amount of current available under short-circuit conditions with the disastrous arcs resulting. This provides protection to the operator and security against breakdown, due to some conducting material getting across the bus-bars.

For voltages of 33,000 and above, fireproof barriers and cellular construction are unnecessary, as the violence of the arc and the destructive effects of a short-circuit depend on the amount of current available at the point of short-circuit or, for the same amount of power, are inversely proportional to the voltage.

Fireproof barriers offer a more or less perfect ground for high-voltage circuits, and the higher the voltage, the more perfect the ground. With barriers the striking distance to ground has to be reduced 50 per cent. or more over what could be obtained with open wiring in the same space.

Enclosed high-tension wiring, recommended by certain engineers, requires a more expensive building and makes the inspection and repair of bus-bars, wiring, disconnecting switches, etc., far more difficult. This increased difficulty of inspection prevents incipient trouble being noticed so readily.

Auxiliary Apparatus.—In receiving stations such as form the subject of this paper, the main circuits are all alternating, and as direct current is usually required for the oil circuit-breakers, etc., it is necessary to install a mercury rectifier or a direct-current generator driven by an alternating-current motor. Usually a small 125-volt storage battery of from 40 to 100 ampere-hours capacity is provided to insure a constant source of direct current, and this is charged by the rectifier or motor-driven generator.

Switching Stations Without Transformers. Such stations are used for sectionalizing transmission lines or for providing branch circuits from the main lines. As a rule, these consist simply of knife-type disconnecting switches, mounted on the towers or poles, and all switching is done only after power is cut off from the circuit. Where branch lines run off from the main lines, fuses are sometimes used, these being made of a sufficient

[illegible]

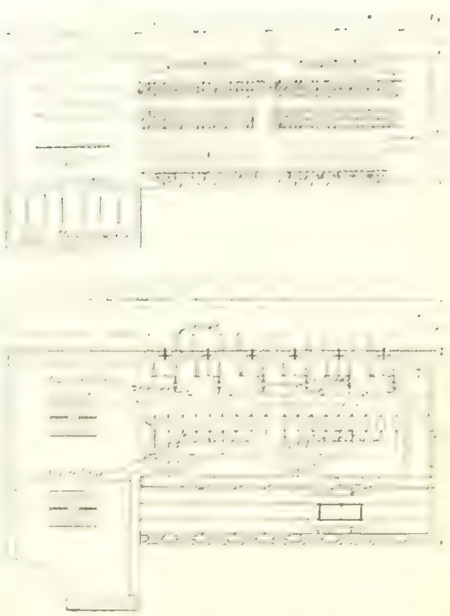


FIG. 6. PLAN OF 66,000-VOLT TRANSFORMER STATION.

multiple both on the high-tension and on the low-tension side. In the incoming-line circuit are two fused-type circuit-breakers to furnish the automatic protection and two oil-insulated choke-coils with low-equivalent lightning arresters and disconnecting switches.

Fig. 6 shows the plan view, Fig. 7 the elevation and Fig. 8 the section of terminal station that will ultimately control five 9,000-kilowatt, 60,000-volt incoming lines; five 9,000-kilowatt, three-phase, step-down transformers; one 12,000-volt local-service feeder, and 29 12,000-volt distributing feeders. This is the station for which the control desk shown in Fig. 1 will be used, and approximately two-fifths of the ultimate installation will be put in at first. The dotted lines appearing on Figs. 6 and 8 show the additional space required for the installation of three single-phase transformers in place of each three-phase transformer.

Fig. 6 shows the plan-view location of the apparatus in the low-tension and high-tension circuits.

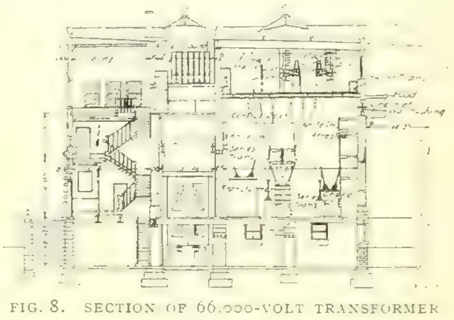


FIG. 8. SECTION OF 66,000-VOLT TRANSFORMER STATION.

One part of the plan view shows the upper floor and locates the low-tension breakers, control desk, terminal panels, etc.; another portion shows the lower floor with the high-tension breakers, choke-coils, lightning arresters, etc.

Fig. 7 shows the relative location of the step-down transformers, high-tension and low-tension circuit-breakers, bus-bars, disconnecting switches, etc. This elevation is taken in such a manner that one portion shows the 12,000-volt circuit-breakers, bus-bars, connections, etc., while the other portions show the control desk, etc. One part of the high-tension compartment shows the oil circuit-breakers and step-down transformers, while another portion shows the outgoing lines, choke-coils, lightning arresters, etc.

Fig. 8 shows the sectional view of the station, locating the transformers, low-tension and high-tension oil circuit-breakers, control desk, relay panels, etc. As may be noted, all of the high-tension apparatus, bus-bars, wiring, etc., have been located on the main floor, and can be readily inspected without danger, and without having to visit several floors and remove a large number of doors. The low-tension breakers, bus-bars, etc., are placed on the second floor, with the control desk, instrument and relay panels, etc.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Conclusion of Report of Chicago Convention.

[illegible] at the thirty-first convention of the National Electric Light Association at the Auditorium Hotel, Chicago, on May 18 to 22, [illegible] 100 the total attendance at the Washington (D. C.) convention [illegible] which was the largest up to that time in the history of the association, which goes back to the year 1885. Thus the convention was the most successful which the association has ever

WILLIAM C. L. EGLIN.
President of the National Electric Light Association. See page [illegible].

held in the vital matter of the number of people attracted to it. The programme of papers was excellent, and there were many good discussions. Particular credit is due for the large amount of valuable material brought out in the "Commercial Day" discussion. The exhibition of electrical appliances was perhaps the best ever given under the auspices of the association, while it would have been difficult to improve on the entertainment features and the systematic manner in which they were handled. A notable feature was the large attendance at the convention sessions. Two large halls were provided (for there were parallel sessions on two days), and on more than one occasion in each hall there were men standing up awaiting vacant seats. The tragic death of Mr. R. C. P. Holmes of the Commonwealth Edison Company of Chicago, mentioned in the Western Electrician of last week, was a depressing influence during the closing days of the convention. Had it not been for this sad and mysterious affair, there would have been nothing to mar the complete success of the greatest of all electric-light conventions.

The proceedings of the first three days were given in last week's issue of the Western Electrician, which was in the hands of delegates attending the convention on Friday, the closing day. The conclusion of the report is given herewith.

Thursday's Proceedings.

Morning Session Adjourned Out of Respect to Mr. Holmes.

Immediately after the Thursday morning session was called to order Charles R. Huntley of Buffalo, past-president, was recognized by the president. Mr. Huntley referred in feeling terms to the murder, as it seemed, of Mr. Holmes, and, out of respect to the dead man's memory, moved that the association adjourn until 1:30 p. m. President Farrand said that the motion admitted of no debate and declared the session adjourned.

Tungsten Lighting in Brooklyn.

At the opening of the Thursday afternoon session M. S. Seelman, Jr., of the Brooklyn Edison Company, gave an account of the method of handling the tungsten-lamp situation in that city. [illegible]

"With the understanding that the supply of tungsten lamps would be, at least for some time, limited, and with the idea that it would be more profitable to utilize such lamps as we could secure, in replacing gas illumination, thus adding to our revenue, rather than to place them in present sockets, where they would be likely to reduce current [illegible] company to exploit the Tungsten lamp, and especially [illegible]

"The Tungsten Lamp Specialty Company was therefore formed with the clear understanding that [illegible] pective customers a unit price covering a complete tungsten equipment, including wiring and the supply of appropriate fixtures, reflectors and lamps. It was not deemed wise for the company to do its own wiring, as the Edison company preferred to avoid all complications with the local electrical contractors, and to rather secure their co-operation than their ill-will. Specifications were therefore drawn, covering wiring in molding for a minimum of four 100-watt lamps, not more than six lamps on any one circuit, with a separate switch for window lights and a switch for each store circuit, contractor to hang fixtures, which were to be furnished by the company. These specifications were submitted to all contractors in good standing in Brooklyn, and resulted in the Tungsten Lamp Company securing a blanket price of $2 per outlet and 50 cents per switch. Types of single-light fixtures were adopted which cost the company from 45 cents to $1.20, according to style and length of stem. The reflector adopted as a standard for general use was Holophane No. 7391. The price of the 100-watt lamp when sold separately was fixed at $1.75.

"The proposition the Tungsten Lamp Company advanced to the public was to supply a complete equipment (the minimum being four lamps) for $7.50 per outlet, including, as aforesaid, wiring, fixtures, reflectors and lamps. This price allowed about $2.50 per outlet for office and sales expense.

"Five solicitors were employed, and each one supplied with a sample kit, consisting of a neat satchel, enclosing sample fixtures, reflectors and a 100-watt lamp. These solicitors were instructed to let exclusive electric installations severely alone and to confine their efforts, as far as possible, to stores illuminated altogether by gas; but they were also permitted to solicit business in stores partially illuminated by electricity and partially by gas, provided they could put the gas out of business. Business was to be done as far as possible for cash, but installments spreading payment over not more than six months might be accepted where credit was good.

"The Tungsten Lamp Company has been operating on this basis for about seven weeks, and during that time it has secured 50 contracts, covering the installation of 312 tungsten lamps. Of these, 42 contracts replaced installations exclusively gas, while eight replaced gas in installations partially electric. The majority of these stores are now lighted by tungsten lamps, and it is exceedingly pleasing as well as somewhat unusual to find so many satisfied customers, for in each case the customer is delighted not only with his illumination, but with his bills."

Mr. Seelman told of a tea store having average gas-lighting bills of $11 a month. With tungsten [illegible] reduced to $7 a month. He continued:

"We have given all customers option of renewing burned-out lamps in their installations for $1.75 a lamp, or of having us maintain their installation for 35 cents a month per lamp (which is a guarantee of five months' life). So far 15 customers [illegible] themselves of the maintenance proposition and the others have themselves assumed the life risk of the lamps. It was expected that in handling these lamps, with their fine brittle filaments, there would be inevitably some breakage. This breakage, however, did not amount to a very large item, but the number of defective lamps has proved so far greater than was anticipated, and out of all reasonable proportion to the number of lamps handled. The breakage in shipment from manufacturers is negligible. A few lamps are broken in delivery to customers' premises, or by agents in demonstration, but the majority of lamp failures have been due to faults of construction in the lamp itself.

"As a result of the installation of 774 lamps, we have 162, or 21 per cent., failed and broken lamps, the large majority of which went out after burning from 10 minutes to 24 hours. The principal trouble seems to be that a number of the lamps have defective vacuums, as noticeable from a distinct violet color when the current is turned on. These lamps invariably burn out in a short time. A number of lamps have also blackened after burning from 50 to 100 hours. These lamps we have been obliged to replace. Mr. Morrison, manager of the General Electric lamp works, tells me that these troubles are merely incident to the early stage of manufacturers, and will doubtless be soon remedied.

"Although in business such a short time, the Tungsten company has been able to meet the financial requirements under which it was organized. It has not only been able to do the business outlined in the foregoing, thus securing a number of new customers for the Edison company, without any expense to the company, but it can show a surplus over and above all expenses. It has also obtained considerable tungsten experience of value to the Edison company."

Relation of Engineering and Commercial Departments.

The long "Commercial Day" programme (relating to business-getting methods) prepared by C. W. Lee of New York was reached on Thursday afternoon. Henry L. Doherty of New York, past-president, presided with ability at "Commercial Day" sessions. He first introduced his old friend, Louis A. Ferguson of Chicago, who delivered an address on "Relationship Between the Engineering and Commercial Departments." The following extracts will show the trend of Mr. Ferguson's address:

To me it has always seemed that the relation between the engineering departments—speaking broadly and including both the constructive and the operating engineering—and the commercial or business-getting departments should be as close as possibile, even to bringing them, if necessary, under one head, for their work when considered at their foundations is so dependent one on the other.

The engineer, to fill that specification, must be of the highest, broadest type. He must have other qualifications than the ability to design the power house and calculate the sizes of the conducting wires and cables of the distribution system. He must have broad, sound judgment to determine the

Photograph [illegible] Light of Tungsten Lamps which were Exclusively Used for General Illumination.
A VIEW IN EXHIBITION HALL AT CHICAGO ELECTRIC LIGHT CONVENTION.

[illegible] this, it seems to me, it is desirable that the head of the contract department should be a technically [illegible]

[illegible] necessarily be an expert in higher mathematics or theoretical electricity, but I do mean that he should [illegible]

[illegible] last 25 years and that in the early days of this development there were few technical men, aside from civil engineers and architects.

Why are the lawyers who have achieved marked success in their profession sometimes chosen to conduct the affairs of large undertakings? They are technical men. They are business engineers; they [illegible]

[illegible] by having his territory divided in this way, as there [illegible] dences.

[illegible] should contain such information as owner of the building, occupant, street and number, class of building, class of business, wired or not, kind of illumination and kind of power used, upon completion of which itemized and detailed information is [illegible] secured. It is very easy to overload a card index with information that it is almost impossible to keep up. This card should therefore be limited to essential data only.

The natural growth of a large city may be assumed to be 10 per cent. It would appear, therefore, that the increase of gross earnings above this amount is due to pushing the business. The representatives should have the credit for this increase. They should put in considerable time on the natural growth of existing business, for which they should receive proper credit.

Rates should be competitive, all things considered. The large prospective customer is not interested [illegible]

[illegible] the year previous. I think what most companie[illegible]

[illegible] Almert of Wichita, Kan., spoke of the manner of handling complaints.

Arthur Williams, New York: In New York the [illegible] who for the time being may give up the use of electric current for any reason, very largely because he [illegible]

SCENE IN ASSEMBLY HALL AT THE CHICAGO ELECTRIC-LIGHT CONVENTION OF 1908.

apply to the engineer as to his capability for the conduct of a large business apply similarly to the lawyer. He must be broadly educated, either originally in his college life or in after years through contact with men of broad ideas and experience.

The importance of more intimate relationship between the engineering departments and commercial departments, including the accounting as well as the contracting, cannot, it appears to me, be too strongly emphasized. Their work is so interlaced and the successful accomplishment of it so interdependent that each should do all it can to educate and assist the other, for, after all, the determination and the continuation of a sound policy in the management of the company demands a proper understanding and the closest and most friendly co-operation between the various departments of its business.

The Campaign for Central-station Business.

Henry J. Gille of Minneapolis (as editor, with several assistants) presented a paper on "Preparation for a Campaign." He said that the city should be divided into districts—the residence districts separate from the business districts—and there should be as many business districts as there are residence districts. In the residence district I have found that one good way is to make the division on a basis of the number of residences on the line. The business district must be divided arbitrarily. Each representative should be given a business district and a residence district, for the reason that of getting the same results. Rates should be in such form that the customer can readily understand them, and it should be the duty of the representative to explain the rates, so that there will be no misunderstanding. Mr. Gille considers the rate question of more importance than any other except service. These two are the leading factors in building business.

Every complaint, whether received by letter or personal call, should be thoroughly investigated by referring to the consumer's account. In very many cases the reason for complaint is readily found, and reply should be made to the consumer at once. Promptness should be the aim in the settlement of complaints, as it creates a better feeling in the customer's mind to know that he is getting prompt attention, and it also facilitates very much the collection of accounts. As the work requires careful attention and is of such varied character, it should be directly under the charge of a high-grade man, one who is familiar with the business and who has tact and good judgment. The word "Complaint" should be eliminated as the name of a department.

J. T. Maxwell of Philadelphia opened the discussion on Mr. Gille's paper. He spoke of the custom of the Philadelphia Electric Company in holding a general meeting once a month, attended not only by selling managers and solicitors but by men from other departments as well. All the papers were prepared and read by solicitors who had from two to three weeks' notice of their subjects. The men per cent., as elsewhere, the actual net loss of business is very small indeed, as is shown from year to year upon most careful examination. I do not quite agree with Mr. Gille in the opinion that it is not desirable to secure business along new lines; as a matter of fact, I think that every profitable chance to extend our lines should be seized, that every hundred feet of additional line underground or overhead may give us just so much additional capacity for supplying new customers.

Mr. Seelman told of an experiment to get the 1,200 to 1,600 employes of the Brooklyn Edison Company interested in new-business getting. A school was organized, meeting one night a week, at which the practical requirements for getting new business were taught. Thus a number of solicitors working evenings among individual acquaintances were added to the company's forces. This system has been in force for possibly three months, and the remuneration is on this basis: On all contracts for new business—no extension business is taken on this basis—the company gives 50 per cent. of the first full month's bill of the customer to the employe-solicitor who secures the business. For additional or renewal business, 50 per cent. of ten dollars is given, and 10 per cent. of the amount over ten dollars. The company will pay out in commissions to employes some $750 or $800 for the business secured in the first three months of the operation of this plan. Mr. Seelman did not

[*Continued on page 434.*]

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[illegible] the receivership of the Chicago [illegible] which is now drawing to [illegible] one of the most [illegible] kind in history [illegible] has been settled [illegible] special at [illegible] will be in the neighborhood of $2,000,000. One receiver has al[illegible] largely responsible for the satisfactory reorganiza[illegible] cost over $1,200,000, and at least one attorney is [illegible] public service corporations, would it not be well to create legislation looking to the economical adjustment of receiverships in the interest of stockholders and creditors?

NEW YORK has in its Subway "the finest and most efficient example of underground railway construction in the world," according to Mr. Bion J. Arnold in the fourth of his reports to the Public Service Commission for the First District of the State of New York. Nevertheless, it is subject to improvement and possesses certain fundamental defects or omissions which should be avoided in the building of future underground railways of like character. Thus the present New York Subway lacks sufficient capacity to carry enough passengers, as now operated, to pay a fair return on the investment and at the same time allow for a suitable depreciation reserve. It is also defective in what may be termed "overload capacity;" the station headway limits the number of trains, whereas the capacity of future subways should be limited only by the number of trains that can be passed safely over the tracks between stations. Mr. Arnold makes a number of recommendations by which the capacity of the present Subway may be increased from 30 trains an hour to 40 trains an hour. He also says that "All future trunk-line subways should be designed with stations on the reservoir principle; that is, with double tracks in each station for each main-line track. This can best be accomplished by not only double-decking the stations, but also double-decking the subways between stations, and by this method secure the carrying capacity necessary to justify the occupancy of the street and at the same time produce a property which will justify its cost. Where a crosstown subway is to be provided for, the stations should be triple-decked."

Mr. Arnold's report is one of much importance. Chicago will soon be building a subway, and the lessons of the New York Subway, as pointed out by this skillful engineer, will be of the utmost value in planning the later one. The Western Electrician hopes in a later issue to go more at length into the conclusions and recommendations of this valuable report.

IN REVIEWING the work accomplished at the Chicago convention of the National Electric Light Association one is struck by the great mass of material accumulated. Long reports of the proceedings are given in the Western Electrician of last week and this week, but these merely give a general survey of the work accomplished. Some of the papers and discussions will be presented in future issues, but, from sheer limitations of space, there will remain much that will not be available to those who did not attend until the full report of the convention appears in book form several months hence. Of late years the final official report has made two bulky volumes. It is valuable for reference; but to get the greatest good from the convention one should attend it in person. No electrical man who was present at the sessions and exhibition of the Chicago convention could fail to profit greatly thereby.

The convention, under the guidance of Mr. Dudley Farrand, was a most successful one. The total number of those present was 1,788, the largest in the history of the association. The papers and discussions were important and eminently helpful. The exhibition contained the latest electrical appliances of a character suitable for such a display and presented a brilliant spectacle. The various entertainment features were well planned and carefully carried out. One of these events was a visit to the great Fisk Street generating station of the Commonwealth Edison Company, and this feature, while a pleasant relief and entertainment, was also of much educational value, for this power house is an inspiration to every man engaged in central-station work or indeed to anyone following electrical pursuits.

Naturally the tungsten lamp attracted a great deal of attention. This appears to be the tungsten year, and the Convention Hall and Assembly Hall were brilliantly illuminated by the beautiful white light of these new lamps. A valuable paper on the subject of "The Status and Commercial Possibilities of High-efficiency Lamps" was presented by Mr. W. W. Freeman of Brooklyn (who was, by the way, promoted from the office of secretary to that of vice-president). This paper is now running in the Western Electrician. There was also a paper on "Series Incandescent Systems with Tungsten Lamps" and a discussion by Mr. Seelman of the unique plan adopted to handle the tungsten situation in Brooklyn. But there was less general free-for-all discussion of the new lamps than one would expect. This was largely due, no doubt, to the fact that the discussion of Mr. Freeman's paper is contained within it in the shape of a symposium of opinions on the commercial significance of the new high-efficiency lamps—a feature that adds greatly to the value of the paper.

The "Commercial Day" programme was a perfect mine of good things in the experience and suggestions of experts. An especial word of praise is due Mr. C. W. Lee, chairman of the "Commercial Day" programme committee; Mr. Henry L. Doherty, who presided with ability at "Commercial Day" sessions, and to the large number of gentlemen who assisted in preparing reports, papers and addresses. Every feature on this programme was distinctly good. The association is certainly doing its part to broaden the uses of electricity and to disseminate information relating to the sale of the product by the most scientific and enterprising methods. The only drawback was the absence of Mr. J. Robert Crouse, the widely known apostle of electrical development and co-operation, who was detained by illness. By his zeal, tact and untiring industry, Mr. Crouse has done much for the electrical forward movement, and the association did well to adopt resolutions of sympathy.

But the useful work was not confined to the Commercial Day sessions. The association took important action on the subject of grounding secondaries and on the adoption of uniform accounting. It received an exhaustive report on gas engines. It did not neglect the small stations, for one of the best papers presented related to the design of stations in cities of 20,000 population or less. This paper will be given in full in the Western Electrician. The association also indorsed the movement for the determination of a common unit of candlepower. It listened to an interesting and instructive debate on public policy. It awarded $2,600 in prizes for the solicitor's hand-book. It listened to eminent men in the "Council of Progress"—a new feature. It considered the meaning of the term "high-tension." It adopted specifications for the joint construction of electric-light and telephone pole lines and it completed the new specifications for street lighting, adopted, with some omissions, at Washington last year. There were many other interesting features on the programme (such, for instance, as Professor Brooks' instructive demonstration of the self-synchronizing of alternators), and the record is one in which the National Electric Light Association can take a just pride—and wonder how it was all gone through with in three and a half days.

Important action was taken by the adoption, substantially, of Mr. Doherty's plan of organization. This means a great extension of the work of the association. The constitution is amended to permit the holding of contests and exhibitions; to sanction the organization of state or "geographic sections" and also of "company sections" in individual central-station companies, and to provide for the calling of "national conferences." Some of these extensions will be of unquestioned usefulness; but it is doubtful whether state sections of the national organization will not conflict with existing state associations which have done useful work—work, in some instances, best performed by local organizations, backed by state pride and state knowledge, without outside entanglements. Time alone can tell how this "geographic section" plan will work out.

Mr. William C. L. Eglin of Philadelphia was elected president, and the choice is an excellent one, for Mr. Eglin has earned his spurs in the association by hard, self-sacrificing and able work. The association also paid a delicate and well-merited compliment to Mr. John F. Gilchrist of Chicago in electing him secretary and treasurer during his absence abroad.

Waterpower Development of Michigan.

At the [illegible] the American Institute of [illegible] E. [illegible] Rapids-Muskegon Power Company [illegible] but interesting [illegible] opment of Michigan [illegible] power [illegible] number of hydro-electric [illegible] Particular [illegible] Commonwealth Power Company [illegible] Jackson, Battle Creek [illegible] cities and towns [illegible] Michigan Power Company [illegible] large cities and many other [illegible] as well as a number of [illegible]

The plants at [illegible] were described [illegible] pole line connecting these plants with Grand Rapids and Muskegon and the [illegible] suspension type insulators that is to be put in service from Croton Dam [illegible] Grand Rapids [illegible] June 1st. [illegible] long, will be operated at [illegible] and probably eventually at [illegible] highest potential used for transmission purposes anywhere in the world.

The discussion of the paper consisted principally in a series of questions asked Mr. [illegible] in regard to troubles from and protection against lightning, underpiling of dams, governing of hydraulic turbines, construction of lines, rates, etc. This discussion was participated in by Messrs. C. E. Freeman, W. B. Jackson, P. Junkersfeld, J. R. Bibbins, F. F. Smith, D. W. Roper, I. R. Cravath, Prof. Morgan Brooks, Prof. F. B. Woodworth and others. Among the points brought out were that spilling over of static discharges has caused trouble from honeycombing of the insulator pins, that the ground wire over the transmission line has caused more trouble than good and is being removed and likewise with choke coils.

A German Idea in Electric Heating.

Throughout Germany and most of Continental Europe the prevailing method of heating rooms is by means of large ornamental tile stoves, which often reach nearly to the ceiling and have a large heating surface at a rather moderate temperature. Therefore they have the advantage of not drying the air so much as compact steam radiators or electric radiators that are operated at high temperature.

In Berlin there has been brought out recently a system of electric heating designed by Mr. Gutjahr, which is adapted to these tile stoves. An electric radiator is mounted inside the closed stove so that it will rapidly heat the walls thereof by a circulation of the enclosed air. The stove has a number of spring valves which permit an equalization of air pressure within and without. The heat is given off from the exterior tile surface of the stove and is thus tempered so as to avoid the dry, high temperature effect.

As the average price of current in Germany is only about four cents per kilowatt-hour, this indirect system seems to have opened up a promising field for electric heating in that country. It is said that an average-sized room can be heated in one hour and will remain warm for a long time, as the tiles retain their heat for considerable periods.

Public Control in Saskatchewan, Canada.

Briefly stated, the policy of the Saskatchewan (Canada) government creates a Department of Railways, Telegraphs and Telephones, and gives to this department control over all telegraph and telephone systems which may hereafter be constructed or acquired by the department. The policy makes the building of long-distance telephone lines a provincial undertaking, chargeable to the province as a whole. It makes the matter of municipal telephone construction a municipal undertaking, chargeable to the municipality and controlled by the municipality. It makes the construction of rural telephone systems rural undertakings, chargeable to those who desire to unite as communities to secure the benefit of the telephone, and managed and controlled by them, and assisted by the government by a free grant of the poles, which is said to represent 60 per cent. of the cost of the construction of lines in Saskatchewan. The money to provide the construction of the long-distance

[illegible]

Annual Meeting of the American Institute of Electrical Engineers.

[illegible]

[illegible] for the last fiscal year. This consisted of a sum [illegible] and treasurer. The most interesting facts brought out were:

[illegible] during the year. At these meetings 204 original papers [illegible] Institute papers were discussed. The increasing in[illegible]

At [illegible] New York [illegible] there have been held eight regular and two special [illegible] preservation and technical education. A total of 17 papers were read at these meetings. The regular annual convention was held at Niagara Falls, June 25-28, 1907, at which 32 professional papers were presented and discussed.

The total membership on April 30, 1908, was 5,674, a net increase during the year of 1,153. There is one honorary member, 573 members and 5,100 associates.

For the year ended April 30th the total general receipts were $73,764, of which $62,398 was for entrance fees, transfer fees, dues and badges. The remainder was principally from the sale of Transactions, advertising and interest on deposits. The total general disbursements were $66,560, leaving a balance of $7,204, deposited in general fund.

Receipts for special funds and for designated purposes during the year amounted to $15,488.46 and the expenditures for these purposes $98,307.78, the largest expense item being $90,000 from the land, building and endowment fund on account of the mortgage on the land occupied by the Engineering Societies Building. This fund had grown to a total value of $1,0[illegible] and now has to its credit $13,348.31. It is hoped that within a year enough more will have been collected for this special fund to clear the Institute of its share of this obligation. The equity of the Institute in the land and building of the Engineering Societies is valued at $533,346.61.

After the approval of the board of directors' report the committee of tellers on the election of officers reported the results of its count of the ballots. The following-named gentlemen were declared elected for the ensuing terms, beginning August 1, 1908:

President—Louis A. Ferguson, Chicago, Ill.

Vice-presidents—C. C. Chesney, Pittsfield, Mass.; Calvert Townley, New Haven, Conn.; B. Gherardi, New York city.

Managers—David B. Rushmore, Schenectady, N. Y.; H. E. Clifford, Boston, Mass.; Charles W. Stone, Schenectady, N. Y.; W. G. Carlton, New York city.

Treasurer—George A. Hamilton, New York city.

Secretary—Ralph W. Pope, New York city.

The terms of these officers are one year except the vice-presidents, who serve two years, and the managers, who serve three years. Below are given the names of the officers who hold over:

Vice-presidents (terms expire August 1, 1909).—James G. White, New York city; W. C. L. Eglin, Philadelphia, Pa.

Managers (terms expire August 1, 1909).—John J. Carty, New York city; A. M. Schoen, Atlanta, Ga.; Paul M. Lincoln, Pittsburg, Pa.; Paul Spencer, Philadelphia, Pa.

Managers (terms expire August 1, 1910).—Morgan Brooks, Urbana, Ill.; Harold W. Buck, New York city; Percy H. Thomas, New York city; Benjamin G. Lamme, Pittsburg, Pa.

President H. G. Stott then reported to the meeting the results of the national conference on the preservation of natural resources of the country held at Washington, D. C., May 13th, 14th and 15th, which he attended as representative of the Institute. He thought that the engineers of the country ought to be congratulated that the resolutions adopted by the conference were substantially those offered by himself and the presidents of the other three engineering societies represented, and

[illegible]

Funeral of E. C. P. Holmes.

[illegible] by the retiring president, Dudley Farrand of Newark, N. J., and the new president, W. C. L. Eglin of Philadelphia.

[illegible] Holmes' department at the Commonwealth Edison Company, he having been the company's purchasing [illegible] Charles A. Harding, J. M. Sadler, C. A. Lind, P. J. Barrett, Jr., Charles Clark, T. J. Benson and Charles Marden. The honorary pallbearers were B. E. Sunny, C. E. Brown, W. W. Low, Louis A. Ferguson, J. H. Goehst, William A. Fox and C. E. Corrigan.

Services were conducted by the Rev. O. J. Anderson and the Rev. D. J. O'Neill of St. Cyril's Church, the remains being taken to Mount Olivet Cemetery for interment.

The most thorough investigation on the part of the police authorities, private detectives and Edison officials has thus far failed to reveal a real clue as to the circumstances leading up to the tragedy or to identify the persons responsible, the prevailing theory still remaining that Mr. Holmes was murdered and robbed.

Electrical Engineers Wanted.

The United States Civil Service Commission announces an examination on July 22-24, 1908, to secure eligibles from which to make certification to fill one or more vacancies in the position of electrical engineer and mechanical draftsman, at an entrance salary of from $100 to $200 per month, in the Reclamation Service, and vacancies requiring similar qualifications as they may occur. Eligibles from this examination may be appointed as electrical engineers or assistants for the design, installation or operation of hydro-electric and steam power plants in the West, or as mechanical draftsmen for office work and drafting in connection with preparation of plans. Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any of several cities in different states, for application Form 1312.

Locomotive Brotherhood Takes in Motormen.

The Brotherhood of Locomotive Engineers at its meeting in Columbus, Ohio, on May 19th took important action in regard to what the brotherhood termed "the electrical problem." Men will hereafter be admitted to full membership who are acting as motormen on ordinary interurban electric roads. The only restriction is that the line on which they work shall operate more than 20 miles outside of an incorporated city, and that the applicant shall have had six months' road experience. The convention took the broad ground that the motive power of the future will be electricity, and that if the brotherhood wished to retain its standing it would be absolutely necessary for it to broaden.

Street Lighting Abroad.

George U. Crocker, of the Boston Finance Commission, who has just returned from a trip to Europe, having visited a number of the large cities for the purpose of observing the lighting facilities abroad, will shortly report his findings in official form, with data as to cost and efficiency, to the commission. He gives it as his impression that the methods of street lighting on the Continent, generally speaking, are much better than those in vogue here.

National Electric Light Association's Convention in Chicago.

[illegible]

[illegible] was an unqualified success, because it had not been experimented with long enough. Some complications have arisen, and certain modifications are required, but the speaker thought the plan is securing certain business for the company which would not otherwise be secured, and in its principal features a part of the plan, at least, will survive.

H. K. Mohr of Philadelphia and Theodore I. Jones of New York took part in the discussion, as did also C. N. Stannard of Denver and J. S. Cartwright of Knoxville, Tenn.

M. C. Osborne of Spokane, Wash., described his system of records. There are 10 solicitors for a city of 100,000 people and one stenographer takes care of the system of records. The semi-annual report for the period ending December 31, 1907, shows that of the total expense incurred by this department 45 per cent. was paid for salaries and bonus, 10 per cent. for advertising, five per cent. for miscellaneous expense, 29 per cent. for free work on signs, and 11 per cent. for free wiring.

Mr. Gille: In regard to extensions, there is a just difference of opinion. If the company has all the money it needs to make extensions, it is certainly desirable to go after business to the limit. If it wants to go after business and make no profit the first year, those are matters that are entirely financial; but it seems to me that where a city is not well provided with lines, the extensions should be very liberal, but where a city is well supplied with lines, and money is hard to get, it is a different proposition.

On motion of Mr. Stannard of Denver, it was decided to appoint a committee of five to formulate a uniform system of records for new-business departments.

The Contract Agent and the Representative.

As editor, V. A. Henderson of Memphis, Tenn., presented a contribution on this subject. He described the qualifications of the contract agent and referred to his duties and opportunities. The possibilities of the district representative were also outlined, while the special representative, the sign specialist, power specialists, the woman representative, illuminating engineer and solicitors' meetings all received attention. Mr. Henderson said that the district representative may be said to be the deputy of the contract agent, with activities limited to a certain area. "The district representative is, in fact, a general representative of the company, taking care of all kinds and classes of business within his jurisdiction. His possibilities, like those of the contract agent, lie within himself. He can make his services indispensable to his company, and if he succeeds in doing all the branches of his work intelligently and properly, there can be no question as to his future welfare."

M. E. Turner of Cleveland made some good suggestions of additions to the report.

C. E. White of Cincinnati reported that the new-business meetings of solicitors in that city were held at eight o'clock every morning, and they endeavored to adjourn at 8:07. The 35 men report very rapidly. All information is put on slips, which are tabulated. District or division meetings are held weekly. Mr. White added: "We believe in Cincinnati that we are selling a commodity, the same as any other commodity, and that we should sell it on the same lines, and we endeavor to bring that point forcibly to the attention of our men. We try to make them all-around men. We have our special men, such as our illuminating engineer and our artist. Every Wednesday night we have a general meeting, to which we invite the representatives of every department of the company. We endeavor to create harmony and thorough co-operation between all the departments of the company, and I think we have succeeded in that to a very marked degree. Also, we have in these meetings range sales, signs, samples of outline and window lighting and all classes of business in which we are interested, and we get on the floor, one man selling to another, and one woman selling to another woman, or to the men representatives, and in that way we are able to determine the weak points in the arguments that may be brought out [illegible] thing, never to send any of our men out with his tail between [illegible] struck in the face with a damp towel. We believe in exercising good judgment in the matter of criti- [illegible] neer in the meter department, in the belief that a [illegible] not due to meters at all, and we found the facts [illegible]

of the lighting installation, or badly located fixtures, and these men can often give helpful suggestions. As an illustration, one man whose house had not been satisfactorily lighted, made a complaint, and through a moderate expense our illuminating engineer was able to increase his lighting 300 per cent. without any increase in consumption. The man was so pleased that he gave a good dinner to the men in that department.

Illness of J. Robert Crouse.

Chairman Doherty announced that Mr. J. Robert Crouse of Cleveland, "a man who was practically unknown to us three years ago, but who by his aggressive work has commanded our complete respect, and who by his charming personality has commanded our most sincere regard," had been taken down with nervous prostration, largely due to work done in behalf of the association, which was purely a work of love. He suggested that a committee be appointed to draft resolutions of sympathy, and Arthur Williams of New York made such a motion. As the committee the chair appointed Arthur Williams and George Williams of New York and Percy Ingalls of Newark, N. J. Later during the convention this committee offered the following resolutions, which were adopted:

"Whereas, This association hears with deep regret of the illness of Mr. J. Robert Crouse, who has been most active as a member of the association, constantly, devotedly and unselfishly promoting its interests in every possible way; be it therefore

"Resolved, That we tender to Mr. Crouse our deepest sympathy at this time, with our devout wishes that his recovery may be speedy and complete and that we may be able to welcome him again at our next convention."

Gilchrist and Lee Remembered.

On suggestion of Chairman Doherty a cable message was sent to John F. Gilchrist of the Commonwealth Edison Company, now in Europe, telling him what an enjoyable meeting the association was holding.

Mr. Doherty also spoke in terms of warm appreciation of the work of C. W. Lee of New York as chairman of the programme committee for Commercial Day.

The Display Room.

L. D. Mathes of Dubuque, as editor, presented a report on "The Display Room." He said this feature of central-station activity dated from the Boston Edison Company's display of 1898. He described the appointments and methods of various display rooms and then passed to the value of special demonstrations, including electric and food-show exhibits. Mr. Mathes concluded as follows:

"A field that has had but slight exploitation, for reasons which are apparent, is that of making exhibits and giving demonstrations at county and state fairs. Where a fair is held in the vicinity of a large town or city, there is naturally a liberal attendance from such city. A number of instances have been noted where central-station companies have taken space in the exhibition hall, and, in addition to showing an attractive line of utensils and devices, have demonstrated the sewing machine, washing machine, percolator, chafing dish, and other heating units. This practice has been continued by one company in Iowa for four years, and each season the results have shown marked improvement, the direct sales being satisfactory, while many names were added to the prospective customers' list which produce results upon personal calls at later dates by solicitors.

"No standard has been or will be devised that will cover successfully the varying conditions found in different localities, which means that the head of each commercial department must diagnose the case from the point of view that appeals to him as the most reasonable to take. Efforts of every class that tend to publicity should be classed as advertising. Advertising is one of the most highly cultivated of the American arts. The central-station interests of the country have been slow to become disciples of this art, but the last few years have seen wonderful advancement along these lines. The greatest factor in the advancement of central-station advertising, display and demonstration has been the work of those tireless individuals who created and are so successfully conducting the Commercial Day programme of the National Electric Light Association."

S. A. McCullough, Raleigh, N. C., told of private demonstrations. "We go to some prominent person in town and say, 'Mrs. Blank, we will be glad to have you invite eight or ten of your friends tomorrow afternoon, and we will provide you with an afternoon tea prepared by electricty. We are trying to derive as much as possible from the advertising feature, and we have always been fortunate enough to be invited ourselves, and when we get the people together at this private demonstration, we give them a little talk on electricity. In that way we have been very successful with [illegible]."

A. J. Campbell, New London, Conn.: One idea has occurred to me, which I intend to carry out. I will go to one or two hardware stores and give them a supply of electric appliances that might be sold in hardware stores, and do the same thing with drug stores, and co-operate with them. We will carry the stock and fix a price on it which will give them a profit. They will get all the money that is made in the sale of the appliances; they will turn over to us a figure which we will set, which will be practically the net cost to us, and they will get the difference. I believe we should broaden the sale of electricity. We are selling the electrical appliances, and practically have a monopoly of the business, not because we want to do it or like the job, but because we have got to sell electricity, but I believe that the field should be broadened, and I should like to see the day when electric appliances are sold just as freely and just as readily as pie plates and patent medicines.

Mr. Cartwright of Knoxville, Tenn., asked how the electrical contractors liked that plan.

Mr. Campbell: We have agreed with the electrical contractors to place a profit on each appliance, and we sell them and they sell them at the same price. They do not sell many. I propose to put the appliances in the hardware and drug stores at the price we have agreed on, which is a profit on the cost of the article, but that profit we will give to the drug store or hardware store, and we will simply get the cost price back to us.

H. W. Hillman of Grand Rapids, Mich., described the recent Grand Rapids Electrical Show (see Western Electrician of last week). He said that the show had paid a dividend and had been entirely successful.

John Campbell of Boston said that moving exhibits attracted attention, and Mr. Searle of Rochester remarked that electric incubators and brooders attracted much attention.

William Chandler, Sault Ste. Marie, Mich.: All the current-consuming devices that are shown are attractive, and the consumer looks at them with much interest, but the first question asked is, "What does it cost to use it?" I have connected with the demonstrating room a meter that I had specially arranged to show upon a dial, 10 inches in diameter, scaled to one-eighth of a cent, that can be connected to any cooking utensil that we have to demonstrate, a coffee percolator, or anything else. Thus the ladies in the display room can tell exactly to one-eighth of a cent what it is costing to produce that coffee, the same thing for baking biscuits or making waffles. That is a very simple thing to do, and it saves answering questions; this plan has proved very satisfactory.

The report on advertising was presented by its editor, Charles A. Parker of Detroit, but adjournment for the day was taken before the reading was concluded.

Exhibition Committee Reports to Class D Members.

At a meeting held on Thursday afternoon the exhibition committee, through its chairman, Frank H. Gale, reported to Class D members. It was reported that all expenses had been provided for by the sale of space at the exhibition, with a substantial balance remaining to the credit of the committee. All the members of the committee, which has done such excellent work, were re-elected. By-laws were adopted, and acting under them the members drew lots to determine their tenure of office. The result was as follows:

Three years—James I. Ayer, Cambridge, Mass.; W. S. Heger, Milwaukee; Benjamin Wall, Brooklyn.

Two years—Rodman Gilder, Ampere, N. J.; J. C. McQuiston, Pittsburg; H. M. Post, Chicago.

One year—S. E. Doane, Cleveland; C. P. Frey, Newark, N. J.; F. H. Gale, Schenectady.

The old officers were re-elected, as follows: Chairman, Mr. Gale; treasurer, Mr. Post; secretary, Walter Neumuller, New York.

A pleasant feature of the meeting was the presentation to Homer E. Niesz, the local auxiliary member of the committee for the Chicago convention, who co-operated so effectively for the success of the exhibition, a black Russia-leather dressing case with silver-mounted bottles and brushes with monograms. Mr. Ayer made the presentation, and Mr. Niesz suitably expressed his thanks for the handsome gift.

Thursday's Entertainments.

The pièce de résistance of the entertainment programme for the ladies was the automobile tour of Thursday through the South Side parks and boulevards, with luncheon at the South Shore Country Club. The ladies left the Annex about 11 o'clock in large touring cars in parties of five or six, and were taken for a ride to the south, going through some of the boulevards, Washington Park, the Midway and Jackson Park to the clubhouse, where an elegant luncheon was served to the 205 ladies and five men in the party. This luncheon, beginning with canapé en surprise and ending with basket glacé with strawberries, was a triumph; the ladies declared that it could not have been improved in any respect. While it was in progress there was music by Tomasso's Orchestra and singing and playing by four musicians in Venetian costume. After the luncheon the ladies were again escorted to the automobiles and taken for a ride around Chicago, extending to the North Side and West Side, wherever the occupants of the car wished to go in the two hours available. The

weather was perfect [illegible] proved [illegible] delightful [illegible]

In the evening [illegible] Illinois and the Studebaker. [illegible] Lane" was the attraction at the former theater and Elsie Janis in "The Hoyden" at the latter. At both theaters the [illegible] to the convention [illegible] and the "stage" were [illegible]

This ended the entertainment programme, which was the result of the most careful attention and carried out with admirable thoroughness and method. The entertainment committee [illegible] Mr. Louis A. Ferguson, chairman, and Messrs. Godfrey H. Atkin, Ernest A. Edkins, H. Rea Hixson, Oliver R. Hogue, James W. Johnson, William H. Ott and John F. Seaver.

Friday's Proceedings.

Central-Station Advertising.

There were parallel sessions on Friday morning, and the first one, that devoted to the continuation of the Commercial Day programme, was called to order at 8.45 a. m., owing to the delay caused by the adjournment of the Thursday morning session.

The first feature was the continuation of the reading of Mr. Parker's report on "Advertising." This report begins as follows:

"We have reached a time when it may be said, with absolute truth, that the advertising and marketing of electricity are on a par with the advertising and marketing of any other commodity that can be named.

"This does not, of course, mean that the advertising of electricity is everywhere of the highest standard, but it does mean that, taken as a whole, central-station advertising will compare favorably with the advertising methods of any other great branch of industry.

"The returns we have had in the compilation of this report indicate a greatly increased interest in the subject of advertising. Of a canvass of 138 central stations and men, 54 complete sets of answers were received.

"Then, again, everywhere there is evident a much broader view regarding advertising and advertising methods, today, than was held a year or two ago by the majority of central-station men. It used to be a common thing to hear central-station men discussing whether advertising or solicitation was the best method of getting business. Today unprofitable arguments of this kind are seldom heard."

Mr. Parker then gave the answers to a number of questions sent out. One was in relation to slogans or catch-words, and these examples were given:

"Altogether, all the time, all for Alliance."
"Watch Scranton grow."
"St. Louis to the front."
"Boost for the city of lights."
"Chicago, the electric city."
"Minneapolis makes good."
"Boost for a bigger, brighter, busier Baltimore."
"The electric city of Indiana."
"In Detroit life is worth living."

Mr. Mohr of Philadelphia opened the discussion. He said local conditions will always demand particular and special treatment. Mr. Seelman of Brooklyn agreed in this. Several others spoke.

S. H. Smith, Marion, Ind.: The newspapers of Marion co-operate very closely with our company. The scheme of giving portable lamps was suggested by us from the fact that a great many of the residents were using electric lighting. The newspapers gave a portable lamp for $2.90. The subscriber agreed to take the newspaper for six months. He was to pay 90 cents when the order was given and the lamp delivered and 10 cents a week for the lamp as a payment on it. Well, our company would furnish a coupon with a globe to use on the lamp, and I might say there were about 300 portable lamps sold. The lighting company got the benefit of the advertising, and also received the benefit from the use of the lamp.

Publicity.

The paper of Percy Ingalls of Newark, N. J., on "Publicity" was read in abstract by C. W. Lee. Among other things, Mr. Ingalls said:

"In these days of public-service commissions, when public-utility companies are being investigated and drawn into the limelight through the medium of the public press, it is within the province of every lighting company to pave the way favorably for such investigations. Even though these companies can successfully weather the bombardment of cross-examination and unfavorable newspaper comment, still half the battle will be won at the outset if the fangs of such unfavorable publicity can be neatly and cleverly drawn and the poison eradicated. This can readily be accomplished through the medium of the newspapers and by taking the public into the confidence of the company.

"As corporate control has been shrouded in mystery for many years past, and as there has been no definite reason for secrecy in the operations of public-utility companies, the best-known officials today are acknowledging the error of their ways [illegible]

[illegible] and franchise agitation in the air, too many com[illegible] resorted to at the eleventh hour, with only partial success.

"A [illegible] able to explain its methods, tell the object of its existence, and handle a mass of interesting facts and figures, thereby creating renewed interest in the operations of the company. If this copy is handled in a sincere way it becomes productive of untold good.

"Beyond the question of public policy, there are many mediums of publicity that can be taken advantage of by every lighting company, assuming, of course, that in its endeavor to secure the good-will and business of the community in which it operates, good service, fair rates and courteous treatment by employes are facts and not theories. These mediums cover popular talks upon illumination, cooking and heating, dinners to contractors, boosting the city, advertising the installation of large power units or additions to plant equipment, cultivation of friendship with the newspaper men and the furnishing of live news stories to the papers."

Converse D. Marsh of Boston gave his views, from which the following paragraphs are taken:

"The first thing in establishing a publicity department is to secure mutual trust and confidence between the newspaper men and the publicity man. With such a start as this, results of tremendous importance and advantage to the company are forthcoming.

"My observation has been that the exasperated newspaper man who has been foiled or put off, or treated merely as an impertinent interloper, will never step outside of his path to say a good word for the company. His paper will seldom print matter commendatory of the company, however interesting such items might be or however advantageous they would be even to the newspapers—not to mention the company. It is just the old story of the human element, which must be duly noted and measured in all walks of life or business."

"Editors and reporters are human, just as we are. They take as much pride in their work as we do in ours. If we help them to make that work perfect and truthful, there will be a distinct gain to the electric-light company. Don't tell the reporter to 'come around the next day.' Remember that stale news is no news, and the thing that may interest people today may not interest them tomorrow. If you put off the reporter on some point on which he may have some knowledge and on which his paper desires further particulars, you will probably be placed at a distinct disadvantage in print."

Among those taking part in the discussion were D. T. Campbell of Scranton, Pa., Mr. Searle of Rochester, Mr. White of Cincinnati, Mr. Stannard of Denver, F. M. Tait of Dayton, Mr. Gille of Minneapolis, Mr. Gregory of East St. Louis and others.

Council of Progress.

On Friday morning, at the Commercial Day session, there was a "Council of Progress," consisting of addresses by several well-known men. The first speaker was Hon. Leslie M. Shaw, former secretary of the treasury. Mr. Shaw devoted himself principally to economic topics. Only a few extracts from his speech can be given:

I am not an alarmist, but I want you men to think along some line besides your particular business. It will be necessary for you to think about your business intensely, but the trouble is in these times we have little time for anything else. The next time your wife comes into the library and says, "John, what in the world are you studying over," and you say, "I am studying public questions," you have her send me your photograph. (Laughter and applause.) But if we continue a great, self-governing and governing people, the people generally will think on public questions, because you can't leave it entirely to the fellows who have no business, for if you do you will get into difficulty, and the trend is away from the teachings of the fathers.

We are opposed to commercial bossism. The man who reaches out his hand to crush a business competitor is considered by us all fit for the penitentiary, but the politician who, through love of power, actuated by the same motive, reaches out both hands to crush a political competitor, receives no end of encomium from press and people. (Applause.) It is the same principle exactly, the same love of power; the same results in both instances.

In New York they have taken from the cities and towns the right of self-government as respects utility corporations, and have given the governor, [illegible]

[illegible] check, but, figuratively speaking, I am going to confess in this presence that for the moment we are going as rapidly as I care to go, and we are [illegible] night. (Laughter and applause.) But out of it all [illegible] legs under us, and not go too rapidly, continually [illegible] business and putting in lights and insisting that the world shall have light, you should study these questions a little and watch the effect.

John R. M[illegible] Company of Chicago, spoke next. He said the merchant or manufacturer should have two characteristics—truthful representation of what he has to offer linked with an enthusiastic belief in what he has to sell.

W. F. Robertson of the Robertson [illegible] Company of Buffalo dwelt principally on the great good to the industry being accomplished by that "bunch of enthusiastic boosters," the Rejuvenated Sons of Jove.

George Macbeth, president of the Macbeth-Evans Glass Company of Pittsburg, dwelt on the scientific advancement of illumination.

The speakers in the Council of Progress [illegible] accorded the thanks of the meeting by a rising vote.

Creating Demands for Electricity.

George Williams of New York read, in part, the report on "Creating Demands for Electricity," of which Frank B. Rae, Jr., and himself were editors. Special street lighting, electric heating, light for hastening the growth of vegetation, decorative lighting and many uses of electric power were cited as examples of created business.

A "stereopticon talk" on outline and sign ligting was then given by Mr Williams. The pictures were viewed with much interest, particularly those showing the great advancement in Scranton. On this point Mr. Seelman said:

Mr. Freeman, general manager of the Brooklyn company, came to me two or three months ago with a picture of the Scranton development in his hand. He said, "This seems to me to be wonderful. I think you ought to go and take a look at it; see how they do it, and see if we cannot do something like it in Brooklyn." I took a train and went to Scranton and came back impressed with the fact that never in the history of the electric-lighting business was there such development as has been shown in Scranton. I believe it was done in less than a year. I came away impressed with the idea that Lackawanna Avenue in Scranton could give points to the "Great White Way" in New York, and I am a New Yorker. (Applause.) I tried to analyze how that was done. I said to myself, "Scranton is a good town; of course there are lots of other good towns; many as bright and full of money as Scranton. How is it, in the course of 9 or 10 months, this wonderful result has been accomplished, when other towns have been running along for years and have not been able to approximate it; not little towns, either, but big ones as well." And I believe the result of my analysis was correct. I made up my mind that it was the force of personality; I made up my mind that it was a salesman of business ability. First of all, the ideas were conveyed to the minds of the salesmen and then came the salesmen's ability to sell the goods. The result was the most remarkable, I believe, that has ever occurred in the history of electric lighting in our country. To my mind, the utmost credit, not only for the work they have done, but for the example they have set, is due to the men who have done this work in Scranton, and I believe the real heroes of this convention of 1908 are George Williams, Mr. Tidd and Mr. Campbell, the men who have made Scranton the real electric city of this country.

F. M. Tait, Dayton, Ohio: I would like to ask the editors of these papers what they have found to be the largest connected load per capita in outline and in sign lighting? Either two or four candlepower? I would like to ask what standard we might shoot at?

Mr. Williams: The largest revenue I know of from sign and outline lighting approached 95 cents per capita, in a town of 20,000 people. I believe there must be some cities that run over that.

There was a long discussion on sign lighting, bringing out useful points which will be presented, if possible, in a future issue.

Illuminating Engineering (Lansingh)

Van Rensselaer Lansingh of New York, as editor, presented a report on "Illuminating Engineering as a Commercial Factor." This paper was illustrated by lantern-slide pictures. It was a compilation of some recent results with lighting installa-

[illegible] in electrical engineering can be handled by the average intelligent solicitor, so in illuminating engi- [illegible] can be handled [illegible] amount of proper training. A technical education [illegible] small amount of study and a large amount of observation and good common sense. Thus, the solicitor must know:

(a) [illegible] should be placed.

(b) [illegible] give certain results.

(c) What types of globes, reflectors or shades should be used to secure the desired distribution of light.

(d) [illegible] of lamp to use.

(e) How high they should be placed.

These points require no highly developed technical education, but, as above stated, simply a thorough understanding of the fundamental principles of good illumination—illumination, understand, not illuminating engineering. If a solicitor is properly trained along these fundamental lines, he can, without much difficulty and with great satisfaction to both the customer and himself, design the lighting for the ordinary house, the ordinary store, and the ordinary small auditorium or hall. In cases of [illegible] theaters, churches, etc., it will be desirable in many cases to consult some practicing illuminating engineer, although many of the larger central stations are adding such a man to their regular force.

The paper of Joseph L. Becker, Jr., of Brooklyn on "The Electrical Contractor" was taken up, but consideration of it was postponed until the joint session in the afternoon.

Receiving Stations Operated from High-tension Lines.

While the Commercial Day programme was being considered in the banquet room on the sixth floor on Friday morning a parallel general session was in progress in Assembly Hall on the ninth floor of the hotel. The first paper taken up was that on "Receiving Stations Operated from High-tension Lines," by S. Q. Hayes of Pittsburg. A long abstract of this interesting paper is given elsewhere in this issue.

Lightning Protection.

Robert S. Stewart of Detroit presented the report of the committee on protection from lightning. The apparent damage done by lightning to electrical apparatus was less in 1907 than in the year before. The most important development of the year was the aluminum electrolytic arrester. Of this the committee says: "The laboratory tests on aluminum arresters are most remarkable, and the few plants we have heard from are satisfied with the performance in regular service. Whether the arrester will stand a direct stroke of lightning without injury is not known, but we know that no other arrester will take care of a direct stroke. The total life of the arrester is also uncertain. There is, however, no apparent depreciation in the arresters that have been examined after a year's service. It may be noted here that the aluminum arrester may be used on either direct or alternating current."

The report was discussed by Farley Osgood of Newark, Alex Dow of Detroit, Dr. C. P. Steinmetz and others. Dr. Steinmetz called attention to the increasing number of wireless stations, and said that in the vicinity of these stations troubles similar to lightning might be expected. Lines of wires can hardly be grounded too frequently. They [illegible] Iron is a more effective ground conductor than copper. Ordinary gas pipe affords perhaps the most effective protection for lightning arresters. By planting grass around gas-pipe "grounds" the earth may be kept moist.

[illegible] of Meters.

[illegible]

[illegible] various conditions to which these [illegible] applied.

"[illegible] the term 'high tension' as applied to a voltage over a stated amount may carry with it the unwarranted implication that voltages in excess of such a stated figure are under all conditions hazardous.

"In so far as overhead-line construction is concerned, we feel that any line voltage can be safely installed and operated if the methods of construction are adapted to the voltage carried. It may be said that at present, and under the existing conditions of the art, voltages up to 5,000 volts [illegible] are considered as distributing voltages.

"Therefore, in view of the purely relative value of the term 'high tension,' your committee unanimously recommends that no definite resolution attempting to place a limiting value on the term be adopted at this time by this association."

Dr. Steinmetz, a member of the committee, explained the report, which was adopted.

Joint Pole-line Construction.

Paul Spencer presented "A Specification for Line Construction on Poles Jointly Used by Electric-light and Telephone Companies." Complete specifications designed for construction for not to exceed 7,500 volts were given in the paper, and President Farrand said that they had been adopted by the Bell telephone interests. F. B. H. Paine of Niagara Falls announced that in conjunction with some telephone engineers Mr. Spencer is engaged on the preparation of specifications which contemplate the joint use of poles up to 20,000 volts.

Self-synchronizing of Alternators.

Prof. Morgan Brooks of the University of Illinois gave an interesting demonstration of his synchronoscope. A 200-kilowatt, three-phase, 25-cycle motor-driven alternator was synchronized without and with a simple coil of 350 feet of No. 4 weatherproof wire wound on an ordinary reel. The machine was at Harrison Street station, about one mile from the convention hall, where a synchroscope and ammeters were connected in series through a large cable especially arranged for the test. Normal full-load line current for this machine was 1,800 amperes. In the synchroscope in the convention hall the movement of the pointer over the dial showed the variation in phase, while the ammeters, directly below, showed the rush of current. The experiments were watched with great interest, and were perhaps the most interesting feature of the convention from a purely technical point of view. Dr. Steinmetz complimented Professor Brooks' exposition.

Illuminating Engineering (Ryan).

W. D'A. Ryan of West Lynn, Mass., gave his paper on "Illuminating Engineering." This was an interesting and up-to-date paper. The speaker said that the tungsten lamp will undoubtedly revolutionize the general lighting field, and he gave some results of practical tests to determine the costs and relative merits of various lighting systems, with a number of new devices. An effort will be made to present this paper in a later issue of the Western Electrician.

Specifications for Street Lighting.

W. D'A. Ryan presented the final report of the 1907 committee to consider specifications for street lighting. The original report was given in the Western Electrician a year ago; the present winding-up was merely the addition of some technical details in the shape of data sheets and tabulations giving the results of extensive tests to determine the relative lighting values of different street arc lamps. Mr. Ryan explained the purport of the final report as follows:

The specifications of the 1907 committee call for the standardizing of street lights in terms of a standard 16-candlepower incandescent lamp, a lamp having the X value of 4, because the same illumination would be obtained from the standard 16-candlepower lamp at one-fourth of the distance. It also means for the same illumination midway between the lamps you would require four times as many lamps per mile, and it also means that the relative candlepower of the different lamps is as the square of that X value; that is, if you wish to know how many 16-candlepower incandescent lamps would be required on poles spaced the same distance as the arc lamp, you would require 16. The principal point, however, is that the X value means that it is a fractional value. Take the value four times the illumination given by a standard 16-candlepower lamp at one-quarter the distance, and you can easily make the measurement. If the arc lamp was measured at 200 feet, the incandescent lamp would be 50 feet, but the arc lamp might be measured at a relatively greater distance and the [illegible] proportionally greater distance. Any difference in the street, at [illegible] figured back to the candlepower curve, and will go approximately to the same limit, for the reason that there is not much change in the candlepower [illegible] 480 or 520, but will be within the accuracy of the [illegible] street accuracy.

President Farrand: In other words, for the benefit of the electric-light man who is not an expert in mathematics, the relative values for surface illuminations, as in street work, of the different types of lamps, are indicated by the values now determined; that is to say, the ratio per street illumination for the 6.6 series open arc is 3.5 to 4 as against the 9.6 series open arc. The luminous arc is 5.5, as compared to either of these two. It also shows that the 7.5-ampere alternating current arc is about equal in practical illumination of the horizontal surface to the 9.6 open arc.

The report was adopted as the final action of the National Electric Light Association. With the explanations given the conclusion of the report, given herewith, will be intelligible. The adoption of the values resolves the lamps under consideration into the four following classifications:

First classification .... Value of $X = 5\frac{1}{2}$
4.0-ampere, direct-current, series luminous arc

Second classification .... Value of $X = 4$
9.6-ampere, direct-current, series open arc
6.6-ampere, direct-current, series enclosed arc
7.5-ampere, alternating-current, series enclosed arc

Third classification .... Value of $X = 3\frac{1}{2}$
6.6-ampere, direct-current, series open arc
5.0-ampere, direct-current, series enclosed arc
6.6-ampere, alternating-current, series enclosed arc

Fourth classification .... Value of $X = 3$
5.5 ampere, alternating-current, series enclosed arc

Evolution of New-business Building.

The concluding session of the convention was held on Friday afternoon. There was some discussion of the Ryan papers, and then President Farrand turned the meeting over to Chairman Doherty, who called for the paper of George N. Tidd and Duncan T. Campbell of Scranton on "Evolution of New-business Building." The writers gave examples of central stations that have continued methods of new-business getting during the business depression and also made a strong plea for the upkeep of commercial departments and advertising. They cited opportunities for increasing business along existing lines. Here are a few paragraphs from the report:

The mission of a commercial department is not ended when the people are induced to use electricity. It is then only begun. The successful new-business getter is the man who, after securing the new business, sees to it that his customer is satisfied and that the customer believes that the "getter" has been on the square with him and intends to continue to be on the square.

The confidence of a community is the greatest asset that any corporation, firm or individual can have. A commercial department with the right kind of solicitors employed and a progressive and up-to-date company back of it can gain and keep for the company the confidence desired. It can make boosters out of knockers, can put a smile where a frown has been conspicuous, and make the competitor with no commercial department look like a balloon returning to earth.

No advertising can equal the advertising you get from your satisfied customers, and the ideal solicitor is the man who by courteous treatment of the people on whom he calls makes assistant solicitors of all his customers.

Don't wait for competition to force you to organize a business department. When you do business without competition, as you would do it against strong competition, you will find that prospective corporations will receive scant encouragement from the people who are to be called on to buy their product.

The paper was discussed by A. W. Houston, Jr., of San Antonio; H. W. Peck of Rochester, and R. M. Searle of Rochester.

The Electrical Contractor.

Mr. Becker's paper on "The Electrical Contractor" was taken up. In the course of his report Mr. Becker said: "Co-operation with experienced contractors is becoming more and more essential to the central station. It has gained the good will of a closely affiliated fraternity besides promoting the sale of electricity to a larger extent than before this co-operation existed. It is indeed gratifying to note the material change that has taken place in the relations of the central-station managers and the electrical contractors. The many novel methods and the energy displayed by a number of the contractors in various cities throughout the country prove conclusively that the 'get-together' habit has grown with remarkable rapidity and with satisfactory results."

The paper was discussed by F. H. Golding of Rockford, Ill., who spoke a good word for the contractors, and by Alex Dow of Detroit, who said that the lighting company resented the "playing of favorites" by solicitors in their relation with contractors.

Douglas Burnett of Baltimore said that a statement of James R. Strong, president of the National Electrical Contractors' Association, quoted in Mr. Becker's paper, to the effect that Baltimore was one of the places where there is unfair competition between the lighting company and the contractor, [illegible]

[illegible] Development Association.

From the committee to assist in the further development and prosecution of the plans of the Co-

[illegible] Mortimer of [illegible]

[illegible]

[illegible]

A vote of thanks [illegible] incandescent lamps for their financial support to the Co-operative [illegible] which has amounted to over $50,000, was adopted.

F. M. Tait of Dayton presented a brief report on "Co-operative Commercialism" in place of Mr. Crouse, who [illegible] Mr. Tait reported that since the last National Electric Light Association convention Mr. Crouse has confined his efforts to underwriting the $125,000, [illegible] before any of the [illegible] binding. Up to October [illegible] had been underwritten [illegible] $100,000 and Mr. Crouse [illegible] was very sanguine of underwriting the [illegible] But at that time the financial depression put a check on the proceeding, which is now in abeyance.

COMMERCIAL SESSIONS APPRECIATED.

Alex Dow of Detroit spoke [illegible] the great importance of the "Commercial Day" sessions, and he moved a special vote of thanks to those who have done the work, especially to Mr. C. W. Lee and "to his [illegible] able, vigorous, and, thank God! young assistants." The motion was carried unanimously. Chairman Doherty closed the Commercial Day programme with the remark that the commercial [illegible] has been [illegible]

SOLICITOR'S HANDBOOK PRIZE AWARD.

In the absence of John F. Gilchrist, Mr. Tait presented the report of the committee awarding the prizes for the solicitors' hand-book offered by the Co-operative Electrical Development Association. The sum of $2,000 was awarded in prizes in three sections—that is, handbooks for soliciting lighting, power and heating business. The committee examined 19 manuscripts and awarded the prizes by numbers, not knowing the names of the contestants. The awards were as follows:

Light.

First prize, $500, to R. Borlase Matthews, London, England, and C. T. Wilkinson, Schenectady, in collaboration.

Second prize, $300, to James L. Wiltse, Brooklyn.

Third prize, $200, to H. W. Hillman, Grand Rapids, Mich.

Heat.

First prize, $300, to R. Borlase Matthews, London, and C. T. Wilkinson, Schenectady, in collaboration.

Second prize, $200, to James L. Wiltse, Brooklyn.

Third prize, $100, to La Rue Vredenburgh, Boston.

Power.

First prize, $500, to Paul H. Bate, Chicago.

Second prize, $300, to C. A. Graves, Brooklyn.

Third prize, $200, to R. Borlase Matthews, London, and C. T. Wilkinson, Schenectady, in collaboration.

It was decided that no one manuscript shall be accepted as the complete and final handbook to be printed, but that the editor shall use suggestions and material from all. In addition to Mr. Gilchrist, Percy Ingalls of Newark, N. J., and George Williams of New York served on the committee of award.

MISCELLANEOUS BUSINESS.

T. C. Martin, chairman of the Committee on Memorials, reported that suitable memorials would be written in relation to the following-named deceased members: Lord Kelvin, W. A. Kreidler, R. C. P. Holmes, Edward R. Coffin, Prof. C. P. Matthews, Walter I. Barnes, W. H. Hammond, James Hislop, C. H. Newhall and others.

A telegram was read from J. B. Crouse, father of J. Robert Crouse, saying that the latter's physicians forbade his attendance at the convention, but that he sent greetings and good wishes.

Resolutions of thanks were adopted to President Dudley Farrand; Vice-presidents Alex Dow and W. C. L. Eglin; Secretary and Treasurer W. W. Freeman; Assistant Secretary and Treasurer Harriet Billings and her efficient office organization; Samuel Insull, Louis A. Ferguson and Homer E. Niesz of the Commonwealth Edison Company, Chicago; Frank H. Gale, chairman, and Walter Neumuller, secretary of the Exhibition Committee; George H. Porter, master of transportation; Miss Edith M. Myers, chief of the Registration Bureau, and her assistants; the Convention Daily, conducted under the direction of C. W. Lee and his staff; the ladies of the reception committee, and the various standing and special committees.

President Farrand expressed his thanks for the courtesies extended to him and for the attendance

[illegible]

National Electric Light Association in such geographic sec- [illegible]

EXHIBIT OF ENGINEERING DEPARTMENT OF NATIONAL ELECTRIC LAMP ASSOCIATION AT CHICAGO ELECTRIC-LIGHT CONVENTION.

the approval of the executive committee.

No companies, associations, firms or individuals not members of the National Electric Light Association shall be eligible to any form of membership in any geographic section of the National Electric Light Association.

Upon the application to it by any Class A member, the executive committee shall authorize the organization of any or all of the officers and employes of said Class A member into a company section of the National Electric Light Association.

No person not a member of the National Electric Light Association shall be eligible to membership in a company section of the National Electric Light Association.

Upon certification to the treasurer of the National Electric Light Association by the executive officers of any geographic section, stating the membership of any of said sections as of the preceding first day of January, and upon approval by the executive committee, the treasurer of the National Electric Light Association shall pay over to the proper officers of each of said sections an amount not to exceed $2.50 per member of said sections, plus one-half the amount of entrance fees received by the National Electric Light Association during the preceding year from new members (other than Class A and Class D) of said sections; provided that these moneys are for use only in meeting the legitimate expenses of the sections.

Upon application to it by at least fifteen Class A members, the executive committee shall call a national conference upon any designated subject or subjects affecting the central-station business, due notice of which conference shall be sent to each member of the association.

The expenses of national conferences may be met by appropriations by the executive committee from the general funds of the association and by special contributions, which latter shall be governed as prescribed in Article V, Sec. 2, for the special annual convention funds.

CONSERVATION OF NATURAL RESOURCES.

The committee on the president's address complimented him on his work, particularly on the establishment of the Bulletin and of the practice of having a definite time to be at the headquarters of the association. Mr. Farrand's action in attending the national conference at the White House for the purpose of conserving the natural resources of the country was commended, and that gentleman was appointed to represent the association during the coming year in any additional conferences which may be held on the same subject.

[illegible]

and the system of carrying on the increased work [illegible]

tant subjects requiring the association's attention. Mr. Eglin has also served on a number of important committees of the association, notably the steam-turbine committee and the gas-engine committee.

The active business experience of the new president has been in connection with the various electric-lighting companies in Philadelphia, first being connected with the Edison Electric Light Company of Philadelphia in 1880, and with the various consolidated companies culminating in the Philadelphia Electric Company, which owns and operates all of the electric-lighting companies in the city and county of Philadelphia. Mr. Eglin is at present the electrical engineer of this company.

Mr. Eglin's general characteristics are to allow his work to stand for itself and to endeavor to advance the standing of the association as a national body in any branch of its work with which he has been connected. He has contributed many articles on important technical subjects to the American Institute of Electrical Engineers and to the technical press. With the work of the Institute he has long been identified, having served as chairman of the Philadelphia branch, and is at present one of the vice-presidents of the American Institute of Electrical Engineers. He was for a number of years active in the work of the Engineers' Club of Philadelphia, having served on its board of management as chairman of the information committee and as vice-president. He is also a member of the Engineers' Club of New York, the American Electrochemical Society and the Illuminating Engineering Society. He has also served on various committees of the Franklin Institute of Philadelphia.

Mr. Eglin is also a member of prominent clubs in Philadelphia—Union League, Merion Cricket Club, Manufacturers' Club, Bryn Mawr Polo Club,

[illegible] and [illegible] Club, [illegible] Golf Club and [illegible], and at the Mohawk Club, Schenectady, N. Y.

The Exhibition—And Some of the Men Who Attended It.

The exhibition of electrical appliances provided for the Chicago convention by the Class D members was a beautiful and effective display. The Exhibition Hall on the ninth floor of the hotel adjoined the Assembly Hall, as last year. The booth arrangement was simple and uniform, making all the exhibits easily accessible. The decorations followed an unassuming but systematic plan, and with the brilliant illumination, which was entirely by tungsten lamps, the entire exhibition scheme was attractive and entirely satisfactory.

There was no time during the entire four days of the convention that the aisles and booths were not well filled with interested visitors, and this in the face of the fact that nearly all the sessions of the convention proper were attended to the capacity of the assembly hall.

The various branches of the electrical industry were well represented and many new things were shown, brief mention being made of them in the following paragraphs. Views of some of the exhibits are also given herewith. Especially noticeable, however, was the recognition received by the tungsten lamp as a practicable and desirable lighting unit. The general lighting of both the exhibition hall and the assembly room was by tungsten lamps with proper reflectors. The accompanying views of the exhibits were taken with no other light than that from the regular illumination. On account of the architecture of the hall an adequate general view of the exhibition room could not be secured, the view given on page 430 showing only a part of the whole.

The exhibition committee received the deserved praise of the Class D members, as well as the entire association, for the successful manner in which it carried out its part of the programme. On a preceding page is given a brief account of the annual meeting of Class D members and the presentation to Mr. Niesz.

Notes of the Exhibits and Visitors.

I. A. Bennett of Chicago was in attendance every day.

S. L. Grossman looked after the interests of the Safety Electric Company.

J. Alexander Navarre represented the F. Bissell Company of Toledo, Ohio.

Lindsley, the pole man, was present in behalf of Lindsley Brothers Company.

The Electrical Dealers Company of Indianapolis arrived in the person of A. M. King.

President Warren Ripple of the J. Lang Electric Company, Chicago, looked in on the boys.

Bion J. Arnold was present at the convention, as was W. L. Arnold of The Arnold Company.

President Beardslee of the Beardslee Chandelier Manufacturing Company was at the convention.

A. Pullen of the Leather Preserver Company was on hand looking after the company's interests.

R. J. Russell, secretary of the Century Electric Company, St. Louis, talked "Century" products.

W. N. Matthews, the electrical merchant of St. Louis, was on hand during the entire convention.

M. Lobenthal was on hand in the interests of the Economical Electric Lamp Company of New York.

Western Manager Fred F. Skeel looked after the interests of the Crouse-Hinds Company of Syracuse.

Messrs. Sargent and Lundy were busy every day looking after the comfort of convention delegates.

Advertising Manager Woodworth found time to stroll in in the interests of "telephonic automaticity."

W. D. Shaler of the Doubleday-Hill Electric Company, Pittsburg, was here, there and every [illegible].

Messrs. [illegible] and Thorpe of the Franklin Electric Manufacturing Company were everywhere in [illegible].

[illegible] Selway, N. Y., came General Sales Manager John Brooks of Pass & Seymour.

[illegible]

[illegible]

The Thomas Wrigley Company distributed a number of circulars calling attention to its famous "toggle bolts."

H. B. Squires was at the convention, ably representing Otis & Squires, manufacturers' agents, of San Francisco.

Western Manager Groh of the American Conduit Company's Chicago office mingled with those at the convention.

Messrs. Hamrick and Tarkington, the amiable representatives of Kohler Bros., were present at the convention.

The American Electrical Works was represented by New York Manager Donohue and Western Manager Hammond

President C. F. Zeigler and G. Ertmann represented the Reynolds Electric Flasher Manufacturing Company of Chicago.

Of course the two Napoleons in the lamp industry were on hand—Messrs. Tremaine and Terry are always welcome.

Messrs. Holmes and Brown of the Vulcan Electric Heating Company, Chicago, lost not a moment during the convention.

Harry P. Moore, sales manager of the Chase-Shawmut Company, came from Newburyport, Mass., to atend the convention.

The Conrad-Blanton Company of Columbus, Ohio, distributed a blotter at the convention calling attention to its plug tongs.

Messrs. Ummach and Barron of the R. Williamson Company were present looking after the company's interests during the meeting.

President Joseph Belden of the Belden Manufacturing Company came over from the North Side several times during the convention.

Dr. Raymond of the Sheldon School as usual did most excellent work in behalf of higher education in electrical commercial circles.

H. L. Wells, advertising writer, was on hand looking after his interests. He has opened an office in the Monadnock Building, Chicago.

A. L. Haase, sales agent for Peirce specialties and also a line of pole-line hardware, was on hand taking orders and meeting his friends.

Mr. Manson of the Okonite Company came on with the New York contingent on Master of Transportation Porter's convention train.

O. R. Johann of the Specialty Sales Company, Cedar Rapids, Iowa, was on deck boosting the Everstick anchor and renewing old acquaintances.

Of course Thomas G. Grier of the American Circular Loom Company was on hand, backed as usual by his large staff of handsome and efficient workers.

President Lambert Schmidt of the German-American Electric Company came to the front with a flaming arc lamp and made a very attractive exhibit.

Chicago Manager Van Vleet of the Cutler-Hammer Manufacturing Company of Milwaukee was careful and successful in managing his company's interests.

President T. C. Turlay and Secretary and Treasurer William M. Smith of the Chicago Insulated Wire and Manufacturing Company were on hand as usual.

E. R. Grier, at one time a Chicagoan, but now connected with the Arrow Electric Company of Hartford, Conn., met many old acquaintances at the convention.

Syles R. Fralick, sales agent, who is located at 161 South Canal Street, Chicago, saw to it that his numerous specialties received proper attention during the meeting.

H. A. Strauss, vice-president of the Falkenau Construction Company, was around meeting his numerous friends. Mr. Strauss announces that business is very good.

General Sales Manager James Olson of New York came to the convention for the Habirshaw wire interests. Was there ever a convention complete without "Olson?"

E. Kuhlman of the Kuhlman Electric Company, Elkhart, Ind., was on hand explaining the advantages gained by the use of his transformers. Mr. Kuhlman reports business good.

Mr. Stromberg and Secretary and General Manager H. A. Johns of the Stromberg Electric Manufacturing Company, Chicago, strolled over to take a look at the electric-lighting exhibits.

H. A. Baum, secretary and treasurer of the Safety Electric Company, was present at the convention. He has developed a remunerative business in the last year in new and re-newed lamps.

D. J. Burns, sales manager of the Ward Leonard Electric Company, Bronxville, N. Y., exhibited a [illegible] which replaces lamp banks. This attracted the attention of central-station men.

President C. A. S. Howlett of the Electric Club of Chicago not only was energetic in looking after the affairs of the Western Electric Company, but he did the convention honors for the new club.

Messrs. Worbs and Pomeroy of the Adams-Bagnall Electric Company were in daily attendance. Mr. Pomeroy of late has won great praise for his efforts in upbuilding the new Chicago Electric Club.

J. C. Gibson, Chicago representative of the Oneida Community, Ltd., was in attendance Friday. Mr. Gibson just reached Chicago from a long business trip through the West and announces business very good.

Western Sales Manager Locke Etheridge of the Avery Scale Company of Milwaukee was on hand to point out to central-station men the merits of the automatic coal-weighing apparatus of his company.

The Benjamin Electric Manufacturing Company's interests were looked after by R. B. Benjamin, president; W. D. Steele, vice-president; A. N. Fox, advertising manager; Harry Watson and George Knott.

Commercial Engineer W. T. Jackson, as usual, did the honor for G. M. Gest, engineering contractor, and did them well. Mr. Jackson received co-operation from J. A. Doyle, Chicago, and Ed Tillson.

The Electrical Dealers' Company, Indianapolis, was represented by A. M. King. This company has just started in as a wholesale supply company at 217 Board of Trade Building. It will handle everything electrical.

The Zeidler Lamp and Brass Company, Lomira, Wis., passed out a neat circular calling attention to its "Baby Torch." The company has opened a Chicago office at 21 North Clark Street, in charge of Donald S. Clark.

Western Manager A. L. Waterbury of the American Sewer Pipe Company was active during the convention. Mr. Waterbury has only recently taken hold of this branch of the company's business; his activity has been marked.

Bernard C. Beckman, western sales manager of the Standard Paint Company, frequented the booth of the Central Electric Company, where he displayed a line of his company's products, which are of interest to electrical men.

A. O. Einstein, sales manager of the Crescent Company, was at the convention pushing his company's specialties. J. H. McGill, president of the company, took time to run down from Valparaiso and mingle with the boys.

The Columbia Incandescent Lamp Company was represented in the persons of President Arthur C. Garrison, Vincent Gray and J. B. Coale, the latter better known throughout the Great West as "King Coale of the Lamp Business."

Many convention visitors accepted the invitation of the Haller Sign Works to visit its reception room and works. President William Goltz was kept busy at the convention looking after the interests of present and prospective customers.

Sherman M. McFedries, secretary and treasurer of the J. L. Schureman Company, was on hand in the interests of his company. He was kept busy shaking hands and telling of the fine points of the company's electric motor-controlling devices.

Western Manager Wolff of the New York Insulated Wire Company was active on behalf, not only of his wire, but looked as well after the interests of the Paiste Company. Mr. Wolff was not only active in business but social circles as well.

There were no more active "hustlers" at the convention than President Arthur Frantzen and Assistant Manager Oscar Fuchs of the Zenco Electrical Supply Company. The Zenco company has been most active in the supply field during the last year.

The Fibre Conduit Company of Orangeburg, N. Y., manufacturer of Orangeburg fiber conduit and Orangeburg linaduct, was represented by W. W. Smythe, Jr., western manager, who was in attendance renewing old acquaintances and making new ones.

The Standard Underground Cable Company had an able corps of representatives at the convention, viz., J. R. Wiley, W. M. Rogers and J. E. O'Neill of the Chicago office, T. E. Hughes, Philadelphia; A. A. Anderson, Pittsburg, and E. J. Pietzcker, St. Louis.

The Patterson Electric Time Switch Company of Washington, D. C., showed an electrically operated time switch which automatically controls arc lamps, electric signs, show-window lights and street lights with accuracy, turning them on and off as often as is desired.

Western Electric Manager Godfrey Atkin, assisting General Sales Manager Blizard of the Storage Battery Company of Philadelphia, was active during the entire week. Mr. Atkin did himself credit as

[illegible]

business. Mr. DuBosch has his headquarters in [illegible]

[illegible]

FOUR PROMINENT EXHIBITS AT CHICAGO ELECTRIC-LIGHT CONVENTION.

F. L. Driver, president of the Driver-Harris Wire Company, Harrison, N. J. was in daily attendance. The Driver-Harris Company recently opened a Chicago office, in charge of George T. Westcott, which will enable the company to properly take care of its growing western business.

Western Manager H D. Howe, "the indefatigable" of the Holophane interests, was most decidedly in evidence. Mr. Howe not only worked the National Electric Light convention to a finish, but he will start in a day or two on a lecturing tour with "Holophane" as his subject.

Attorney Frederic P. Vose of the Electrical Trades Association found time to attend the convention. Mr. Vose received many congratulations on the well-earned compliments that have appeared in the daily press and from other sources relative to his skillful handling of the Lipsey case.

The Chicago Pneumatic Tool Company confined its exhibit to a demonstration of a Duntley portable vacuum cleaner. Central-station men are becoming more interested in this line of devices, as it opens up a new field of income. H. L. Lanphear and B. E. Harris, general sales managers, were at the exhibit.

No more active participant in convention business and social life was there to be found than Western Manager Haughton of the Bryan-Marsh Company. ment Association. Mr. Crouse is ill, probably from overwork, and although desirous of putting in an appearance took the advice of his physician and family to stay at home.

The Fort Wayne Electric Works exhibited its well-known products, including type K meters, fans and small motors. Among those present were F. S. Hunting and A. A. Serva of Fort Wayne; Tom Ryan of Cincinnati and the following from Chicago, headed by W. S. Goll: A. L. Pond, L. A. Carr, W. K. Eicher, W. S. Hine.

C. L. Bundy and R. H. Manwaring of Philadelphia were present in the interest of the Philadelphia Electrical and Manufacturing Company. They exhibited an attractive display of line material, arc-lighting apparatus, tungsten street-lighting appliances and underground apparatus, etc. The company has a very good rust-proof compound.

A. S. Ives of the Poughkeepsie Light, Heat and Power Company of Poughkeepsie, N. Y., and Mrs. Ives, were among those warmly welcomed at the Auditorium. Mr. Ives a year or so ago left the manufacturing field to enter the operating branch of the electrical business. His training in the producing side of the electrical business eminently fits him for his new duties.

Sales Manager Clarence E. Delafield of the Ideal Electric and Manufacturing Company of Mansfield, [illegible] beautiful specimens of electrical advertising that have been prepared under his hand in the cities of Cleveland and Chicago. The McJunkin exhibit at the convention was merely part of as many as 800 advertisements written on the subject of "electricity," for the two above-mentioned cities.

Dossert & Co., 242 West Forty-first Street, New York, manufacturers of solderless connectors, cable taps and terminal lugs for electric cables and solid wires, had an interesting exhibit. The company was represented by H. B. Logan, president, and Charles A. Flynn, mechanical engineer. The exhibit included a number of new devices for central-station work and connectors for heavy cables.

The booth of the Electric Appliance Company was devoted largely to a display of a fine line of Sangamo wattmeters, including alternating-current and direct-current instruments and switchboard types. Among the company's men present were President W. W. Low, P. R. Boole, F. J. Alderson and C. A. McCarthy. R. C. Lanphier of Springfield was present for the Sangamon Electric Company.

Among the prominent central-station people who were extended Chicago's hospitality were Mr. and Mrs. Irving P. Lord of Waupaca, Wis. It is hardly necessary to mention that Mr. Lord is called the electrical magnate of Waupaca, and many there are who will remember the bountiful hospitality [illegible]

[illegible] ... large lining [illegible] ... convention [illegible]

[illegible] ... Chicago agent, represented the Condit Electrical Manufacturing Company [illegible] ... the control of oil circuit-breakers and switches, laminated circuit-breakers and switches, pole line switches, type LS switches for small induction motors, and high-tension type D switches. P. R. Fisher, manager of sales, and William Taussig and Fred R. Babcock attended the convention.

The Gregory Electric Company, Chicago, was well represented. On hand were President and General Manager A. L. Kuehmsted, Vice-president and Sales Manager A. O. Kuehmsted, G. C. Besold and General Superintendent J. D. Zook, Assistant Superintendent J. A. Vincent and Sales Engineer E. H. Nagelstock. This company made a photographic display and showed various departments in the company's large Chicago plant.

Western Manager Charles C. Baird of the McRoy Clay Works put in an appearance on Wednesday morning. Mr. Baird within the year took charge of the western business of the McRoy Clay Works, succeeding Mr. Kirkpatrick, who resigned to take up another conduit business. Mr. Baird has done most excellent work in the West. Previous to that time he was closely associated with the conduit industry in the East.

Much credit is due to C. A. Tupper of the Allis-Chalmers Company for his painstaking care of all incoming and outgoing shipments during the National Electric Light convention. Mr. Tupper had the forethought to bring with him quite a force of Allis-Chalmers men to aid him, and therefore everything moved along with clock-like precision. Visitors have been loud in their praise of the work of the committee as carried out by Mr. Tupper.

Sales Manager J. B. Estabrook of the Colonial Electric Company, Warren, Ohio, was one of those who opened the convention on Tuesday morning—at least Mr. Estabrook was in attendance all day during the first period of the exposition. Colonial lamps, under Mr. Estabrook's management, have earned a well-deserved reputation, and this is borne out most substantially by the largely increased output of the Colonial factory during the last year.

General Sales Manager N. C. Cotabish of the National Carbon Company came early, stayed late, and, as has been his custom for years, was most active at the convention. Backing Mr. Cotabish and Secretary J. S. Crider of the company were Assistant Sales Manager F Kerlin and the following-named gentlemen: A. E. Cowen, F. C. Park, C. W. Wilkins, S. S. Wilson, F. J. Kysela, F. H. McDowell, Wallace O'Connor, A. V. Ward and F. H. Murray.

Somebody said that the electrical sadiron paper weight presented by the American Electrical Heater Company of Detroit was the "hit" among the souvenirs, for it certainly was in demand. President B. H. Scranton, Secretary Robert Kuhn and Bert Dewey of the American Electrical Heater Company were on hand. The company this year decided not to make an exhibit, but the souvenir certainly "did the work" and added to the many friends of the company.

Western Manager Harry A. Ford of the Hausermann Metal Manufacturing Company, Masonic Temple, Chicago, was energetic in pushing his metal name-plate, and presented for the first time also a beautiful specialty in the shape of an advertising novelty paper clip. This paper clip is made according to any pattern as desired by an advertiser. Mr. Ford reports great inerest in this clip on the part of electrical manufacturers interested in high-class novelty advertising.

No one was more warmly welcomed than Secretary and General Manager Norris of the Banner Electric Company, Youngstown, Ohio. Those in the electrical business during the last five years [illegible] ... of the Banner company through "banner betterness," and only recently it has been decided further to extend this company's Youngstown facilities. Mr. Norris is to be congratulated on a wonderful success in the incandescent-lamp industry.

[illegible] ... Studebaker company [illegible] ... comprehensive exposition of electric vehicles during the [illegible] ... Both pleasure and commercial vehicles were shown [illegible] ... type of vehicle and to show its adaptability to the [illegible]

[illegible]

display of alternating-current and direct-current fans were exhibited. E. B. Kittle, manager Chicago office, was in charge, assisted by J. F. Richards, D. J. Cook, R. R. Caskey, M. J. Kerwin and A. N. Anixter.

The New Lexington High Voltage Porcelain Company of New Lexington, Ohio, had an exhibit with the Central Electric Company, western sales agent. It showed a line of porcelain insulators for voltages from 4,000 to 100,000 inclusive. These high-voltage porcelain specialties are all "gas fired." The value of this method in the production of the highest insulation is well known to most high-tension experts. The factory was represented at the exhibit by J. A. Sandford, Jr., sales manager and electrical engineer.

The Messrs. Carr, who are now in control of the business of the Dearborn Drug & Chemical Works, Chicago, were well to the front during the ball in the gold room Monday night and during all the business and social functions of the convention. The business of the Dearborn Drug and Chemical Works under the management of the Messrs. Carr has progressed to a wonderful degree. Those in charge of boilers nowadays realize the great value of the scientific boiler-cleansing method carried on in a chemically correct manner.

The Universal flat-rate controller which switches incandescent lamps on and off when the consumer's contract is disregarded was inspected with interest by many central-station men in the Central Electric Company's booth. This device is used in various parts of the country. The Hartford Electric Light Company of Hartford, Conn., recently made a contract for controllers with the Universal company amounting to $10,000. The interests of the Universal company were ably taken care of by President L. Schmetzer, Superintendent Frank Kraemer and F. W. Meyers.

A complete line of its well-known electric heating and cooking devices was exhibited by the Simplex Electric Heating Company, Cambridge, Mass. The feature of the exhibit was a compact serviceable electric range having an oven, three stoves, a combination griddle and broiler and the necessary appliances. This range is built for service and will take the place of any coal or gas range. Of the company's men present were General Manager James I. Ayer of Cambridge; Roger Williams, New York manager; H. R. Hixson, Chicago manager, and E. R. Jacobs of the Chicago office.

Much interest was manifested in the materials and methods of the Minerallac Company, Chicago, for underground cable joints. Minerallac has excellent qualities for making high-tension joints of any nature. The company also exhibited terminal bells, quick-action voltmeter switches, portable cable-testing sets and cable and conduit hangers or cleats. The Chicago Electric Meter Company's printing attachment for power wattmeters was also shown and made a hit with the central-station men. The Minerallac Company was represented by R. F. Pierce, manager, and W. E. Pemberton, of sales.

The Novelty Incandescent Lamp Company of Emporium, Pa., was well represented by President R. K. Mickey. Mr. Mickey has recently formed an alliance with Fairbanks, Morse & Co., Chicago, who are the selling agents for the Novelty company. It is stated that these gentlemen are now preparing plans for a new western lamp plant to take care of the greatly increasing business. Messrs. L. J. Olson and M. O. Southwaith of Fairbanks, Morse & Co. assisted Mr. Mickey in keeping the Novelty company well to the front. Mr. Mickey was accompanied by Mrs. Mickey at the convention.

In its attractive booth the Crocker-Wheeler Company exhibited a lighting transformer, a small induction motor and a form L direct-current motor. Heretofore the company has made its chief offering to central stations in the line of direct-current and alternating-current generators and its celebrated line of form L direct-current motors. It now takes its place as a supplier of alternating-current and direct-current motors and transformers of the enviably high Crocker-Wheeler standard. The booth was in charge of Rodman Gilder, publicity manager, assisted by Julian Roe, Hugh A. Brown and Herbert E. Kerber.

The General Compressed Air and Vacuum Machine Company of St. Louis was represented at the convention by Sales Manager Thomas S. Clohesy. Mr. Clohesy will be remembered not only as an old-time central-station man, but many of those who were in attendance at the recent elecrical show will recollect the splendid exhibit of vacuum-cleaning machinery of the company there made under his care. The company is now installing a large vacuum equipment in the New Odd Fellow Building and the Lemke Building, Indianapolis; in the Commercial Building, Dayton, and one in the New General City Hospital, Kansas City.

The American District Steam Company of Lockport, N. Y., originator of underground steam [illegible] ... exhibit. This company has [illegible] ... years of experience in developing the underground steam heating business

Every detail of the operation of both live and exhaust underground steam-heating systems was explained by the company's engineers and representatives, the following-named being present: Robert Hall, treasurer; H. C. Eddy, Chicago manager; J. A. Bendure, electrical engineer; H. C. Kimbrough, H. G. Zuckerman and F. H. Stevens. The company gave out a handsome paper cutter as a souvenir.

The Moline Incandescent Lamp Company, Moline, Ill., was represented by General Manager Theodore Mueller, Sales Manager C. R. Wood and Factory Superintendent Frank Myers. The Moline staff was jubilant over its attraction at this convention—a 25-candlepower Moline tungsten lamp for service on either alternating or direct-current circuits. It should be mentioned also that the Moline company has been well to the front in all progressive steps in the manufacture of tungsten lamps; and this company is now selling in large quantities not only the 25-candlepower tungsten lamps but 32, 50 and 80-candlepower Moline tungsten lamps as well. The Moline company distributed a souvenir in the form of a handsome watch fob.

The Pacific Electric Heating Company of Ontario, Cal., recently opened sales offices in Chicago and is a new member of the National Electric Light Association. Its line of goods was displayed by the eastern representative, Henry F. Holland. Among the new devices shown by the company was its pressing iron with a controller attached by which the operator may employ three degrees of heat obtained by different units. Among the other new devices was an electric curling-tong heater which screws into the ordinary socket in place of the lamp and the tongs are held firmly in place by means of a spring and are very quickly heated. The Pacific electric toaster was also exhibited. All "Pacific" devices are guaranteed and during the convention the company closed many contracts for irons.

Charles H. Hodskinson, so well known through his excellent work as Boston master of transportation, brought his Boston constituents through to Chicago with flying colors. Mr. Hodskinson, as is well known, is Mr. C. L. Edgar's right bower and a tremendous worker in behalf of the National Electric Light Association. It was largely through Mr. Hodskinson's efforts that Cartoonist McCutcheon came to the front so handsomely in behalf of the National Electric Light Association. Mr. Hodskinson, together with Mr. McCutcheon and George Ade, recently made a five weeks' trip through the West Indies and countries of Central America. As Mr. Hodskinson put it, we "did" most effectively the entire "American-Spanish Maine."

W. H. Atkins of the Edison Electric Illuminating Company, Boston, arrived on Monday on the special train from Boston. Mr. Atkins was constantly on hand during the most heated sessions of the convention. "Some people consider Boston ultra-conservative," said Mr. Atkins, "but I would like to inform you that the Boston Edison Company is now looked upon rather as ultra-progressive." This remark prefaced an explanation as to the Boston Edison Company's method of securing business through its attractive electrical exhibition on Boylston Street, Boston. Mr. Atkins said enough to indicate that it is worth the while of progressive manufacturers and central-station men as well to investigate the merits now in vogue in the "City of Culture."

Among the lamps that were competing at this "convention of lamps" was the new 16-candlepower standard 3½-watt Clark lamp. The Clark Incandescent Lamp Company, whose factory is at present in Toledo, is pushing this new lamp, which is rapidly meeting with favor, and reports are to the effect that a number of these lamps have burned on test over 2,000 hours. President and Manager A. J. Clark of the Clark Incandescent Lamp Company announces that it is the intention of his directory to move the factory from Toledo to Detroit. But provision has been made for taking care meanwhile of all customers during the removal. A large stock is already on hand and buyers of incandescent lamps, he states, will feel no difference in shipping service.

Vice-president E. F. Kirkpatrick of B. S. Barnard & Co., New York and Chicago, was on hand during the convention period. As is now very generally known, it was not very long ago that Mr. Kirkpatrick severed his former connection in the conduit business to accept the vice-presidency of B. S. Barnard & Co. Since he has taken hold of the western branch Mr. Kirkpatrick has made remarkable headway. With headquarters in the Monadnock Block and factories East and West, Mr. Kirkpatrick's facilities for quick shipment and prompt deliveries of conduit have been decidedly conducive to "good business." "Kirk" was everywhere and "always" at the convention. Mr. Kirkpatrick is naturally elated, too, over having secured so large a share of Chicago City Railway business.

The Pittsburg Transformer Company's exhibit included the largest transformer ever shown at a light convention. It was a 500-kilowatt, 60-cycle,

22,000-volt primary, [illegible] secondary. [illegible] The full-load efficiency was 98.5 per cent. and [illegible] showed a temperature [illegible] full-load run. [illegible] new alloy vanadium [illegible] new [illegible] in [illegible] lung transformers. [illegible] remarkable improvement [illegible] transformer cores [illegible] reduced [illegible] 15 per cent. by the use of the alloy vanadium [illegible] The company exhibited a full line of [illegible] power transformers up to 50 kilowatts [illegible] standard voltages and for high tension. Regular Pittsburg stogies and "Pretty Girl" calendars were distributed.

The exhibit of the Electric Service Supplies Company contained a complete line of Garton Daniels lightning arresters, Locke porcelain insulators, G. & W. porcelain detachable potheads and safety line disconnectors, Guay steam [illegible] and Keystone portable lamp guard. Samson "Spot" arc lamp cord was shown. Some of the lightning arresters were connected to the lighting circuit so the delegates could see how the circuit-breaker principal

[illegible]

[illegible] a fine display of meters which were embodied in the exhibit of the Central Electric Company. There were presented the International illuminated dial, large and small round-pattern alternating and direct-current instruments, horizontal edgewise and automobile volt-ammeters. One particularly novel feature of this exhibit was the glass front instruments which exhibited the working parts of the alternating and direct-current types. Incidentally it should be mentioned that the city of Chicago has just installed in its Emerald Avenue sub-station an installation of International alternating-current instruments, which order was secured by the Monarch Electric and Wire Company. At the convention the International Meter Company was represented by President W. W. Cheney, Jr., Secretary [illegible]

The Excello Arc Lamp Company of New York certainly did itself proud at the Chicago convention. President Hirschberg, backed by Western Manager

[illegible] Manville Company was the new Linolite system [illegible] portable lamp-testing meter. A switchboard and [illegible] latest types of Noark fuse devices and many other [illegible] first time. The following representatives were in attendance: J. W. Perry, manager electrical de-

Dossert & Company.
Triumph Electric Company.
Wagner Electric Manufacturing Company.

American District Steam Company.
Chicago Fuse Wire and Manufacturing Company.
G. M. Gest.

Federal Electric Company.
Simplex Electric Heating Company.
Fort Wayne Electrical Works.

Western Electrician.
Central Electric Company.
Minerallac Company.

Duncan Electric Manufacturing Company.
Sangamo Electric Company.
Crocker-Wheeler Company.

SOME OF THE ATTRACTIVE EXHIBITS AT THE CHICAGO ELECTRIC-LIGHT CONVENTION.

operates following a lightning discharge. Two poles had been erected in the exhibit and fitted up with cross-arms on which were shown a number of porcelain insulators, P. & B. truss pins, porcelain potheads and steel gains. The underhung type of porcelain insulator for 100,000-volt transmission lines attracted a great deal of attention. Messrs. J. W. Porter, E. R. Mason, H. L. Adams, M. S. Earl and C. D. Willison were in attendance.

The G. & W. Electric Specialty Company exhibited its eight types of porcelain potheads. These devices are intended to connect underground cables with overhead lines which range in voltage from 115 to 20,000. Central-station construction engineers have found these devices indispensable for such work. The use of the porcelain pothead has been a most important factor in perfecting cable pole construction. The display included also a line of disconnecting device for use on high-tension lines, crossing telephone, telegraph and railroad lines. The device consists of a clamp which is released by a spring when wire is broken, and hanging ends are dropped dead below without further damage. The G. & W. ground-pipe cap, with which ground pipe is driven and wire attached at a single operation, has met with much favor. A. Wakefield, Armstrong and his expert "right arm," H. W. Fowzer, was on hand literally night and day. The company's "many-lamp" exhibit in front of the Auditorium was pronounced a most excellent educator as to the splendid attractiveness of the Excello flaming arc lamp. The Excello company has only recently started its western department, and owing to Mr. Hirschberg's broadgauge policy, as carried out by Western Manager Armstrong, the company has made strides that have already won it a host of friends. Mr. Hirschberg will go abroad in the early spring and the management of the business will be left in the hands of Mr. Armstrong, who will divide his time between New York and Chicago. A neat pocketbook was given to friends of the company.

Sales Manager Adrian Tobias of the Duncan Electric Manufacturing Company made a very interesting convention exhibit of a method for measuring the total output of a central station from which there can be delivered direct current, single-phase, two-phase and three-phase current. By this method the readings were totalized, or summed up, on one integrating wattmeter, and the combined load curve of the several generators is exhibited by a graphic recording wattmeter. These instru-

trical department, Chicago; G. A. Saylor, manager electrical department, Milwaukee; T. G. Younglove, manager Chicago office; F. G. Frumveller, Chicago office; E. B. Hatch, president the Johns-Pratt Company, Hartford, Conn.

An exhibit showing apparatus in operation is clearly the one which attracts attention, as was demonstrated by the booth of the Otis Elevator Company. The company showed one of its direct-current elevator models with automatic single push-button control. This elevator is arranged with a single push-button at each landing and a set of buttons in the car corresponding with the number of landings. The momentary pressure of any button at a landing brings the elevator car to that landing and the momentary pressure of one of the buttons in the car results in the movement of the car to the landing corresponding with the button pressed. Door locks and switches are provided to prevent the opening of any door save that opposite which the car stands, and also prevents the movement of the car when any door is open. This combination is entirely automatic in operation and provides against accident to anyone whether familiar with the apparatus or not. This automatic elevator can also be furnished for multiphase and

single-phase alternating current as well as for direct current.

Master of transportation George F. Porter of the National Electric Light Association certainly deserves credit for his continuous success with convention specials. This time Mr. Porter brought from New York over a hundred passengers on his Pennsylvania special, and if he could have heard the compliments paid behind his back he would be well [illegible] in all matters of [illegible]. An important point that should not be forgotten relative to Mr. Porter's transportation work refers to his remarkable efforts to secure from the Central Passenger Association a reduced rate for this convention. Mr. Porter actually secured a reduced rate for this convention, but, owing to the immense amount of red tape in railway circles, this rate could not be made effective in time for this convention. But the credit is due Mr. Porter for having established practically a reduction in rates that should be a precedent for next year's application.

To the average central-station man the induction motor is still a mysterious machine. It is not generally known how easily the characteristics of this rival of the direct-current motor can be determined. The ordinary way to arrive at conclusions on the basis of two simple tests—the no-load and the short-circuit test—is by drawing the circle diagram. But a compass, triangles and cross-section paper are not usually carried in one's pocket. The Triumph Electric Company of Cincinnati, Ohio, however, offers to those interested in the testing of induction motors a neat two-leaf flyer setting forth a very simple algebraic method to calculate starting torque, pull-out torque, maximum brake horsepower, slip, power-factor and efficiency. This includes a new method of testing called "service test," and enables one to determine the efficiency and output while the motor is in service. The flyers can be obtained upon application at the Cincinnati office of the Triumph Electric Company.

The General Storage Battery Company, Boonton, N. J., exhibited Bijur high-duty Planté battery plates. These plates are built up of cast-lead lattice-work grills solidly welded by a new heat process into a gridiron frame. The negative plates receive a permanization treatment invented by J. B. Bijur and described in the Western Electrician of March 30, 1907, which gives a sustained capacity in ampere-hours throughout the entire life of the plate. Owing to the open design of the grills there is a complete circulation of the electrolyte and ample room for expansion. This results in a minimum variation in voltage between charge and discharge and renders the plates absolutely non-buckling. The General Storage Battery Company also manufactures the Bijur regulator for reducing fluctuating loads to a steady average value. The company was represented at the convention by Alexander Bradley, Chicago representative, the Rookery, and W. C. Durant, sales engineer, Boonton, N. J.

The Triumph Electric Company of Cincinnati, Ohio, through Sales Manager W. H. Jacob's indefatigable efforts and skillful advertising methods, made a hit with the company's new automatic starter for induction motors. This starter made its debut at this convention. It is built on an entirely new principle. There was also exhibited a line of Triumph induction motors, the largest of which was a 40-horsepower machine. The Triumph company rather laughs at the hard-times talk. A message was received by telephone during the convention to the effect that the company has just received an order for as much as seven carloads of generators and motors. Further, the message intimated the strong probability that the order would be duplicated within three months. The company's representation at the convention was as follows: Home office, Cincinnati, J. C. Hobert, manager; W. H. Jacobs, sales manager; C. S. Reno, chief engineer, and S. Senstius, chief electrician; F. L. Merrill of Chicago and Ed S. Ford of Cleveland.

Among other things the Wagner Electric Manufacturing Company of St. Louis exhibited a five-horsepower, single-phase motor of the latest design, a 10-horsepower polyphase motor, and a set of standard Wagner instruments. Visitors to the convention noticed particularly the large material [illegible] and ample weight of the 10-horsepower [illegible] motor of the company, as compared with [illegible] 10-horsepower motors. These [illegible], but have an exceedingly [illegible], giving them a fine appearance. The company was represented at the convention by the following-named gentlemen: W. A. [illegible] general manager; W. [illegible] manager; V. W. Berger[illegible] [illegible] T. Richard[illegible], advertising manager, all of St. Louis, and the following [illegible] W. Goldsmith, [illegible] A. W. W[illegible]hoff, [illegible] A. H. Mu[illegible] [illegible] W. A. Clark [illegible].

[illegible]

ager F. H. Gale of the heating department of the General Electric Company were enabled to make a very attractive exhibit of electric fireplaces in connection with that of the General Electric Company. This electric fireplace is now being pushed by Rathbone & Panigot through the General Electric Company and other sources, as well as by the factory at Grand Rapids. The device is making a hit in high-class residence service. The fact that this electric heater not only gives heat but light as well and at the same time does not vitiate the air, is comparatively economical—all these points with a number of others make it an ideal fireplace for people of refined taste. Messrs. Rathbone & Panigot recently made a striking exhibit of their electric fireplace also in Grand Rapids, and this electric fireplace was also shown and won much favorable comment at the Chicago electrical show.

Prof. F. B. Badt was constantly in attendance looking after the interests of the Weston Electrical Instrument Company and the Ward Leonard Electric Company, for which companies he is western sales agent. Many of his old-time friends among the members of the National Electric Light Association were glad to welcome him, and to see his great physical improvement since his late illness. Weston instruments were in evidence in several exhibition booths, although the Weston Electrical Instrument Company had no separate exhibit. D. J. Burns, general sales manager of the Ward Leonard Electric Company, co-operated with Professor Badt in showing and introducing a new type of rheostat known as a meter-load rheostat, and which type is to be used for testing integrating wattmeters. This new type has many points of superiority over the old lamp-bank type, which has been used heretofore. P. A. Westburg, Professor Badt's able assistant, was also very much in evidence. The style of the firm is still F. B. Badt & Co., Inc.—F. B. Badt, president and treasurer; P. A. Westburg, secretary, with headquarters at 1503-4-5 Monadnock Block, Chicago.

The Engineering Department of the National Electric Lamp Association occupied a large space in the center row of exhibits. The booth was decorated with grapevines, bearing delicious looking fruit. Pennants bearing the monogram of the association were hung on the corner posts and antique lanterns containing the same insignia were prominently displayed. Tungsten and tantalum lamps, each with its proper Holophane reflector, were shown, as well as various devices for the demonstration of the properties of these popular lamps. Aside from the well-known tungstens, the 100, 60 and 40-watt sizes, the first public exhibition of 20-candlepower, 25-watt, 100-125-volt tungsten lamps was made. These little lamps, with the standard Edison base and a regular 16-candlepower bulb, made a deep impression upon all who saw them. A 12½-candlepower, 25-watt, 100-125-volt tantalum was also shown for the first time and was the subject of much favorable comment from the central-station men. S. E. Doane, chief engineer of the association, was present, as were the officials and representatives of the various companies comprising the association. The booth was in charge of P. E. Norris, assisted by Messrs. P. F. Bauder and W. H. Fisher of the Engineering Department.

The General Electric Company was located near the center of the hall with a fine exhibit. A full and attractive line of heating devices, including the new mantel-type luminous radiator, was shown. Prominent among the apparatus exhibited were the tungsten lamps for both interior and outdoor lighting and the luminous and flame arc lamps. There was also exhibited the new aluminum-cell lightning arrester, a line of meters, both portable and stationary, and a number of motors, both alternating and direct-current, for small power purposes. An oscillograph was in operation and records were taken to show the effect of different values of reactance on the wave form. A daily demonstration of electric cooking devices was made. Among those representing the company at the convention were E. W. Rice, Jr., J. R. Lovejoy, C. D. Haskins, P. D. Wagoner, F. G. Vaughen, D. R. Bullen, E. E. Gilbert, W. L. R. Emmet, C. W. Stone, N. R. Birge, C. B. Burleigh, C. P. Steinmetz, J. W. Kirkland, Theo. Beran, A. D. Babson, H. J. Buddy, A. D. Page, T. E. Bibbins, F. H. Gale, G. L. Thompson, D. B. Rushmore, F. W. Willcox, James W. Johnson, James Lyman, W. D'A. Ryan, G. H. Stickney, E. L. Callahan, F. N. Boyer, J. Scribner, J. R. Livsey and others.

Representatives of the Nernst Lamp Company at the convention were frequently called upon to conduct parties of visitors to some of the large and unique installations of Nernst lamps in the vicinity of the convention hall. Marshall Field's store was, of course, the greatest point of interest. Those who had visited the store on former occasions were completely surprised at the great improvement in the general appearance made by the new Nernst fixtures. The former fixtures were low hanging and contained six to eight different sources of light, while the new ones are near the ceiling and consist of a single source. On account of the many important installations of Nernst lamps in Chicago, the May number of the Glower was made a special Chicago number and was illustrated by some twenty pictures of stores and offices typical of modern Chicago. The following Nernst men were in attendance at the convention: W. D. Uptegraff, vice-president; Max Harris, general sales manager; Otto Foell, chief engineer; John J. Sorber, manager Chicago office; W. B. Miser, manager Duluth office; A. M. Miltenberg, manager Omaha office; C. F. Reel, manager St. Paul office; L. E. Berebaum, manager Davenport office; Wallace Williams, manager Peoria office; J. O. Little, manager publicity department; A. L. Eustice, Chicago; C. H. Kenneweg, Pittsburg; W. J. Guntz, G. R. Clover, C. P. Kellogg and P. J. Doyle of Chicago.

The Central Electric Company, Chicago, exhibited a very complete line of supply material, mounted on a specially constructed exhibit board. Among the devices exhibited were the well-known Pittsburg high-efficiency silico-vanadium steel transformers; a working exhibit of the Universal flat-rate controller, illustrating the method of using tungsten lamps in conjunction with flat-rate systems; "gas-fired" New Lexington high-tension porcelain insulators of all voltages up o 100,000; P. A. remote-control electrically operated switches in capacity up to 2,500 amperes and 3,000 volts; D. & W. fuses, cut-out boxes, etc., high-tensioned outdoor and indoor oil switches; O. K. fuse boxes preventing theft of current; Westinghouse alternating-current integrating wattmeters, S. E. circuit-breakers and International instruments. Among the newer devices was shown the "Central" resistance or load box for use in testing intergrading wattmeters, this load box taking the place of the usual lamp bank heretofore used. This box is especially novel in that the various resistance units can be changed or replaced as desired or found necessary. The artistic effect of the exhibit was greatly enhanced by the new line of "Central" lighting fixtures of original design and exquisite workmanship. The entire exhibit conformed to the general scheme of decorations employed by the committee, a fact of much importance in such exhibitions. The exhibit was planned and presented by Manager of Sales H. W. Young.

The Westinghouse exhibit at the convention was at the head of the convention hall and directly opposite the elevator entrance. The space, being small, was given up chiefly to small motors, measuring instruments, detail apparatus, lamps and heating appliances. The heating field was recently entered by the Westinghouse Electric and Manufacturing Company, through the acquisition of the Hadaway Electric Heating and Engineering Company of New York, and considerable space was devoted to the well-known Hadaway apparatus, such as sad-irons, glue pots, tailors' geese, velouring stoves, etc. A full line of lamps, embracing the metallic flame arc lamp and tungsten lamps of various sizes, down to eight candlepower, was exhibited. The booth was brilliantly illuminated with tungsten lamps, and all eyes were directed to it by a revolving wheel studded with these lamps. Among those in attendance were the following: Westinghouse Electric and Manufacturing Company—C. S. Cook, manager railway and lighting sales department; S. L. Nicholson, manager industrial and power sales department; C. B. Humphrey, manager detail and supply sales department; G. B. Griffin, assistant manager detail and supply sales department; Charles Robbins, commercial engineer industrial and power department; H. P. Davis, assistant chief engineer; T. P. Gaylord, manager Chicago office; J. A. Brett, manager Cincinnati office; C. F. Medbury, manager Detroit office; G. E. Miller, manager Cleveland office; W. R. Pinckard, Chicago office. Westinghouse Machine Company—E. H. Sniffin, sales manager; C. C. Chappelle, manager Chicago office; J. R. Bibbins of the Pittsburg office; C. L. Davis of the storage-battery department. Nernst Lamp Company—W. D. Uptegraff, vice-president; Max Harris, general sales manager; Otto Foell, chief engineer; J. J. Sorber, manager Chicago office. Westinghouse Lamp Company—T. G. Whaling, assistant general manager. Westinghouse Companies' Publishing Department—J. C. McQuiston, manager; J. O. Little, Pittsburg.

One of the liveliest meeting places throughout the convention was at the booth of Allis-Chalmers Company, where officers and salesmen of the great engineering and machinery building works at Milwaukee renewed old acquaintances and made many new ones. President W. H. Whiteside spends two days at the convention. A. H. Whiteside, manager of the company's steam and electrical department, was equally prominent. B. A. Behrend, chief electrical engineer, was also in attendance with numerous members of his staff and a large number of power and electrical machinery salesmen, including James W. Gardiner, district manager at Chicago, and L. M. Harvey in charge of the Milwaukee sales office. In the company's exhibit particular attention was attracted by a sample board showing specimens of the complete line of blading, including foundation rings, shroud-ring protection, etc., from a 1,500-kilowatt Allis-Chalmers steam turbine. Machines representing the company's standard line of induction motors for alternating current and new type K motors for direct current formed special features of the exhibit, as did also two of the line

of standard lighting transformers recently brought out by the company. Large framed prints [illegible] some of the principal [illegible] at the West Allis works, [illegible] covered by the illustrated title [illegible] the company's power and electrical bulletin. In a [illegible] let addressed to members of the association attention was called to the fact that the largest gas-engine-driven electric generating unit in the world operating on blast-furnace gas are installed at South Chicago, within half an hour's ride of the Auditorium Hotel. These consist of two of four machines now being installed by the Illinois Steel Company at its works in South Chicago, the two referred to being already in continuous parallel operation. Each unit is composed of a horizontal twin-tandem double-acting gas engine direct-coupled to a 25-cycle, three-phase, 2,200-volt, alternating-current generator. The complete units were built by Allis-Chalmers Company. These are the largest engines operating on blast-furnace gas, either in the United States or abroad, said to be of one-third greater capacity than any other gas-engine-driven units in this country utilizing furnace gas. A special type of generator was designed for direct connection to these engines, and the combination has been very successful. The exhibit was in charge of C. A. Tupper.

An interesting display of electrical apparatus was made by the Western Electric Company, and consisted of arc lamps, intercommunicating telephones, power apparatus and electrical supplies. The arc lamp exhibit consisted of various types manufactured by the company and also of two of the Beck flaming arcs, of which this company is the sole American agent. The Beck lamps were made to serve a useful as well as exhibition purpose, being suspended from the balcony and serving to illuminate the entrance to the Auditorium building. A demonstration of the heat-resisting property of the deltabeston insulation, used on several of this company's lamps, was made, the lamps being short-circuited and allowed to take full current for several hours. The telephone exhibit was devoted to intercommunicating apparatus, several sets being shown. Two 20-line wall sets were in operation. Desk-type sets were also on exhibition. The power-apparatus display was not as complete as in some previous exhibits made by the company, advantage being taken of the proximity of the Hawthorne plant, where all power apparatus is manufactured. Mention is made of this feature elsewhere in this issue. A two-horsepower, three-phase induction motor and a five-horsepower direct-current motor were shown, the latter being in operation. The illustration of the exhibit shows two types of fans manufactured by the company, the Hawthorne Universal direct-current and the Victor alternating-current. The "Hawthorne Universal" is a combined desk and bracket type, and was in general use by a number of exhibitors. Among numerous supply articles exhibited were several sets of Buffalo grips in various sizes; Habirshaw tree insulation, which is being used to a great extent for fastening wires to trees; two large boards exhibiting D. & W. fuses and panels, and a sample disk, together with literature and model, showing the construction of the Rateau steam turbine. In addition to bulletins and circulars such as are usually distributed, the Western Electric advertising department added a unique feature in the form of a useful pocket memorandum book and a handy map of Chicago. The exhibit was in charge of H. M. Post, advertising manager of the company. Managers of the various branch houses were also in attendance at the convention and assisted Mr. Post, as did the managers and assistants of the Chicago house. Following are some of the branch-house managers in attendance: L. T. Milnor, Cincinnati; W. L. Green, St. Louis; J. A. Pizzini, New York; A. L. Hallstrom, Philadelphia; E. H. Peterson, St. Louis; R. M. Morris, Pittsburg.

New Use for Manganese Steel.

A good example of how the development of one industry helps another is found in an order for manganese steel disks recently placed by the Cutler-Hammer Clutch Company of Milwaukee. This company, in addition to manufacturing magnetic clutches, makes a specialty of lifting magnets for handling pig iron and scrap metal. The growth of this latter business and the natural desire of the manufacturers to perfect every detail of their product has led to the adoption of manganese steel for coil shields—the coil shield being the flat disk fastened to the under side of the lifting magnet for the double purpose of protecting the magnetizing coil and interposing between the two poles of the magnet an area of non-magnetic material.

Brass, which is non-magnetic, has heretofore been used for this purpose. Ordinary steel will not do because it is a magnetic metal and would serve to conduct the magnetic lines of force from pole to pole. Manganese steel seems to be the ideal metal for this purpose. Fifty-inch magnets recently furnished by the Cutler-Hammer Clutch Company to a number of steel mills in the Pittsburg district are all equipped with manganese-steel coil shields.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By Joseph B. Baker.

Part IX.

The Test Room (Continued)

Meter Supports.—[illegible]

[illegible]

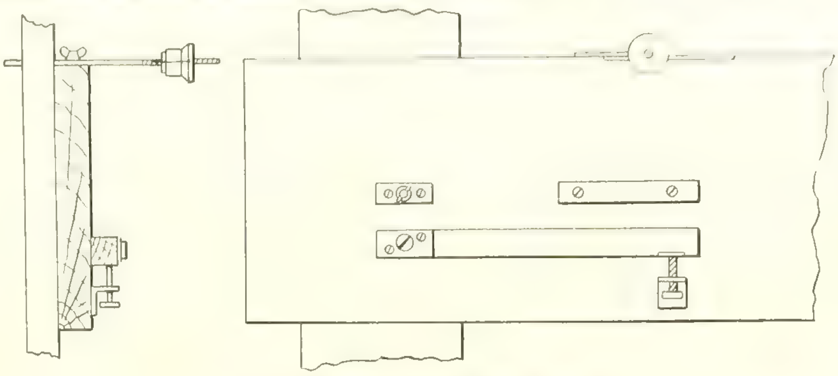


FIG. 11. METER SUPPORT FOR TESTING.

are built like a rack, or with an overhead shelf, special rigs are employed.

One of the simplest ways of holding the meter in a level position is to provide a narrow ledge or shoulder on the panel of the rack well above the bench and rest the back edge of the meter upon it, securing the meter from falling forward by a clamp to catch the left-hand corner of the meter

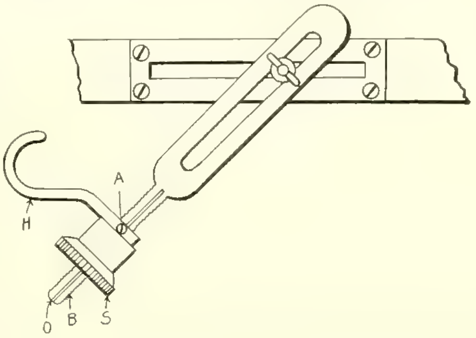


FIG. 12. PLAN OF HOOK USED WITH METER SUPPORT.

and an iron or brass hook to catch the right-hand top of the metal frame. The hook is clamped in a slot on the top edge of the panel, giving wide range of adjustment from right to left as well as from front to back, and has a screw adjustment for pulling up the meter to a level "front and back;" and the ledge itself, which commonly consists of

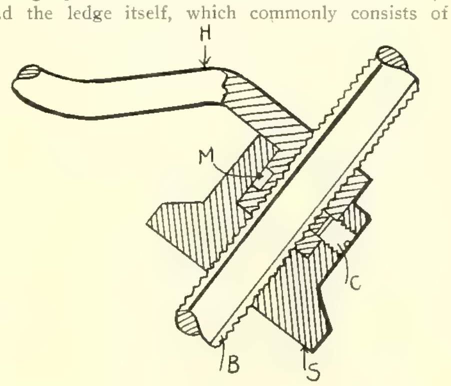


FIG. 13. SECTION THROUGH HOOK USED WITH METER SUPPORT.

a simple strip of hardwood, is pivoted on a lag screw driven into the main rack, and provided with a leveling screw at the other end whereby the meter may be leveled "right and left."

This arrangement is shown in Fig. 11, Fig. 12 being a plan of the hook and Fig. 13 a diametrical section of the same on a larger scale.

The screw (A), tapped into the sleeve of the hook-piece (H), and with its pointed end project-

[illegible]

for giving vibrationless support to meters under test, consists of an air cushion of "life-preserver" shape placed on a shelf above the testing board, and having a wooden disk resting upon it with a rod hanging down from the center and passing freely through a hole in the shelf. At the lower end of the rod is a group of three spiral springs, joined at their upper ends and having hooks at their lower ends for grappling the frame of the meter.

[*To be continued.*]

Note.—This serial article, begun in the Western Electrician of April 4, 1908, is an advance publication of a portion of a forthcoming book by Mr. Baker on the general subject of "Electric Meters." It will be understood that the present serial refers to watt-hour meters used on customers' premises.

The Status and Commercial Possibilities of High-efficiency Lamps.[1]

By W. W. Freeman.

Part II.

Compendium of Incandescent-lamp Practice and Opinions of Member Companies as to Value of High-efficiency Lamps.

Deeming that a compendium of the lamp practice of central stations throughout the country would be of interest and value to the industry, and with a view to ascertaining the experience to date and views of the members concerning high-efficiency lamps, a list of 15 comprehensive questions was sent recently to 650 member companies of this association.

Replies were received from 501 companies, located in Alabama, Arkansas, Arizona, Alaska, California, Connecticut, Colorado, Delaware, District of Columbia, Georgia, Hawaii, Illinois, Indiana, Iowa, Idaho, Kentucky, Kansas, Louisiana, Michigan, Maine, Minnesota, Missouri, Massachusetts, Mississippi, Montana, New York, New Mexico, New Hampshire, North Dakota, North Carolina, Nebraska, New Jersey, Nevada, Oregon, Ohio, Ontario (Canada), Pennsylvania, Quebec (Canada), Rhode Island, South Carolina, Texas, Tennessee, Vermont, Virginia, Vancouver (B. C.), Washington, Wyoming, Wisconsin, West Virginia.

It would therefore seem that the reports as to methods and opinions as to policy are fairly representative.

The questions and summaries of the answers follow:

1. *Do you supply initial installation of incandescent lamps without charge?* The responses show that only 25 per cent. of the companies supply initial installation to customers free. In addition to these, one company supplies free initial installation only in large office buildings, another to business properties only, and a third for installations not in excess of 25 lamps.

2. *Do you supply free renewals of incandescent lamps?* The replies indicate that 62.5 per cent. of the companies do supply such free renewals, while a few companies supply free renewals to large customers only, or exclusively for signs, or for commercial installations, or to meter consumers only, making other types of customers pay for lamp renewals.

3. *How much do you charge customers on first installations and on renewals?* The replies show that the price charged for first installation of lamps up to and including 16-candlepower units runs from 10 cents to 25 cents each, with an average of about 20 cents. A number of companies do not sell lamps

1. A continuation of Mr. Freeman's paper before the National Electric Light Association, begun in the Western Electrician of last week.

[illegible] of the companies who charge [illegible] charge the same price for [illegible] the price charged varies from an allowance of three cents on all lamps re- [illegible] lamps are fur- nished at half the price of the first installation. [illegible] charge for their first [illegible] free of charge.

[illegible] *candlepower lamps on the* [illegible] *what is your cult-* [illegible] The answers show [illegible] per cent. of the companies supply eight-candlepower lamps to the new customer, a little over 50 per cent. supply renewals free of [illegible]

[illegible] *candlepower lamps on the* [illegible] *what is your com-* [illegible] The same percentage holds good as in replies to Question 4.

6. *Do you supply two-candlepower lamps for sign and decorative lighting?* The replies disclose the [illegible] 37.5 per cent. of the companies do supply two-candlepower lamps, usually for signs only, but, as a rule, charge the customers for these lamps.

7. [illegible] *incandescent lamps marked for identification?* The replies show that 54 companies, or a little more than 12.5 per cent., [illegible] mark their lamps.

8. [illegible] *incandescent lamps and lamp* [illegible] *delivery system is employed?* The answers show that nearly three-quarters of the companies do not deliver lamps. Of the one-quarter who do deliver, 54 companies state the method of delivery, and these include: Boys and wagons, 8; boys, 30; trouble men, 6; electrician, 1; meter wagons, 2; inspectors, 2; automobiles, 2; men in uniform, 1; bicycles, 1; linemen, 1.

experience with this lamp? The replies show that 220 companies have not used the tantalum lamp at all. Of the 170 companies who state that they have used the lamp, 86 merely state this fact in terms and do not relate anything as to their experience; 41 express themselves as pleased and satisfied with the tantalum lamp, while 43 have had unpleasant experiences and are dissatisfied with the result of their experience with it; 41 companies charge for the lamp at cost. Several companies charge cost, less renewal charge of carbon filament lamps, while 72 companies charge customers from 15 to 30 per cent. above cost.

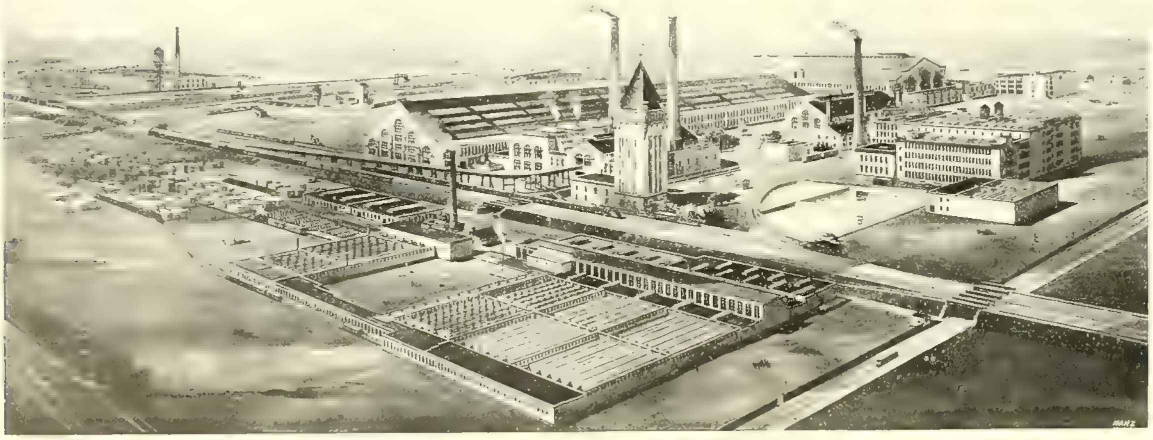
14. *Have you used the tungsten as yet? If so, in what way and with what results?* The replies disclose the fact that 220 companies have used the tungsten lamp, while 178 have not tried it as yet. It would seem from the testimony of those who relate their experience with this lamp that it has proved thus far highly satisfactory. Very few criticisms are made, and these principally of the fragility of the filament and the high cost of the lamp.

[To be continued.]

Convention Delegates Visit Hawthorne Works.

In order to familiarize visitors to the National Electric Light convention with the manufacture of power apparatus and supplies at Hawthorne, the Western Electric Company maintained hourly automobile service between the Auditorium and the Hawthorne Works, situated at the extreme western limit of Chicago. Many visitors took advantage of this opportunity.

The Hawthorne Works of the Western Electric Company cover an area of 150 acres and consists



HAWTHORNE WORKS OF THE WESTERN ELECTRIC COMPANY, WITH RECENT ADDITIONS.

9. *Do you make periodic deliveries, or only upon individual requests?* The responses show that 7.5 per cent. of the companies who furnish free renewals make periodic deliveries and the other 92.5 per cent. deliver only upon individual request.

10. *How accurate a record do you keep of renewal lamps supplied to customers, and what restrictions, if any, are employed in supply of renewals to prevent waste or dishonesty?* Two hundred and sixteen companies reply that they keep no record whatsoever. Other companies keep records of installations and renewals in various forms and watch these records with varying degrees of care to prevent loss by leakage or theft. Very little that was definite appears in these replies as to effectual methods of preventing lamp waste in medium and large central stations, and it would seem as if this subject might with profit be given more co-operative consideration than it has hitherto received.

[illegible] *-watt, 20-candle-* [illegible] *what has and what has* [illegible] The replies show that 224 companies have used this lamp. Of these [illegible] their experi- [illegible] experience with [illegible] 43 com- panies relate unpleasant experiences, such as "burn- [illegible]

[illegible] in the affirmative and 263 in the negative. Other [illegible]

of the most up-to-date buildings for manufacturing purposes. Here are manufactured electric-light and power machinery, lead-covered cable and insulating material. By visiting the shops one is able to follow the manufacture of direct and alternating-current apparatus from the pattern room through the foundry and machine shop to where the finished product is placed in the car for shipment, thus gaining a better conception of actual manufacturing methods than could possibly be given by an exhibit.

Naturally one would expect to see electric power in the plant of a company manufacturing electrical apparatus. It occasions surprise, however, even with this foredrawn conclusion to note how complete an advantage is taken of such power transmission and machinery. One may walk the entire length of the large machine shop without seeing hardly a shaft or belt, nearly all machines being operated by individual motors. In some instances even two and three motors are used on a single machine, as is the case with the large planers and traveling cranes.

Not only are motors used for driving all types of wood and metal working machines, but for hoisting, conveying, grinding, polishing, and numerous other classes of service. Lead covering for cable is formed by hydraulic pressure, the pressure being produced by pumps driven by large motors; vacuum impregnating of insulated materials is done in huge tanks from which the air is exhausted by motor-driven pumps; hand drilling tools are operated and machines for every conceivable use are run by electric power. The accompanying illustration shows the Hawthorne Works with the recent additions, which include [illegible] and woodwork shops occupying [illegible] building [illegible] for the manufacture of black enamel wire, and a hospital building.

Current-saving Device for Moving-picture Shows.

When the arc lamp was first applied to stereopticon, projecting and moving-picture lanterns and theatrical spot lights no particular attention was paid to the efficiency and control of the lamp. A simple hand-feed lamp of the focusing type with one carbon above the other was adopted, and is still largely used. Arc lamps for moving-picture machines must necessarily be of the open-arc type in order that the arc may be short and the craters as large and bright as possible. The standard lamps used for direct current require between 20 and 40 amperes, with 42 volts at the arc. With alternating current it is necessary to use from 30 to 60 amperes, with 32 to 38 volts at the arc.

As all standard lighting circuits operate at 100 to 125 or 200 to 250 volts, some means must be introduced to lower the voltage to that required by the arc. Hitherto little attention was given to the efficiency of the means for reducing the voltage. Rheostats, being the cheapest and easiest to manufacture, were universally adopted for both alternating and direct current, and are still used for all direct-current lamps.

In a 110-volt installation with a rheostat, where a standard moving-picture lamp requires 45 amperes, there is a connected load of 4,950 watts for a lamp which actually requires only about 1,500 watts. This represents a loss of 3,450 watts in the rheostat, which generates a large amount of heat to the discomfort of the operator, who is usually cooped up in a small operating booth.

When a choke coil is used it is evident that the connected load is still the same as with a rheostat. Nevertheless, due to the impedance of the choke coil, which operates with about 0.4 power factor on 110 volts and 0.2 on 220 volts, a considerable wattage saving is effected, averaging 50 to 60 per cent. on 110 volts and 70 to 80 per cent. on 220 volts. On account of this low power factor, however, a choke coil is not thought desirable.

After exhaustive tests, there has been produced the device illustrated herewith, which was designed to meet the demands of the central station and the consumer. This device is known as the Hallberg automatic electric economizer, and is manufactured by J. H. Hallberg, 30 Greenwich Avenue, New York city. This device has two separate windings—a primary and a secondary—being in effect a constant-current transformer. The primary may be wound for any voltage from 100 to 460, and for any standard frequency.

The "Economizer" is made in several sizes, depending upon the style of lamp it is to control. The standard capacity for moving-picture lamps is 2½ kilowatts, with adjustments permitting 40 to 50 amperes constant current at the arc. It weighs about 100 pounds and is put up in a neat, fireproof, brass case that may be mounted in any position on floor, wall or ceiling. It operates with about 0.80 power factor on all voltages and reduces the capacity of the electric-light company's service to the lowest possible amount. If the arc is short-circuited by overfeeding the lamp, the primary current does not increase more than 15 to 20 per cent., and the device is built to stand a dead short-circuit for an indefinite period without overheating.

When the arc is under the control of this device it cannot flame, and the carbon separation may be much less than with any other style of controller. This is of great practical advantage, as it permits the craters of both carbon points to be focused, entirely removing the bad effects of the violet arc rays, and the intensity of the light from the craters is increased by the removal of the arc mist, which is always present when a longer arc is used. The shorter arc also reduces the rate of carbon consumption.

The Hallberg Economizer is said to save 65 per cent. on 110 volts, 80 per cent. on 220 volts, and over 90 per cent. on 440-volt, alternating-current circuits, as compared with the rheostat. It is put forth as the only current-saving device for moving-picture lamps which gives perfect arc control and a steady light with large currents up to 65 amperes. This feature may put the alternating-current arc in a position to compete with, and in some cases excel, the direct-current arc for the class of work referred to. As a general rule, a considerable sav-

[illegible]

75,000-volt Oil Circuit-breakers.

[illegible]

Maximum Watt Demand Indicator.

[illegible]

[illegible]

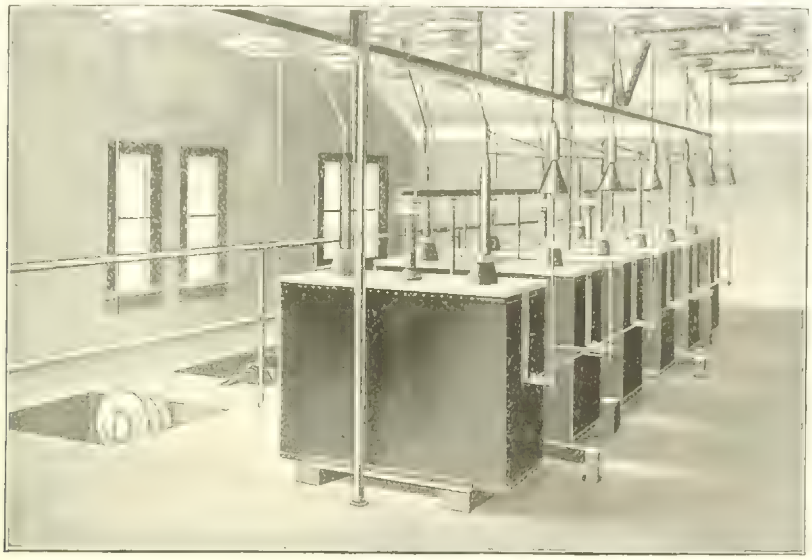


FIG. 1. 75,000-VOLT OIL CIRCUIT BREAKERS IN EDISON ELECTRIC COMPANY'S SUB-STATION AT FERNANDO, CAL.

FIG. 2. SWITCH MECHANISM OF OIL SWITCH AND CIRCUIT-BREAKER.

knifeblade type, being part of a simple pantograph, the lower part of which is pivoted to the metal cap of the central insulator and the upper part to the end of a wooden rod which is attached to a special porcelain insulator secured to the channel iron cross-bar. A vertical movement of the cross-bar imparts a horizontal movement to the ends of the blades as they leave the contacts, these ends being brought together in the center of the tank in the open position of the switch, as shown by the dotted lines. The cross-bar is carried on two guide rods placed in cast-iron frames between the tanks, the vertical movement being given to it by means of a rocker shaft beneath the central tank having two arms which are connected to the lower ends of the guide rods by means of links. The counterweight is also mounted on the rocker shaft. Coil springs for opening the breaker when tripped are placed in each frame, where they operate directly on the guide rods. The tanks are of iron and the covers of marble, made in two pieces, either one or both of these pieces being removable for purposes of inspection without disturbing any other part.

The circuit-breakers shown in Fig. 1 are arranged for hand closing, the handle being carried loosely on the rocker shaft and connected to the closing mechanism by means of a short lever and a dog, the dog being released by the action of the tripping mechanism in the event of an overload or short circuit.

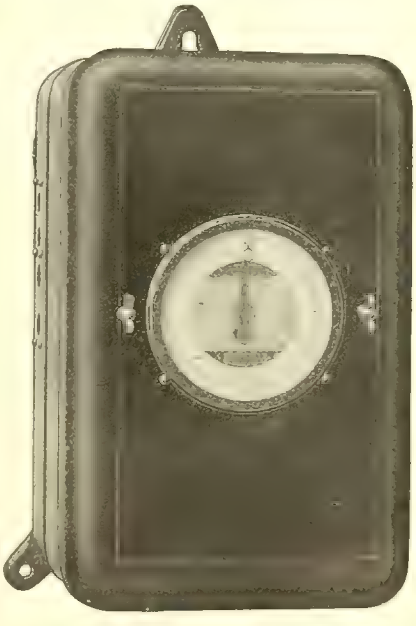
The tripping mechanism, which is very simple in design, is set in motion by any one or any two of the trip coils independently or by all of them acting together, and is automatically reset each time the breaker opens. The trip coils consist of a few turns of small diameter and are placed directly in the line, being suspended from the insulators of the disconnecting switches and supported by the connection to the switch terminals. The insulation of the coil has a very long creepage surface, approximately 60 inches, and a dielectric strength of at least three times the line voltage, thus giving it a higher factor of safety than that of the best series transformer.

These circuit-breakers have been installed in all the sub-stations on the Edison Electric Company's 75,000-volt transmission line from Kern River to Los Angeles, and during a period of several months they have operated automatically a number of times with success. They are manufactured by J. N. Kelman of Los Angeles, Cal.

Commencing June 1st the Northern Pacific Railroad will dispatch its trains between Staples and Dilworth, Minn., by telephone.

time lag. In place of the usual register there is provided a single graduated dial and two pointers. One of these is driven by the moving element through a train of gears, and indicates at any instant the energy passing through the device. The other pointer is driven by the first and remains at the maximum position reached by it, being held in this position by a ratchet. The final position reached by this second pointer indicates the maximum energy taken from the circuit. A thumb-nut is used to set the maximum-demand pointer back to zero, and may be sealed to prevent tampering by unauthorized persons.

The length of time required for the pointer to



FIVE-AMPERE 110-VOLT MAXIMUM-DEMAND INDICATOR.

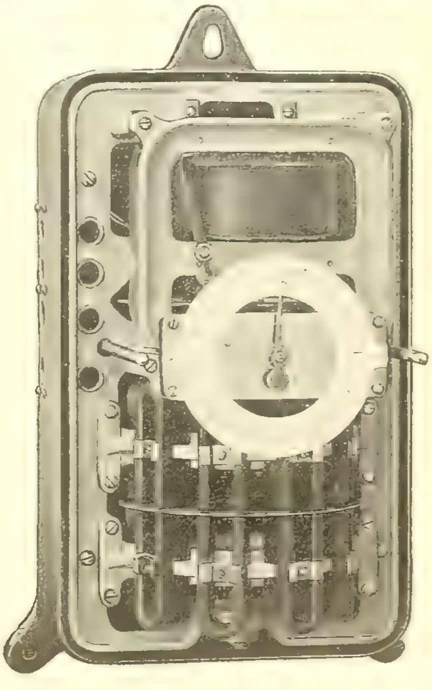
reach its maximum position, or the "time lag," will depend on the torque of the motor elements and the strength of the damping magnets, and may be varied from one minute to 30 minutes. The indicator is rated by defining the time lag at 90 per cent. of full scale, since between 90 and 100 per cent. the movement is very slow compared with the speed from zero to 90 per cent.

The polyphase demand indicators are made self-contained in capacities from 25 to 150 amperes, 220 to 650 volts. Above these capacities current and potential transformers must be used.

been organized at Georgetown, for the construction of a telephone system to connect with Crandall, Elizabeth, Palmyra, Lanesville and other Harrison County towns.

The Silver Valley Line Telephone Company of Pleasant Grove has been organized and the work of constructing a line has already commenced. Carl Holtz is president.

The Brooklyn Mutual Telephone Company, recently incorporated, has entered upon the work of constructing a new plant to compete with the



MAXIMUM-DEMAND INDICATOR WITH FRONT CASING REMOVED.

Brooklyn Home Telephone Company, which recently increased its rate.

The British Columbia Telephone Company, with head offices at Vancouver, B. C., has planned to rebuild the exchanges at New Westminster and Nanaimo, and new apparatus will be installed. Some 53 miles of long-distance line will be built this year, and exchanges will be opened at all necessary points. In addition the company is building a duplicate trunk line between Victoria and Duncans, on Vancouver Island.

CORRESPONDENCE.

Continental Europe.

[illegible] company which is operating the large hydraulic plants of Kander & Hageneck has recently purchased ground for erecting a turbine station of considerable size near Kallnach. The hydraulic work includes a canal of three miles length, of which 1.2 miles will be in tunnel; also a dam of 60 feet height, in the neighborhood of Niederried.

The new telephone exchange at Hamburg is undoubtedly the largest on the Continent, being laid out for an ultimate capacity of 80,000 subscribers. The exchange is now nearly finished and will be put in operation at an early date. It takes the place of the six telephone exchanges of smaller size which have been used up to the present, and it is laid out to handle the lines of the city as well as of the different suburbs. Progress in the use of the telephone has been rapid during the last few years, and at present there are 26,500 subscribers besides 13,000 secondary posts. Formerly the cables for the different circuits were placed overhead, but at present these have been laid underground in cement conduits. The new exchange is a handsome brick building and covers a large surface. In the two main halls are installed the multiple switchboards, and around the halls are the galleries in which are placed the relays and other apparatus. The building has many other rooms which are used for different purposes. In the basement are placed the dynamos, storage batteries, etc. At present there are 900 employes in the exchange, and this number will be increased to 1,600 when the expected number of 80,000 subscribers is reached. The exchange has the most modern apparatus, using the central-battery system with luminous signals.

The new electric furnace invented by Viel is claimed to be a considerable improvement over the existing forms for the treatment of metals. According to the inventor the present electric furnaces with arcs have an efficiency of but 33 per cent. The Moissan type of furnace has 85 per cent., but it is not well adapted for reduction of ores or refining of metals, and not more than one-half of the heat can be utilized here. The main novelty in the Viel furnace lies in the fact that the arc is placed above the material in the crucible and is blown upon the latter by a magnet. Mr. Viel built a 300-horsepower furnace of this kind and claims that he secures the same result from it as with a 900-horsepower furnace of the usual kind, and that it has from 80 to 85 per cent. efficiency. Starting from bauxite as the ore, he obtains the reduction of aluminum by carbon directly and produces two pounds of the metal with an expenditure of 30 kilowatt-hours. In producing ferro-chromium of 60 per cent. value he obtains 7½ pounds of the metal per horsepower-day, while the usual furnaces are said to produce but two pounds under the same conditions. Besides, the percentage of carbon in the ferro-chromium is now reduced to three per cent. and sometimes to one per cent., while it is usual to find eight per cent. in the ordinary product. Therefore the new process seems to be an improvement in this field. A. DE C.

Great Britain.

London, May 15.—A paper read before the Institution of Electrical Engineers last night by Dr. C. C. Garrard of Messrs. Ferranti, Ltd., entitled "Switchgear Control Apparatus and Relays for Alternating Currents," has brought to light a very efficient piece of apparatus, not made by this firm, however, for the protection of inter-connector cables. This particular piece of apparatus, which is in extensive use in the Tyneside district by the power companies in that area, is the invention of C. H. Merz and B. Price, and the principle upon which it depends is briefly as follows: A current transformer is included in the inter-connector at either end, the secondaries of which are connected together through trip coils and the pilot, the return circuit being via earth. As long as the current flows through both current transformers in the same direction (it is immaterial in which direction), the electromotive forces induced in the secondaries of the current transformers balance, and current does not flow through the pilot and trip coils. As soon, however, as the currents at either end become unequal, current begins to flow in the trip coils, and when this has reached sufficient value the switches are opened. The advantage of [illegible]

recommending the acceptance of the proposal, said that fortunately for London, but unfortunately for the shareholders, of whom his firm was the largest, they had been too sanguine. Some of the criticisms made in the press, he continued, had been perfectly fair and he could not deny the justice of the comment that sufficient allowance had not been made for the difference between American and English conditions. This is the first time this has been admitted, although it has been often pointed out.

Something in the nature of an agitation is being stirred up in the metropolitan district by the tramway authorities, urging that an appeal should be made to the powers that be for an enactment that omnibus proprietors, who are the tramways biggest competitors, should be forced to make a contribution toward road maintenance. As all tramway authorities have to maintain the roadway to the extent of 18 inches on either side of the track, and seeing that the motor omnibuses make considerable use of the tram tracks, it seems a somewhat reasonable assumption that at any rate a portion of the wear upon the permanent way of tramways is occasioned by the buses. A further bone of contention is that in many districts in which this takes place the omnibus proprietors are not even ratepayers in the ordinary sense, seeing that they have no property in the district and merely run their vehicles through. G.

Eastern Canada.

Ottawa, May 23.—Merriton, Ont., has decided to construct an electric-light plant to be controlled by the municipality. The streets are to be lighted and electricity will be supplied to citizens.

It is stated that the price William Mackenzie asks for the release of the Toronto Electric Light Company from its contract with the Electrical Development Company is $1,200,000. The contract has 17 years to run. Toronto city cannot take power from the Electrical Development Company. The electric-light company cannot take power from any other concern than the Mackenzie company, unless it first gets the consent of the Mackenzie interests.

The Kaministiquia Power Company has already entered into the tangible profit-earning stage. The record of the company so far has been good, and the management has felt justified in offering, through the London market, the sum of $1,325,000 out of the $2,000,000 which it has been empowered to issue for the purpose of rapidly increasing the development. The company's power house is 18 miles from the twin cities of Fort William and Port Arthur, at the head of Lake Superior, the strategic point for the commerce of the Canadian Northwest.

As to the waterpower at the Kakabeka Falls, the Kaministiquia River falls 180 feet in a distance of 6,500 feet, so that the flow of the river during the comparatively short low-water period of the year is sufficient to develop upward of 15,000 horsepower on the waterwheel shaft. The dams, intake and forebay have been completed to the full capacity of 30,000 horsepower; the aqueducts from 25,000 to 30,000 horsepower, and the penstocks to a capacity of 15,000 to 20,000 horsepower, of which 15,000 horsepower is now completely developed in the form of electricity. These works have been constructed under the best engineering skill available, at a total cost of upward of $1,600,000. H. S. Holt of Montreal is president of the company. W.

New York.

New York City, May 23.—By courtesy of President J. H. Finley, the New York Electrical Society will hold its two hundred and seventy-seventh meeting at the College of the City of New York, Wednesday, May 27th. At 8 p. m. an organ recital will be given in the Auditorium, and at 8:30 the company will adjourn to the assembly hall, where a lecture will be given by F. L. Gilman of the Western Electric Company on "Modern Telephone Apparatus and Its Manufacture." Some of the most notable evolutions in standard forms of apparatus will be on exhibition, and the lecture will be illustrated by lantern slides. After the lecture visitors will be conducted through the buildings. George H. Guy is secretary.

The United States Circuit Court of Appeals has ruled that the receivers of the Metropolitan Street and New York City railways may issue $3,500,000 receivers' certificates for the improvement of the surface traction properties in accordance with the petition filed some weeks ago.

At the annual meeting of the National Association of Manufacturers held here this week John W. Van Cleave was for the third time elected president of the association. The convention closed with a banquet on May 20th, attended by over 500. Mr. Van Cleave was the first speaker, and he said that the business depression is over. He was loudly applauded when he expressed the sentiment that greater prosperity is at hand.

One of the new and exclusive clubs of this city is the Railroad Club, which took its first luncheon at its quarters in the Terminal Building on Monday. The quarters are on the twenty-first and twenty-[illegible] tunnel terminal building and are the most elegantly furnished in the downtown district. The club originated through William G. McAdoo, and among its governors are C. A. Coffin, William M. Barnum, W. G. Besler, Anthony N. Brady, E. P. Bryan, E. C. Converse, R. W. De Forest, Pliny Fisk, Andrew Freedman, E. H. Gary, Clarence H. Kelsey, W. G. McAdoo and others.

On Monday a special car, with Mayor McClellan as motorman, inaugurated the new trolley service across the Williamsburg Bridge into the Subway station built at the Manhattan end of the bridge, from which the Subway trains on the loop connecting the Williamsburg and Manhattan bridges will run.

Yesterday the Public Service Commission awarded contracts on five of the six sections of the Fourth Avenue Subway in Brooklyn, the largest section being deferred for further consideration. The lowest bidder in each case got the work. These contracts, which must be approved by the Board of Estimate, bring the amount the city will have to spend for railroad work to $13,866,267, and for pipe galleries to $898,243, or on the whole work $14,764,510.

The Pennsylvania Railroad will again take up in full force the work of completing the terminal and river tunnels in this city. The successful flotation of a $40,000,000 bond issue enables the company to carry out this and other projects. The actual construction of the big station building will now be hurried.

The New York Board of Trade and Transportation is urging legislation which will place the telephone and telegraph business in the state under the control of the Public Service Commissions. A letter to Governor Hughes states that the telephone business is a natural monopoly and must remain so if the best interests of the public are to be conserved, but it suggests that it should be regulated by the state. It is asserted that with no competition the telephone companies have advanced their prices at will, making the charges higher in districts where the use of the telephone is more universal until now the charge in this city is higher than anywhere else in the world, although about 200,000 telephones are in use here.

The completion of the electrification of the Long Island Railroad from Queens to Hempstead was signalized Tuesday by the passage of the first electric car from the Flatbush Avenue station to Hempstead. The run was made in 36 minutes. W.

Northwestern States.

Minneapolis, May 23.—The electric-light plant at Griswold, Ia., has been sold to J. A. Binkley and W. D. Bailey of Omaha.

The Des Moines & Sioux City Railroad Company of Lake City, Ia., has been incorporated to build a road from Des Moines to Lake City, Sac City, Storm Lake and Sioux City. S. M. Elwood is president.

Fred M. Sadler has been granted a 20-year franchise to operate an electric-light plant in Ellsworth, Minn.

The Minnesota Construction Company, capitalized at $100,000, has been organized to construct an electric railway from Minneapolis to Medicine Lake, Minn. John Blichfeldt is president.

E. E. Rines, electrical engineer, has been engaged by the Town Council of Olivia, Minn., to investigate the electric-light plant and find out what is necessary to put it in first-class condition.

The Fargo-Detroit Electric Air line is being investigated by the Clay County, Minn., grand jury. It is claimed that fraud was practiced by some of the men connected with it.

E. P. Burch has reported to the city council of Alexandria, Minn., that the electric-lighting plant and pumping stations are worthless.

The city council of Valley City, N. D., has instructed the city auditor to advertise the light plant for sale. No bid for less than $40,000 will be considered. A 20-year franchise will be granted.

The Mitchell Illuminating and Power Company of Mitchell, S. D., has incorporated for $200,000, with D. B. Miller, president; Wm. M. Smith, vice-president; D. A. Mizner, treasurer; Henry Swindler, secretary, and Fred M. White, manager. The company has purchased the Mitchell Gas Company at receiver's sale.

The experts of the Wisconsin Railroad Commission place the total value of the Wisconsin Traction, Light, Heat and Power Company of Neenah, Wis., at $660,453, and say it can be reconstructed for $866,087.

Interurban connections will soon be made between River View and Stanley, Wis., and neighboring towns. The power will be furnished by the Eau Claire River.

The city council of Eau Claire, Wis., has employed an expert to find out what it is costing the city to produce water and light.

The Menomonie Electric Light and Power Company of Menomonie, Wis., has closed a contract with the Chippewa Valley Railway, Light and Power Company for electric current.

A meeting of the stockholders of the Central Electric Company was held at the offices of the La Crosse Gas and Electric Company of La Crosse, Wis., for the purpose of selling the property of the

[illegible] Central Electric Company [illegible]
[illegible]

W. [illegible] plant in the [illegible]

Western Canada.

[illegible] Caulley, 256 Nena Street, Winnipeg, have invented and patented [illegible] street cars. The feature is that it follows the rails and does not swing out at curves. There is a possibility that it will be adopted by the Winnipeg Electric Company.

The first electrical conveyor for hydraulic mining ever used in northern Canada is now in operation by the Guggenheims on Bonanza Creek in the Yukon. It is expected this conveyor will revolutionize mining in the Yukon, making it possible to work to bedrock, a thing unobtainable with the dredges previously in use.

Alfred Bowen of San Francisco, representing Kansas City men, has arrived at Edmonton, Alberta, for the purpose of negotiating for the partially completed municipal street-railway system in that city.

It is understood that the Dominion government will start work immediately on the erection of wireless-telegraph stations at Prince Rupert, Jedway and Lawnhill, B. C., and one on Queen Charlotte Island.

City Engineer Keely of Edmonton, Alberta, is making arrangements for the immediate installation of the proposed electric power plant at a cost of approximately $140,000.

A telephone system will be installed at Springside, Sask., by the Yorkton Northwest Electric Company, Yorkton, Sask.

The Alberta government has awarded the contract for the supply of materials necessary for the construction of 700 miles of rural telephone lines to the Northwest Electric Company of Winnipeg and Montreal.

At a meeting of the City Council of Prince Albert, Sask., it was decided not to sell the municipal electric-lighting plant, as it may prove useful in supplying electricity if the proposed municipal street-railway system is built. At the same meeting it was decided to do away with the present street lights and substitute arc lamps, tenders for which will be called shortly. C. O. Davidson is clerk. R.

Pacific Slope.

San Francisco, May 21.—The contracts recently awarded by the United Railroads of San Francisco for additional power equipment will aggregate $375,000. This will double the capacity of the North Beach power station. The new equipment includes a 5,000-kilowatt Westinghouse-Parsons turbo-generator, boilers aggregating 3,000-horsepower, and a 4,000-kilowatt frequency changer, to change the electric current received from the City Electric Company's generating station. On May 6th, when the Atlantic fleet arrived, the United Railroads had its record day, 630,000 fares being collected. Manager Black said that the flexibility of the trolley system was proven beyond a question, although he estimated that the company probably lost 25 per cent of the fares through the crowded condition of the cars on that day. A statement issued by President Patrick Calhoun of the United Railroads shows that the gross receipts of the company for the first three months of the present year were $1,522,716, as compared with $1,606,022 for the corresponding period last year.

The Great Western Power Company is in receipt of a carload of special type earthenware insulators, made to be suspended from the cross-arms. Several cars of structural steel for the steel towers are about due. The company was this week awarded a franchise for a power line in Sacramento county and another similar franchise in Yuba county.

The Permanent Down Town Association of San Francisco has arranged for the placing of 160 ornamental electric lighting poles on Market, Sutter and Powell streets. The city will pay for the electric current for the lighting.

The Northern California Power Company has commenced construction on a 60,000-volt line from its sub-station at Palo Cedro to Kennett. At the latter place another sub-station with a capacity of 7,000 horsepower will be erected. The new transmission line will feed the new electric-process iron smelter at Heroult as well as the smelter at Kennett.

The Board of Regents of the University of Washington, at Seattle, are asking for bids on the proposed new power plant to be erected at the university.

Arthur Gunn, president of the Wenatchee Electric Company, Wenatchee, Wash., announces that his company will within the year put in a 12,000-horsepower hydro-electric plant on the Icicle River, near Leavenworth.

The Rainier Electric Company has secured a franchise for an electric transmission system and for a power plant in the town of Rainier, Ore. A.

PERSONAL.

[illegible] of July. While abroad he will visit his company's [illegible]

[illegible] nology, next week, the honorary degree of doctor of engineering is to be conferred upon him.

Mr. W. [illegible] & Co., left New York last week for a trip through the Northwest. He will remain a few days at Portland, Ore., where the company has an office, and where it has recently taken on some large engineering work, returning to New York about June 8th.

The death is announced of B. H. Thwaite, the gentleman who recently took in hand some interesting experiments in conjunction with the Royal Botanical Society in London upon the influence of electricity upon plant life. It may be remembered that his apparatus included something having a close approximation to artificial sunlight.

William P. Boardman, who built one of the first street railways in America, died at his home in Desmet, S. D., on May 21st. Mr. Boardman superintended the construction of the old New York and Harlem Railway, the line which now nearly corresponds with the Fourth Avenue Railway in New York city. It connected the Bowery with Harlem.

Mr. John H. Sass, long connected with the Western Electric Company, Chicago, has taken a position with the American Electric Fuse Company of Muskegon, Mich., assuming entire charge of the manufacture of the company's black enameled wire. The long and varied experience Mr. Sass has had in the electrical field should bring him success in his new undertaking.

Mr. Herbert C. Petty was elected a director of the Crocker-Wheeler Company on May 13th. Mr. Petty accepted a position in the sales division of the company in January, 1903, and has advanced rapidly to the position of contract manager. The present honor conferred upon him is a recognition of the esteem and confidence which he commands among the stockholders of the company.

Among the 1,788 persons in attendance at last week's convention of the National Electric Light Association in Chicago were at least eight former presidents—Charles R. Huntley, Buffalo; James I. Ayer, Cambridge, Mass.; Samuel Insull, Chicago; Henry L. Doherty, New York; Louis A. Ferguson, Chicago; Ernest H. Davis, Williamsport, Pa.; William H. Blood, Jr., Boston, and Arthur Williams, New York.

The recent death of Robert C. P. Holmes leaves Mr. J. Henry Goehst as the oldest employe of the Commonwealth Edison Company in point of service. Mr. Holmes and Mr. Goehst entered the employment of the original predecessor of the Commonwealth Company in Chicago on the same day. Mr. Goehst, who has risen to the responsible position of superintendent of construction, was much affected by the death of his old friend.

During the convention in Chicago last week the news leaked out that Miss Edith M. Myers, of the New York Edison Company and also chief of the registration bureau of the National Electric Light Association, is to be married before another annual convention of the association is held. Hearty felicitations will be extended to Miss Myers, who has won the respect of all by the serene intelligence with which she has performed her exacting duties.

ELECTRIC LIGHTING.

Stillwater, Okla., has voted $7,000 bonds for an electric-light plant.

The Somerville Light and Ice Company of Somerville, Tex., has been incorporated with a capital of $25,000.

The Newport (Ark.) Water, Light and Power Company has been incorporated with a capital stock of $100,000.

The Navasota (Tex.) Light and Power Company has been incorporated with a capital of $20,000 by R. A. Horlock and associates.

N. P. Conery of New Orleans, La., has purchased the control of the Plaquemine (La.) Electric Light and Power Company.

The city of Weatherford, Tex., contemplates issuing $20,000 of bonds to construct a municipal electric-light plant and extend water system.

The borough of Danville, Pa., recently purchased equipment for an electric-lighting plant which included a 16 by 36-inch Allis-Chalmers Reliance Reynolds-Corliss engine, direct-coupled to a 150-kilowatt engine-type alternator of the same build.

[illegible] of the [illegible]

[illegible] Springs is interested.

[illegible] cellent financial condition. The receipts during the year 1907 were $31,254; expenses, $23,805. [illegible]

The Elks held a meeting in Peoria, Ill., last week and the stores made good use of electric lights for decorating, the most elaborate piece being an elk's head with a scroll at the bottom and a clock dial between the antlers at the top. The dial was 14 feet in diameter, and the total height of the piece was 45 feet. The whole was outlined with electric lights and made a very handsome appearance.

As a means of adjusting the differences between the city and the Sanitary District of Chicago it is understood that the city administration favors the merging of the Sanitary District with the municipality. The plan, it is said, proposes the ending of the drainage trusteeship and the establishment of a new city department to embrace the drainage of the city, water supply, sewer system, etc.

W. B. Holton and associates of Indianapolis have applied for a 20-year franchise for a gas and electric-light plant in Seymour, Ind. The franchise of the Seymour Light Company is about to expire. This company is controlled by Chicago men, who secured it from local people for $55,000 and bonded the plant for $110,000. The receipts failed to pay interest on bonds and operating expenses and the plant passed into the hands of a receiver a year ago. Mr. Holton promises to build a new and modern plant.

F. H. Froehlich, a consulting engineer of Toledo, Ohio, has been engaged to represent the city of Bucyrus, Ohio, in negotiations now going on for the construction of an electric-light and power plant. The city has two plans under consideration, one the construction of a plant to be owned by the municipality and the other involving the sale of the franchise to a private corporation. The data and specifications, which Mr. Froehlich will prepare, will largely determine whether the city of Bucyrus will own its own plant or sell the franchise to a private concern.

There is little doubt but that a complete reorganization of the Toledo Railways and Light Company will be made inside of the next year, as a result of the formation a few days ago of a committee of bondholders of the company, headed by Norman B. Ream. Action is being taken at this time so that there may be ample opportunity for straightening out matters before the maturing of $4,866,000 of four per cent bonds on July 1, 1909, and additional bonds of the subsidiary companies, $5,300,000, making a total bonded indebtedness of $10,166,000 falling due on that date. It is thought that this action will aid materially in the fight for new franchises to take the place of those which expire on November 10, 1910.

In advertising an issue of $2,500,000 of bonds the Seattle Electric Company shows that the gross earnings of the company for 1907 were $4,104,794, and the net earnings were nearly two and one-half times the interest charges on the entire funded and guaranteed debt. The company controls 97 per cent. of the street-railway mileage and the greater part of the electric-lighting and power business in a rapidly growing and very important city, and serves a population of approximately 240,000. The company owns all the outstanding capital stock of the Puget Sound Power Company, excepting shares held to qualify directors. The Puget Sound Power Company has developed a very valuable waterpower within easy transmission distance of Seattle and Tacoma.

ELECTRIC RAILWAYS.

The Angelo Power and Traction Company of San Angelo, Tex., has been incorporated with a capital stock of $50,000.

The striking street-railway conductors and motormen of Cleveland have voted to return to work as new men. The differences may be submitted to arbitration.

The Charleston and Casey Traction Company has been incorporated, with principal office in Casey, Ill. The first board of directors includes H. R. Patton of Charleston and J. E. Walters of Casey.

SOCIETIES AND SCHOOLS.

[illegible] of the University of Michigan [illegible] the present year of 5,010 [illegible] over last year. Of [illegible] students in the department of engineering.

The next meeting of the Chicago Section of the American Institute of Electrical Engineers will be held in the rooms of the Western Society of Engineers [illegible] Mr. R. F. Schuchardt will [illegible] "Recent Developments in Pro[illegible] Apparatus."

The Electrical Engineering Society of the Massachusetts Institute of Technology has elected John Mills, president; H. E. Whitaker, vice-president, and D. G. Haynes, secretary-treasurer. Prof. Elihu Thomson was the speaker at the last dinner of the society for the year on May 22d. The society commended the work of Prof. D. C. Jackson as the head of the course.

The mechanical branch of the Association of Licensed Automobile Manufacturers met at the Hollenden Hotel in Cleveland, Ohio, on May 22d for the annual congress. The organization is composed of the engineers and factory superintendents of the members of the Licensed association. Among the important things discussed was the dynamometer of the Automobile Club of America, an elaborate apparatus for testing cars. The workings of the machine were recently examined by the committee on tests of the mechanical branch. E. W. Roberts of Clyde, Ohio, made an address on two-cycle motors. C. E. Thompson of the Electric Welding Products Company read a paper on combination valves for four-cycle motors.

For the benefit of teachers and others interested in electrical subjects a laboratory course in electrical practice will be offered at the New York University Summer School this season. The course, which is to be given by Dr. J. Loring Arnold, professor of physics, and B. Thurston Le Valley of Stevens Institute is designed to aid teachers to understand electrical engineering and to prepare students for such technical training. The idea of the instructors is to meet the constantly increasing interest in the electrical industry and to supply training outside of technical schools of an advanced but highly practical nature. Besides the laboratory course in electrical practice there will be another course in electrochemistry, which will be conducted by Prof. Arthur B. Lamb, Ph. D., in the Havemeyer Laboratory.

The twelfth annual commencement of the College of Engineering, Armour Institute of Technology, will be held at 8 p. m., on June 4th. The principal address will be delivered by Hon. John A. Johnson, governor of Minnesota. The number of graduates in the different departments is as follows: Mechanical engineering, 13; electrical engineering, 17; civil engineering, 20; chemical engineering, 9; fire-protection engineering, 2; architecture, 5. Advanced engineering degrees will be conferred upon 20 alumni. The honorary degree of doctor of engineering will be conferred upon Mr. Bernard E. Sunny. Other events of commencement week will be the delivery of the baccalaureate sermon by Dr. Gunsaulus at 11 a. m., May 31st, at the Auditorium, and the alumni banquet at the Grand Pacific Hotel on the evening of June 1st.

TELEGRAPH.

The Postal Telegraph-cable Company has filed a statement with the state auditor of Oklahoma showing its gross receipts for 1907 in that state to be $52,575. The Postal Company operates in [illegible] counties in Oklahoma.

It is reported from London that John Henniker Heaton, M. P., the postal reformer, proposes to devote the remainder of his public life to a crusade to cheapen the world's telegraph rates. He is said to be promulgating a scheme for a uniform telegraph rate of two cents a word in Europe. He will agitate for a like rate in Great Britain and all the colonies, irrespective of distance, his ultimate aim being a rate of two cents a word through[illegible] the world.

WIRELESS COMMUNICATION.

[illegible] in the basement of [illegible] School, D. E. Elliott, professor of science at the school, is said to have [illegible] station at Santa [illegible] City, Okla. He [illegible] the wireless oper[illegible] station at the [illegible]

[illegible] and told them the Richmond station had no lofty pole or wires and was home-made.

The Marconi Wireless Telegraph Company of America elected officers in New York recently as follows: President, John W. Griggs; vice-presidents, William Marconi and John Bottomly (the latter general manager); treasurer, W. W. Bradfield.

PUBLICATIONS.

Under the title, "Two Aids to Better Service," the General Electric Company has issued a neat folder (No. 3654) calling attention to some of the reasons why the GE luminous arc headlight has been adopted. On the front page are pictures of the Headlight and the Belmont Tunnel, New York.

Like previous ones, the June calendar card of the F. Bissell Company, Toledo, Ohio, shows originality which attracts attention. This one bears a real hairpin, and the text begins: "If you once get it into your head how much our service means to you we'll have your trade for all time—you'll never want to make a 'switch.'"

MISCELLANEOUS.

The new 1,240-ton yacht Vanadia, built for C. K. G. Billings, has included in its modern equipment an electric elevator which operates between the upper deck and the staterooms and hold.

Secretary W. F. Saunders of the Lakes-to-the-Gulf Deep Waterway Association, which has its headquarters in St. Louis, has issued a call for the third annual convention of the association to be held in Chicago, October 6th, 7th and 8th. Secretary Saunders expects there will be more than 2,500 delegates in attendance.

The Great Northern Railway Company of St. Paul, Minn., recently placed contracts covering a Reynolds-Corliss engine driving a 750-kilowatt Allis-Chalmers engine-type alternator wound for 60-cycle, three-phase circuits, as well as an exciter set and lighting transformers. The new equipment is intended for installation at Superior, Wis., where the power will be used for operating grain-elevator machinery.

Mr. Glenn Marston of New York advocated state control of public-utility corporations in a talk before the Central Y. M. C. A. in Chicago last week. Mr. Marston said that both municipal ownership and municipal control have been found to encourage corruption and that their material benefit to the community, even when conducted with a fair degree of honesty, is more apparent than real. "State control gives all of the advantages of the other forms without any of their evils," he said.

A bonus of about $160,000 will be awarded Allis-Chalmers Company by the Sanitary District of Chicago on a contract for two screw pumping engines installed in the Thirty-ninth Street pumping station, which, with four centrifugal pumping units built and installed there by the same company, represent an aggregate maximum capacity of 2,160,000,000 gallons of water and sewage every 24 hours. The official test shows a duty of 145,000,000 foot-pounds, while the contract calls for 95,000,000 foot-pounds.

TRADE NEWS.

The American Electric Lamp Company of New York, whose New York office was located at 26 Cortlandt Street, has arranged with the Central Electrical Supply Company, 29 West Fifteenth Street, to become its sole selling agent in Greater New York. The agency expects to carry at all times a stock of from 50 to 75 thousand lamps, which should insure prompt delivery of orders.

Henry Lorin Wells has established offices at 1205 Monadnock Block, Chicago, where he will give his attention to the advertising of a limited number of machinery manufacturers whose products do not compete with each other. Mr. Wells is well equipped for this task. He was formerly with the publicity department of the Allis-Chalmers Company of Milwaukee and recently in charge of the advertising of the Power and Mining Machinery Company of Milwaukee.

At the office of the supervising architect, Treasury Department, Washington, D. C., sealed proposals will be received until June 23d. for the installation of a conduit and electric wiring system in the United States post office, court house and custom house at Spokane, Wash., in accordance with the drawings and specification, copies of which may be had at the above office, or at the office of the superintendent of construction, Spokane.

Mr. S. L. Grossman, formerly of the Nernst Lamp Company as sales representative, is now in charge of the sales department of the Safety Electric Company, located at 35 Michigan Avenue, Chicago, which is fast coming to the front with the new and renewed lamp business.

BUSINESS.

C. A. Herrmann of C. A. Herrmann & Co., Chicago, was unable to be at the electric-light convention owing to the pressure of business. Mr. Herrmann reports a great demand for his new Economic miniature arc lamp, which he is just placing on the market.

Sales Manager Edwin Williams of the Diamond Rubber Company, Akron, O., arrived in Chicago the first of this week, just after the electric light convention. Mr. Williams reports great progress on the part of his company in the rapid introduction of its new rubber-covered wire. Mr. Williams is just working his way East after a long trip throughout the West and Southwest.

The General Electric Company has placed on the market a new type of resistance unit for rheostats, fixed resistances, laboratory use, etc., which contains many important improvements in design and construction. The unit consists of a wire wound tightly on a specially formed tube. It is made in two forms, one having porcelain bushings at the end with wire terminals, and the other having metal bushings connected to the winding and suitable for holding in metal grips, and of a size to fit into standard fuse holder clips. Bulletin No. 4587 describes both forms of units and gives the size, ratings, capacities, etc., of the standard types.

Perhaps no three figures have in recent days been more thoroughly stamped upon the mind of the electrical fraternity than those contained in the number 9-0-3. This is the catalogue number of the new attachment plug manufactured by the Benjamin Electric Manufacturing Company of Chicago. The Publicity Department of this company started out in the beginning of the year to "feature" this device, and has been unusually successful in various forms of advertising. The campaign has netted the company large sales. Back of the advertising is the device itself. It is said to possess more good selling points than any other device of this character upon the market. Perhaps the question, "What is 903," together with its corresponding answer, has confronted more electric lighting men than any other single question and answer concerning an electrical device since the beginning of 1908.

The following figures, furnished by the Westinghouse Machine Company, are interesting as tending to controvert the general impression that the turbine business suffered heavily during the year. Although one month's business in 1906 still holds the record with that company at 62,100 kilowatts, the year 1907 was marked by an average demand quite as large. As late as July orders for 34,750 kilowatts were taken during that month, as compared with 25,750 for July, 1906, which is a particularly gratifying showing. For the first nine months of each year the demand for turbines was: 1907, 158,550 kilowatts; 1906, 152,400 kilowatts. Or, taking the middle six months of the year, from April to September, inclusive, thus excluding the usual midwinter activity, as well as the late depression, the average per month is: 1907, 15,833 kilowatts; 1906, 14,365 kilowatts. Thus it is apparent that up to the period immediately preceding the depression of October the demand for turbine equipment shows a steady increase.

DATES AHEAD.

Canadian Electrical Association (annual convention), Toronto, Ont., June 10th, 11th, 12th.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

Michigan Electric Association (annual meeting), Grand Rapids, Mich., August 18th to 21st.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay Island, August 25th, 26th and 27th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 19, 1908.

[illegible] Lewis, [illegible] 1907.

[illegible]

[illegible] St. Clair Motor Company, Detroit, Mich. Application filed Feb. [illegible] 14, 1907.

[illegible]

887,769. [illegible] Kansas City, Mo. [illegible] Kansas City, Mo. Application filed [illegible] 11, 1906.

[illegible]

887,774. [illegible] H. [illegible] N. J. Application filed September 21, [illegible].

[illegible]

887,776. Electroplating Apparatus. Charles [illegible] Long, Shreveport, La., [illegible] Norton Jewelry Company, Kansas City, Mo. Application filed October 4, 1906.

[illegible] board for regulating the current strength.

887,805. Position Indicator for Circuit-distributing Devices. Harry B. Higgins, Minneapolis, Minn. Application filed March 30, 1907.

In combination with [illegible] any of them, is an electrical position indicator comprising an electric lamp and [illegible] located at a distance from the [illegible] distributor.

887,807. Automatic Class Call. John F. [illegible] Minneapolis, Kan. Application filed April 5, 1907.

The hands of a clock make contact with [illegible] of contact buttons on the edge of the dial. Each contact leads to a plug-terminal board for connecting to various circuits.

887,822. Electrical Contact. Richard F. Le Brocq, Etna, N. J., assignor of one-half to James P. Niemann, Lynbrook, N. Y. Application filed March 24, 1906.

There are in combination fixed and movable contacts, a cam operated by clock mechanism, a main lever bearing on the cam, and a secondary lever carrying the movable contact and pivotally connected with the main lever.

887,840. Push-button Switch. Peter A. Paul, Lewisburg, Ohio. Application filed August 15, 1907.

A longitudinally movable but non-rotatable shaft has helical grooves of long pitch. A cam block and an impelling block are mounted on the shaft and engaged by the grooves thereof, these blocks being provided with one-way engaging faces and a spring for holding the block in engagement with each other.

887,868. Trolley-wire Supporting Device for Bascule Bridges. Joseph B. Strauss, Chicago, Ill. Application filed January 28, 1907.

A bascule bridge comprises a main span, two trolley-wire supports, one connected with the main span and the other separate therefrom, and a removable trolley-wire section spanning the space between the supports.

887,871. Electric Heater. Clarence L. Taylor, Alliance, Ohio. Application filed August 24, 1907.

The heating element for an electric flat-iron has three superimposed plates insulated from each other, a flat resistance coil being disposed in an opening in the intermediate plate.

887,877. Insulator. Henry Trumbull, Plainville, Conn., assignor to the Trumbull Electric Manufacturing Company, Plainville, Conn. Application filed March 2, 1907.

An insulator for wall openings has a screw-threaded tubular sleeve for insertion in the opening and a tubular insulator projecting therethrough.

887,887. Party-line Telephone System. Thomas L. Willson, Ottawa, Ontario, Canada. Application filed May 28, 1907.

In combination with a number of telephones connected in multiple is an auxiliary independent signaling circuit, a number of pairs of leads extending from opposite sides of this circuit to the respective telephones, and means operated by the use of any one telephone for connecting the pair of leads corresponding thereto.

887,896. Tie-wire Clamp. George Wrigley, Greenville, S. C. Application filed June 21, 1907.

Two strips each with two legs are arranged to fasten on either side of a pair of strips fitting over the wire.

887,907. Switch Base. William R. Atkinson, New York, N. Y. Application filed August 16, 1906.

[illegible]

counterbalancing device and controlling the magnetic cut-off device.

887,916. [illegible] Domingo C. Cañizares, Paris, France. Application filed June [illegible].

[illegible]

887,923. [illegible] Crandall, Dolgeville, Cal. Application filed June 28, 1907.

[illegible]

887,930. Means for Attaching Line Wires to Insulators. Chester J. [illegible], Beaver River, N. Y. Application filed December [illegible], 1906.

[illegible] at the other end of the latter in which the lever is fulcrumed.

887,932. Electric-railway System. Samuel C. [illegible] York, Pa. Application filed November 28, 1906.

[illegible] branches at each turnout. There are two normally dead conductor sections at each turnout extending between the respective branches and circuit-closing devices connecting these dead sections into the circuit.

887,943. Incandescent Electric Lamp. Marshall D. Jones, Davenport, Iowa, assignor of one-fourth to Louis H. Smith, Davenport, Iowa. Application filed April 30, 1907.

This lamp has an invert, frusto-conical base with the central portion formed with a re-entering frusto-cone, and provided with a reflecting surface.

887,947. Electrically Heated Sad-iron. Frank Kuhn, Detroit, Mich. Application filed September 14, 1907.

The iron comprises a base section and a removable hood section, a heating element secured to the base within the hood and a terminal permanently attached to the heating element and projecting outward through an aperture in the hood.

887,949. Thermostat. Christian J. Letzing, Boston, Mass. Application filed February 28, 1907.

Two terminals are located in substantially the same horizontal line, one carrying a fusible washer adapted when fused to cause the closing of the circuit between the terminals.

887,965. Electric Gas Lighter. Raymond A. Rockwood, Monrovia, Cal., assignor of one-half to Charles T. Stewart, Monrovia, Cal. Application filed April 10, 1907.

A pivoted oscillating valve-stopper is adapted to control the flow of gas to a burner. A pivoted arm is adapted to be moved longitudinally by an electromagnet to operate the valve stopper.

887,980. Electrically Controlled Switch-operating Mechanism for Railways. Karel W. G. J. Stoffels and Johannes J. H. W. Weenen, Amsterdam, Netherlands, assignors to Naamlooze Vennootschap Internationale Electriciteit Maatschappij, Amsterdam, Netherlands. Application filed January 23, 1907.

The mechanism consists of solenoids fixed in the ground and controlling the switch with their cores, of a relay for making and breaking the circuit for the coils and of a contact device suspended to the overhead trolley wire.

887,996. Combined Insulator and Lamp Hanger. James M. Burge, Decatur, Ill. Application filed October 5, 1906.

[illegible]

888,070. [illegible] and [illegible], said Hinkson assignor to said Frye. Application filed October [illegible], 1907.

[illegible] ripened cream, subjecting the same to an electrolytic [illegible].

888,093. Electroplating Apparatus. [illegible] Newark, N. J., assignor to the Hanson & Van Winkle Company. Application filed December 15, 1905.

A [illegible] adapted to be slipped into the container is provided with [illegible] container.

888,096. Cable Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed May 1, 1907.

In combination with a cable having great distributed capacity is a condenser included therein, and a shunt circuit including a condenser and a polarized receiving instrument serially connected.

888,098. Automatic Phototelegraph. Arthur Korn, Munich, Germany. Application filed May 2, 1907.

The system makes use of two selenium cells connected in series with the main battery so as to influence the line current in accordance with light rays.

888,099. Third-rail Electric-railway System. Charles Kozesnik, New York, N. Y. Application filed October 30, 1906.

A hollow third rail consists of top and bottom portions provided with laterally directed side flanges separated by insulating material, the flanges and insulation being interlocked by a dove-tail construction.

888,111. Pleasure Railway. John F. Morrissey, New York, N. Y. Application filed February 15, 1908.

Below the structure is a series of gongs that are operated by strikers electromagnetically controlled by the movement of passenger-carrying sled.

888,151. Electric Water Heater. Oscar H. Fiddes and Herman A. Seifke, San Francisco, Cal. Application filed December 18, 1907.

A water-heating tube has a coil of resistance wire around the same, a vessel above the tube, and communicating with its bottom, and an electric lamp in the vessel, in multiple with the heating coil.

888,153. System for Selecting One of Several Receivers Connected to a Common Conductor. Adolf Franke, Halensee, near Berlin, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. Application filed December 23, 1907.

A selective signaling system is described which is dependent on the length and character of the current impulses.

888,154. Insulator. Howard Friend, Lexington, Okla., assignor of one-half to Walter J. Stevens, Lexington, Okla. Application filed October 7, 1907.

The insulator is a two-part tubular sleeve fitting over the wire and into a metallic holding clamp which is secured to the pin.

888,157. Electric Awning Operator. Egisto U. Viovannoni, New York, N. Y. Application filed November 23, 1906.

A motor raises and lowers the awning through a set of worm gears.

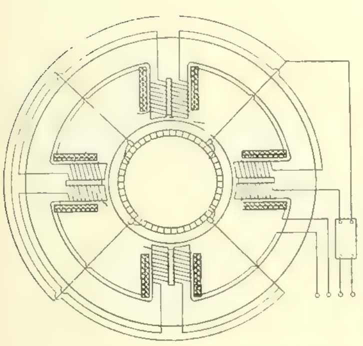
888,191. Oscillation Receiver. Greenleaf W. Pickard, Amesbury, Mass. Original application filed March 9, 1907. Divided and this application filed November 9, 1907.

This oscillation receiver for wireless telegraphy consists of two electrical conductors, one of which is of brass and the other of which is a mass of silicon having a polished surface.

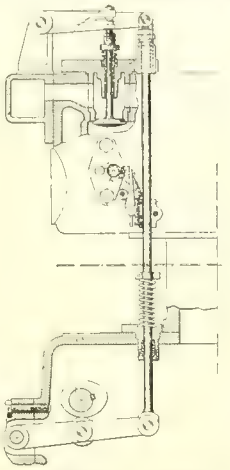
888,195. Timer. Walter W. Robinson, West New York, N. J., assignor to the Witherbee Igniter Company. Application filed August 24, 1907.

Contacts are carried by a hollow casting and a rotatable member located therein carries a spring-actuated roller. A loose ring having smooth inner and outer faces is located between the roller and the wall of the hollow casing.

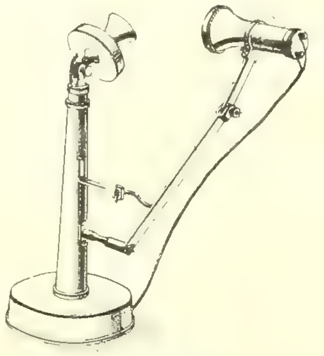
888,196. Igniter Mechanism for Internal-combustion Engines. Edwin Ruud, Pittsburg, Pa., and Conrad Regenbogen, Manchester, England, as-



NO. 888,050.—SPLIT-POLE WINDING.



NO. 888,196.—IGNITER MECHANISM.



NO. 888,211.—TELEPHONE-RECEIVER SUPPORT.

[illegible] Machine Company. Application filed May 18, 1904.

[illegible] rod is a lost-motion connection between them whereby the rod is capable of further motion after the valve is closed. A pivoted bar is carried by the rod for moving the trip rod so as to permit the igniter terminals to contact. (See cut on preceding page.)

888,211. Telephone Instrument. Minor Waters, New Albany, Ind. Application filed July 12, 1907.

[illegible] toward and from the [illegible] operated by the [illegible] (See cut on preceding page.)

888,223. Trolley Pole. George W. [illegible], Louisville, Ky. Application filed November 7, 1907.

[illegible] adjustably [illegible] the means to hold the trolley pole in selected [illegible] positions.

888,235. Lightning Arrester. Edward S. Halsey, Palmetto, Fla., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 10, 1904.

In a chamber with a number of electrodes is an expansible liquid initially contacting with the electrodes. There are means for conducting current to ground through the liquid, and means for causing a violent expansion of the liquid toward one of the electrodes and for limiting the expansion in other directions.

888,241. Protective Device. Karl Kuhlmann, Berlin, Pankow, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed November 20, 1906.

The device comprises a spark gap formed between electrodes and means for adjusting [illegible] the electrodes to repulsive electrostatic forces to decrease the length of the spark gap and relieve the conductor of excess potential.

888,254. Safety Attachment for Linemen's Climbers. John D. O'Connell, Utica, N. Y. Application filed August 17, 1907.

An attachment to a lineman's pole climber consists of a segmental metal strap having its ends fitted for rigid contact with the climber bar and stirrup of the pole climber, and a gaff carried by the strap.

888,260. Apparatus for the Manufacture of Collodion Filaments. Victor Planchon, Lyon, France. Application filed January 23, 1907.

There is a discharge nozzle through which a filament is passed and a rotatable receptacle below the conduit and adapted to contain a coagulating substance, the filament descending into the vessel at a distance from the center of rotation thereof.

888,275. Electric Condenser. Matthew O. Troy, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1902. Renewed November 11, 1907.

This condenser is built up of sheets of conducting material separated by juxtaposed sheets of paper, one sheet of paper being varnished and the other sheet coated or impregnated with paraffine.

888,277. Electric Heater. Hjalmar Wahlquist, Philadelphia, Pa. Application filed December 12, 1907.

In combination with a vessel is an electric heater provided with a bead for engaging a portion of the vessel so as to support the heater.

888,285. Electric Lock. Solomon W. Wibel, Nathan J. McAloney and William R. Cunningham, Denver, Colo. Application filed January 29, 1906.

The locking device has an armature adapted to be acted on by the energized magnet to operate the lock.

888,318. Third-rail Insulator. Lucien H. Dellove, Paris, France, assignor to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny et Cirey, Paris, France. Application filed October 5, 1905.

An insulating block having a depending base and sloping [illegible] walls at its upper part is provided with gripping plates adapted to bear against the rail and the walls of the block, and with means for drawing the plates toward one another. The block simply rests on a recessed support so as to have free lateral movement.

888,335. Printing Telegraph. Charles L. Krum, Chicago, Ill. Application filed August 22, 1903.

[illegible] the paper to be printed [illegible] comprising a pivoted shifter-bar connected with the carriage, armatures attached to opposite sides of the shifter bar, electromagnets arranged opposite the armatures and electric selective apparatus controlling the magnets.

888,3[illegible]. [illegible] Valve. George Macloskie, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July [illegible], 1906.

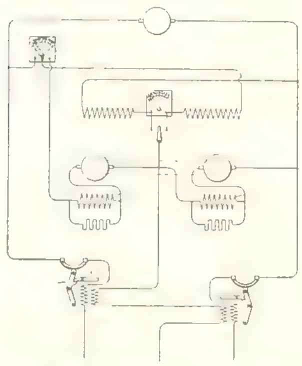
[illegible]

888,[illegible]. [illegible] George M. [illegible] assignor to the General Electric Company, Schenectady, N. Y. Application filed [illegible]

[illegible]

888,3[illegible]. [illegible]

[illegible]



NO. 888,392.—BALANCER SET.

similar series of vanes of different appearance, each of the second series being relatively movable in a circumferential direction between two vanes of the first series.

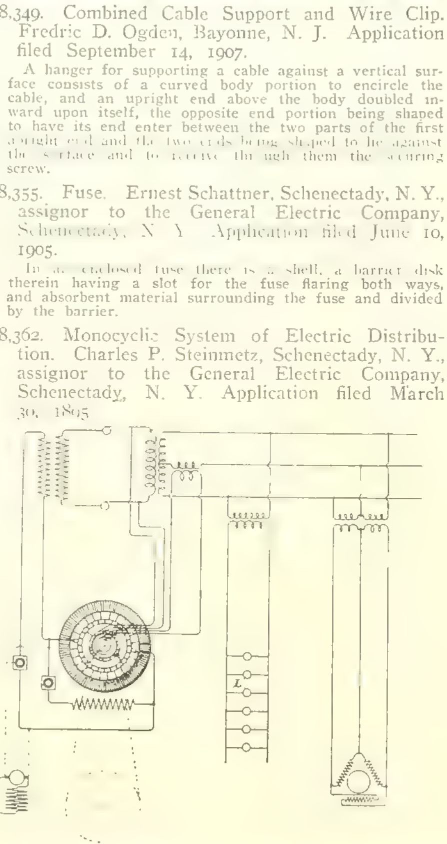
888,349. Combined Cable Support and Wire Clip. Fredric D. Ogden, Bayonne, N. J. Application filed September 14, 1907.

A hanger for supporting a cable against a vertical surface consists of a curved body portion to encircle the cable, and an upright end above the body doubled inward upon itself, the opposite end portion being shaped to have its end enter between the two parts of the first upright end and the two ends being shaped to lie against the surface and to receive through them the securing screw.

888,355. Fuse. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 10, 1905.

In an inclosed fuse there is a shell, a barrier disk therein having a slot for the fuse flaring both ways, and absorbent material surrounding the fuse and divided by the barrier.

888,362. Monocyclic System of Electric Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 30, 1895.



NO. 888,362.—MONOCYCLIC DISTRIBUTING SYSTEM.

In combination with a main single-phase alternator and mains supplied thereby is a third main in electrical connection with these mains, and a motor generator run from the single-phase machine and adapted to supply alternating current to third main and direct current to the field of the generator. (See cut.)

888,371. Dynamometer. John B. Webb, Glenridge, N. J. Application filed March 27, 1907.

This dynamometer has a rotating and twisting shaft and means in operative relation thereto to generate alternating currents having a phase difference dependent on the twist of the shaft. There are instruments for indicating and recording this phase difference.

888,376. Extensible Chandelier. Walter I. Wilson, Los Angeles, Cal. Application filed March 1, 1907.

The distributer connection has an annular upper portion for the attachment of telescoping tubes and openings with threaded orifices communicating therewith for the attachment of electric light arms, and other threaded orifices which pass clear through the wall of the distributer for the attachment of gas arms.

888,378. Adapter for Incandescent-lamp Sockets. Montraville M. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 15, 1904.

This adapter has a side contact electrically connected with shell contacts at both ends thereof, and a longitudinal [illegible] contact.

888,381. Electric Heating Device. William S. Andrews and [illegible] J. Munger, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed September 18, 1907.

An electric heater is provided with a thermostatic [illegible] series with the switch and in thermal relation with the [illegible]

888,382. Sliding Current Collector. Albert H. Armstrong, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. [illegible]

[illegible]

888,389. Electrically Operated Track Switch. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 7, 1906.

The switch point is shifted by a pair of electromagnets governed by a pair of controlling magnets that are responsive to different current strengths.

888,392. Balancer Set. Richard W. Douglass, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.

Compensating machines are connected across the mains and to a neutral conductor, there being a shunt field for each machine and a resistance device and means for including the resistance device in either shunt field circuit. (See cut.)

888,407. Primary Battery. Charles B. Schoenmehl, Waterbury, Conn. Application filed July 21, 1906.

In combination with a cover is a compressed oxide of copper cylinder supported therefrom, a zinc encircling this oxide element and adjacent thereto, and a cylindrical perforated insulating separator with an inwardly projecting supporting flange adapted to bear against the oxide element.

888,416. Controlling Device for Cars. Theodore Bodde, Westfield, N. J. Application filed March 18, 1907.

A permanent magnet on the train releases a safety device associated with it when it passes over an energized track magnet.

888,417. Automatic Controlling Device for Cars. Theodore Bodde, Westfield, N. J. Application filed July 10, 1907.

This is a modification of the preceding patent.

888,418. Trolley Catcher. Willis C. Burdon, Louisville, Ky., assignor of 49 one-hundredths to C. H. Jenkins and Thomas W. Moran, Louisville, Ky. Application filed September 21, 1906.

The device has a casing with an upper cylindrical portion provided with ratchet teeth and a lower well extension for movement of a weight.

888,427. Telephone System. Carl W. Sharer, Philadelphia, Pa., assignor to the Keystone Telephone Company, Philadelphia, Pa. Application filed June 13, 1906.

In a telephone trunking system, in combination with trunk and ringing signals, is a supervisory signal in the trunk circuit controlled by the hook contacts of the called subscriber's instrument.

888,432. Dielectric Separator. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. Original application filed September 24, 1904. Divided and this application filed September 3, 1907.

An electrostatic separator is provided with means for producing a continuous convective current from one electrode to the other and means for feeding comminuted material between the electrodes and through the current, and with means for separately collecting the separated particles.

888,435. Oscillating Fan Motor. Erastus W. Willard, Joliet, Ill., administrator of Harold R. Wellman, deceased. Application filed March 30, 1906.

An oscillatory motor-driven fan has a pair of vanes pivotally mounted on opposite sides of the axis of rotation and disposed in planes at right angles to each other, the vanes being adapted to alternately present their faces and edges to the current of air from the fan.

888,447. Controlling Means for Electric Motors. Harry W. Leonard, Bronxville, N. Y. Original application filed January 28, 1902. Divided and this application filed July 12, 1905.

Automatic means are provided for reversing the rotation of the motor while maintaining the connections of the motor armature circuit unchanged.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 26, 1908:

452,771. Police-signaling Apparatus. H. A. Chase, Boston, Mass.
452,780. Incandescent Electric Lamp. I. J. Flagg, Clinton, Mass.
452,795. Electric Motor. C. J. Kintner, New York, N. Y.
452,872. Automatic Safety Electric System for Railways. E. Deming, Brooklyn, N. Y.
452,873. Automatic Electric Safety System for Railway Switches and Draw-bridges. E. Deming, Brooklyn, N. Y.
452,874. Automatic Electric Safety System for Railway Crossings. Edward Deming, Brooklyn, N. Y.
452,913. Sextuplex Telegraph. T. A. Edison, Menlo Park, N. J.
452,920. Electric Railway. R. M. Hunter, Philadelphia, Pa.
452,931 and 452,932. Electromechanical Gong. F. W. Cole, Newton, Mass.
452,934 and 452,935. Electric Motor or Generator. W. K. Freeman, Brooklyn, N. Y.
452,936. Electric Meter. W. K. Freeman, Brooklyn, N. Y.
452,937. Electric Switch. W. K. Freeman, Brooklyn, N. Y.
452,9[illegible]. Electric Transmitting Clock. H. S. Prentiss, Elizabeth, N. J.
452,9[illegible]. Synchronizer for Electric Clocks. H. S. Prentiss, Elizabeth, N. J.
452,[illegible]. Electric Motor for Wheeled Vehicles. R. S. Dobbie, Jersey City, N. J.
[illegible]. Electric Connection for Distributing Telephone Lines. Wm. M. Goodridge, Highland Park, Ill.
[illegible]. Multiple Cutout for Electric Distributing Systems. J. P. Warren, Chicago, Ill.
[illegible]. Electric Motor. F. Baker, Malden, Mass.
[illegible]. Automatic Electric Switch Mechanism. H. H. Blades, Detroit, Mich.
[illegible]. Electrical Safety Switch. Geo. I. Hill, Lowell, Mass.
[illegible]. Electric Railway Signal. W. C. Walker, Richmond, Va.
[illegible]. [illegible] Recording Metal [illegible] J. [illegible] Rice, Boston, Mass.
[illegible]. Electric Locomotive or Street-car Motor. R. Eickemeyer, Yonkers, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLII. [illegible]

The San Francisco Illuminations.

The electrical illuminations witnessed in San Francisco during the [illegible] from May 7th to 18th, were [illegible] spect. The huge "W[illegible]" [illegible] Telegraph Hill was [illegible] lamps with letters each 10 feet in height, and was visible many miles. It was donated to the Fleet Entertainment Fund by [illegible] Electric Company.

Very large numbers of lamps, sockets, receptacles, etc., were used for decorations. Stocks in these lines were practically exhausted, and dealers in other Coast cities had to send East for sockets for their own fleet illuminations.

[illegible]

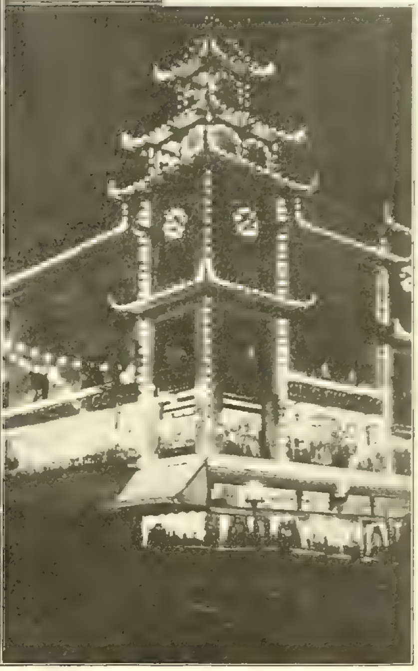
[illegible] descent lights, while lying [illegible] the 27 [illegible] harbor [illegible]

The tall tower of the Union Ferry Depot was outlined in incandescent lamps, and the dome was completely covered with lights. On the side of the tower fronting Market

The Atlantic and Pacific Fleets Outlined in Electric Lights on May 7th in the Harbor. Twenty-seven Warships Were Illuminated.

Decorative Lighting in the Chinese Quarter, Dupont Street.

Union Ferry Depot. About 3,500 Lamps Were Used on this Exterior.



Decorative Lighting in the Chinese Quarter at Dupont and California Streets

THE SAN FRANCISCO ILLUMINATIONS.

Street was an immense shield with the national colors in electric lights, while underneath it, on the front of the building, were six smaller shields. Two strings of incandescent lamps extended from the tower across East Street connecting with the double row of similar electric lights which extended two miles up Market Street, forming graceful arches of light.

The great nave of the Ferry Depot was illuminated with thousands of red, white and blue incandescent lights. The electrical department of the Hendy Machine Works did the wiring for the special lighting of Market Street and the San Francisco Gas and Electric Company furnished the current.

In order to supply the large quantity of additional current required for the public and private illuminations, all of the electric power plants in the city were run up to their greatest overload capacity. All three of the big 3,000-horsepower gas-engine generating units at Martin Station were in operation at once, and more current than usual was taken from the long distance transmission lines facades were outlined in red and white lights. The arcades of the first story were entirely covered with lights. Twenty feet above the roof of the 12-story building waved an "electric flag" measuring 15 by 40 feet. The waving effect was produced by the usual flasher arrangement. On account of its large size, the flag could be seen at a great distance.

Fourteen pointed arches of iron, each covered with several hundred incandescent lamps, spanned Fillmore Street at the street intersections, and strings of lights extended across the street at short intervals. The upper part of the shattered City Hall dome was again illuminated as a reminiscence of former years.

The illumination of the new Chinese Quarter on Dupont Street was one of the most striking features. Several of the fine stores in the new Chinatown have towers or cupolas in the shape of pagodas. These, as well as the principal lines of the buildings, were completely outlined in incandescent lamps and covered with flags. Arches of glow lamps were also strung across Dupont Street could furnish the proper anchorage and unobstructed views for such a grand night spectacle as was seen on San Francisco Bay from the commanding hills of the city.

Telegraphs in China.

At the end of 1906 the Imperial Chinese Telegraphs had a system of 22,419 miles of lines, with 34,473 miles of wires and a submarine cable of 946 miles, and 379 offices. The staff of the head office in Shanghai numbered 67 and the general staff 3,175, while inspectors, linemen, etc., totaled 2,400. In addition, there are many provincial lines, usually constructed by the administration, but worked and managed independently by the provincial authorities. The telegraph companies having connections with China are the Great Northern, Eastern Extension, German, Dutch and Commercial Pacific, while the French cable connects Touraine with Amoy, a German cable Shanghai with Kiachow and Chefoo, and a third cable, partly Chinese, Chefoo with Port Arthur. China also has frontier connections with Burma, Indo-China and Russian Siberia.

Insulation of High-tension Transmission Lines.[1]

[illegible]

[illegible] porcelain are the [illegible] for the insulation [illegible] as fast [illegible] when the pressure [illegible] volts.

[illegible] is a very important feature, not because it is depended upon for actual insulation, but because it serves to give the porcelain body a surface which will be non-hygroscopic and absolutely smooth, so as not to retain dust or moisture readily. Difficulty was experienced with the early porcelain insulators because of the glaze checking or crazing after being

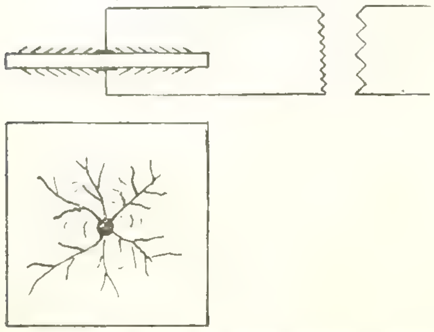


FIG. 1. INSULATION OF HIGH-TENSION TRANSMISSION LINES.

in service a short time, and much trouble was also experienced from pitting, due to the elements attacking the glaze. These troubles have all been overcome, and a good piece of modern porcelain is so glazed that it will stand up for an indefinite period, under the severest weather conditions, without showing the slightest tendency to craze or pit.

White glaze was first used for porcelain insulators, but it was found that these were too attractive as targets for the hunter and the small boy, and a dark brown has now become standard with most users. A limited number of consumers demand an insulator with a slate-colored glaze, asserting that this color is less conspicuous, particularly where the insulators are mounted on galvanized-steel towers. Other colors—red, yellow, blue and green—are sometimes called for by power companies which wish to distinguish the various circuits by the color of the insulators. Such colors, however, being very special, are generally more expensive and harder to obtain with any degree of promptness, hence should not be specified except in extreme cases.

An insulator under heavy load may show brush discharge, which is an indication that while the insulator remains intact, the dielectric surrounding it (the air) has broken down.

The dielectric strength of air plays an important part in the design of an insulator, for it is well known that under ordinary temperatures and pressures, this value is much below that of most solid insulating materials.

With the foregoing facts in mind, let us con-

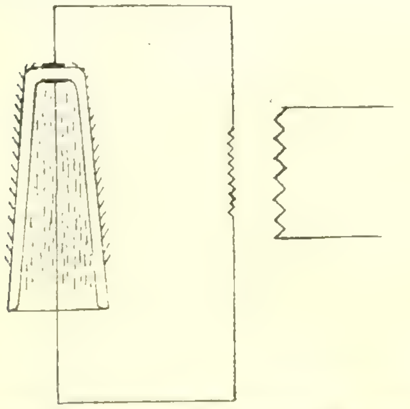


FIG. 2. INSULATION OF HIGH-TENSION TRANSMISSION LINES.

sider the effect of an electrical charge on a few [illegible]

In Fig. 1 is shown a thin plate or disk of insu- [illegible] electro-motive force.

Starting with a low potential, only current to [illegible] potential is raised the air in the vicinity of the [illegible]

[illegible] down the air further from the electrodes. If the voltage is sufficiently increased, this process continues until the streamers unite around the edges, forming a short circuit, or puncture of the plate occurs.

It must be borne in mind that this is not the result of surface leakage, but of breaking down of the film of air next to the insulator.

Once the air has become ruptured, the spreading of the streamers will be affected to a certain degree by the shape and dimensions of the solid dielectric.

In Fig. 2, for instance, if the potential is carried sufficiently high, the air within the chamber breaks down, and the effect is the same as if the chamber were filled with a conducting fluid.

In Fig. 3 appears an insulator head, and under such a test the streamers would start at first the same as in Fig. 1, but upon reaching the downward projection they are forced away from the streamers on the top surface until a point is reached where the electrostatic field is no longer strong enough to break down the air, and the streamers die out and further rupture of the air adjacent to the insulator ceases.

With these points in mind it is a comparatively simple matter to follow out in detail the action of a regular insulator under varying load conditions.

Surface insulation has little to do with insulator performance, and the actual leakage over the insulator will be inappreciable unless the surface is covered with dust or water or some other foreign substance. Under high potentials, the wet surface should be considered as a conductor, while the dry surface should be regarded only in relation to the electrostatic effects described.

Let us now consider the action of an ordinary insulator under varying service conditions. Assume that the one appearing in Fig. 4 is operating at its normal line voltage and that all surfaces are dry and clean. If properly designed for this voltage, the electrostatic field about the different shells will be too weak to break down the air, hence no brush discharge or "static" will be in evidence. Let the potential be increased, and as the electrostatic field becomes more intense the air fails and brush discharge is seen around the different shells near the

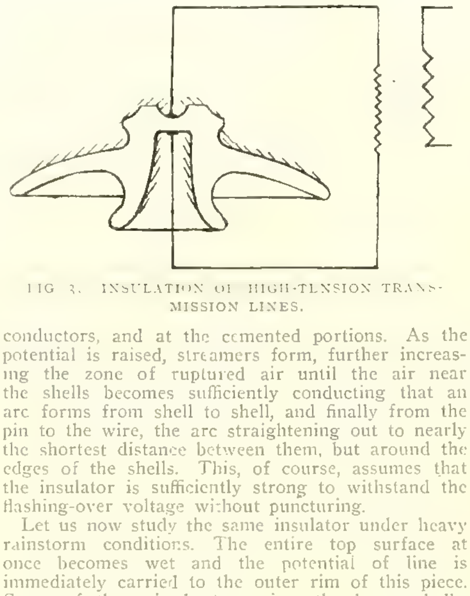


FIG. 3. INSULATION OF HIGH-TENSION TRANSMISSION LINES.

conductors, and at the cemented portions. As the potential is raised, streamers form, further increasing the zone of ruptured air until the air near the shells becomes sufficiently conducting that an arc forms from shell to shell, and finally from the pin to the wire, the arc straightening out to nearly the shortest distance between them, but around the edges of the shells. This, of course, assumes that the insulator is sufficiently strong to withstand the flashing-over voltage without puncturing.

Let us now study the same insulator under heavy rainstorm conditions. The entire top surface at once becomes wet and the potential of line is immediately carried to the outer rim of this piece. Some of the rain beats against the lower shells, wetting them, not only where it strikes, but on the under surface of the upper shells, due to spattering, the amount of surface so acted upon depending upon the force and angularity with which the rain is driven and upon the design of the shells. Under a severe storm it is quite possible for practically all of the insulator surfaces to become wet and conducting except, possibly, the under surface of the center or bottom shell. If the insulator is properly mounted with respect to the cross-arm, and the center shell is correctly formed, this inner surface will remain dry. In the meantime the line potential has followed the wet surfaces of the insulator until it has reached the bottom edge of [illegible] center shell, so that the full line potential is now being carried by the [illegible] shell alone.

The insulator can now fail in either of two ways: [illegible] rupture of the air film adjacent to the inner surface, because of the intense electrostatic field, resulting in an arc from the shell to the pin, [illegible] puncture of the shell itself.

[illegible]

[illegible]

is maximum at the neck of the smallest shell, for here the current density is highest, and therefore the heating effect is greatest.

From the foregoing it is evident that the behavior of an insulator under severe weather conditions is of chief concern, and its ability to maintain dry surface under the most trying conditions is a direct measure of its value as an insulator.

The contour of the different pieces has much to do with the wetting of the shells in a storm. The shape of a shell may be such as to deflect the

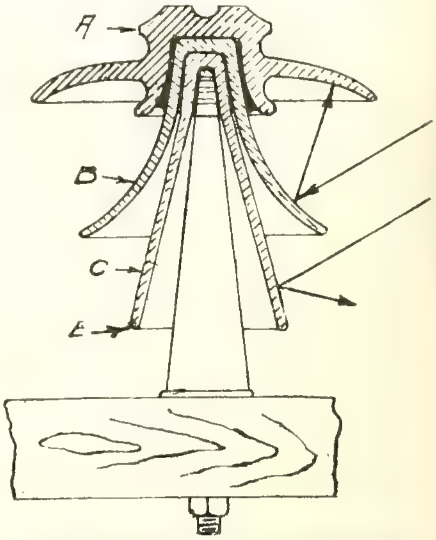


FIG. 4. INSULATION OF HIGH-TENSION TRANSMISSION LINES.

air currents, thereby carrying the rain up into recesses which would otherwise be dry. The flare of the skirt portion of the shells also plays an important part.

Referring to Fig. 4, the second shell (B) is flared or curved outward at the bottom, and in a driving rain the drops will be deflected against the under side of the top portion, as shown by the arrows, because of the curved surface. The third shell (C), however, is straight, and, as the arrows indicate, the raindrops are deflected downward, so that the shell above is not spattered.

Another advantage possessed by the curved shell is that for a given potential difference between the surface of the shell and the rim of the shell above, the tendency for discharge between these two points will be considerably lower than with the straight type of shell. It is well known that discharge between a point and a plane surface will take place at a lower potential difference than would be required to cause a discharge from such a point to the concave side of a spherical surface, all points on which are equally distant from the point forming the other electrode. In the case of an insulator (Fig. 5) the rim of any shell corresponds to the point, and the curved shell below to the spherical surface. In many designs the flare of the skirt is determined by a radius swung about the rim of the shell above as a center (Fig. 5),

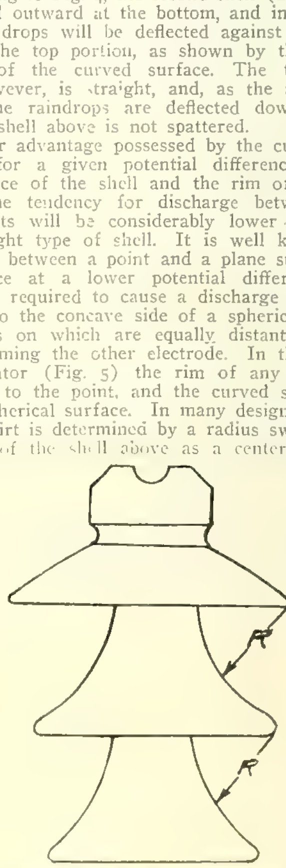


FIG. 5. INSULATION OF HIGH-TENSION TRANSMISSION LINES.

the curve beginning at the theoretical dry line, based upon the assumption that the rain falls at a 30-degree angle with the horizontal.

In drawing the specifications for insulators, points often come up which make a proposition unnecessarily difficult and expensive for both the purchaser and the manufacturer, and this condition could often be prevented if the manufacturer were given a full understanding of the actual requirements, and not hampered by more or less foolish specifications which the engineer, when he drew them up, knew could not be met.

The following suggestions to aid in drawing insulator specifications are being offered with an idea of making them cover all general insulator requirements. These specifications are made so that they [illegible]

[illegible]

[illegible] surfaces should be carefully dried and a second weighing made. The increase in weight expressed as a percentage of the original weight will give the absorption.

[illegible] and those upon which the insulator rests in burning not to be glazed. The pinhole should be left unglazed if the insulator is to be cemented to an iron pin.

All cemented joints should be carefully made with neat Portland cement of the best quality, and the assembly should be so done as to leave no hollow spaces or voids between the cemented surfaces. In assembling the cement should be mixed only as needed and in the proportions of 80 per cent cement and 20 per cent. water, and no cement which has been mixed for more than 30 minutes should be used. The assembling should be so done as to bring all of the various parts in correct alignment.

All parts should be carefully inspected as they come from the kilns, and any which are chipped or cracked, particularly at the surface where the cells are cemented together, should be discarded. Badly warped or distorted pieces and those having checks of appreciable depth at any points on the surface should be rejected.

All parts should be tested for one minute at full-line potential, except in cases where the design of the piece will not permit reaching this voltage without flashing over. In such cases the test voltage should be within 5,000 volts of the flash-over value.

Each assembled insulator should be tested to at least double the full-line voltage for a period of not less than three minutes.

The insulator should be capable of withstanding a rain test at twice the operating voltage for a period of 10 minutes without flashing over or injury to the insulator, the precipitation being at the rate of $1\frac{1}{4}$ inches in five minutes and directed against the insulator in a fine spray at 45 degrees.

All insulators to be operated at 23,000 volts or more should be tested with at least one kilowatt of available generator capacity for each insulator under test.

In the part tests each piece should be immersed in water to completely cover the cementing surface, and the inside should be filled with water to practically the same depth, and the potential should be applied to the two wet surfaces. In testing assembled insulators they should be inverted with the heads immersed to the tie-wire groove, the pinhole being filled with water to the full depth of the thread.

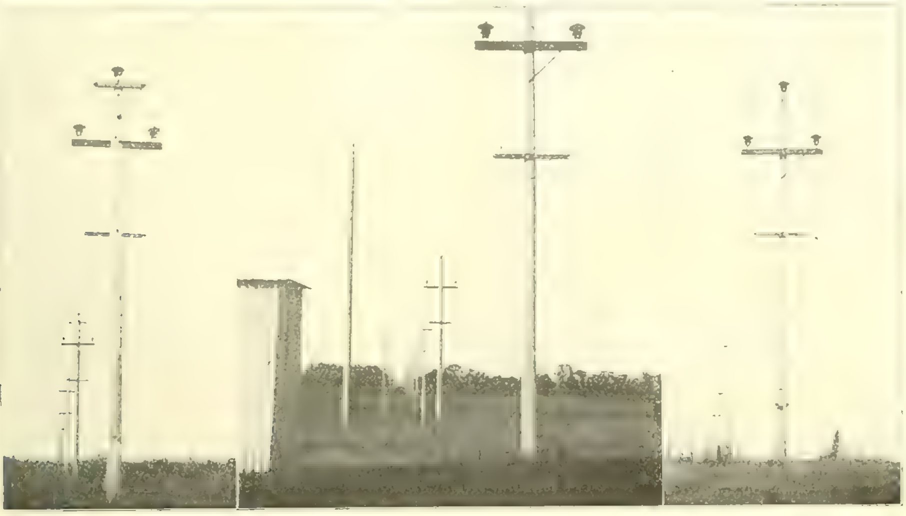
The Mexico City Motor Car and Omnibus Company has established a regular service of electric omnibuses and electric cabs in Mexico City. The omnibus lines reach to points not reached by the electric-railway lines, and the electric cabs do a general passenger business.

Lightning Protection Discussed in the Light of Practical Experience.

[illegible] American Institute of Electrical Engineers in New [illegible] value to engineers dealing with problems in light[illegible] parative Tests of Lightning Protection Devices on the Taylor's Falls Transmission System," by J. E. [illegible]

Mr. Vaughan said that on account of the wide divergence of opinion on the subject of lightning protection and the impossibility of reconciling the conflicting results of practice, it was decided to try out on the Taylor's Falls system all existing devices of promise and such others as might be devised in order by comparing them in actual service to work out some effective scheme for future protection.

The line runs 40 miles from Taylor's Falls to Minneapolis. Near its center was found a zone of some nine miles that was especially subject to severe lightning, and the splintering of six poles in different parts of this zone before any wire was strung suggested the necessity for special protection at exposed points against direct stroke. Three No. 0000 copper cables were supported on 14-inch four-part porcelain insulators arranged on a six-foot equilateral triangle with the apex at the pole-top. The line voltage is 50,000. At the sub-station on the outskirts of Minneapolis the voltage is stepped down to 13,800. For protection of the power house and sub-station low-equivalent multi-gap arresters and oil-insulated choke-coils were installed, supplemented at the sub-station by a set of experimental aluminum-cell-type arresters connected to the entering line through a small number of arrester gaps in zigzag arrangement, set so as to be normally active. The transformers at all stations were further protected on their low-tension sides by static discharge gaps.



Overhead Grounded Wire, Type B. Lightning Rod, Type B Lightning Rod, Type A

FIG. 1. LIGHTNING PROTECTION ON TAYLOR'S FALLS LINE.

For line protection three kinds of horn-type arresters were installed, one at each end and one in the middle of the line, primarily to pass off disturbances of unusual magnitude, and also to experiment with the different forms.

The sub-station arrester consisted of a single gap on each phase, arranged with a sheaf of water jets forming series resistance to ground. This required too much water and was replaced by tanks of water with terminals of carbon rods in fiber tubes.

The power-house arrester had two gaps in series between each phase and ground, with the second gap shunted by carbon terminals placed in the river.

The arrester at the middle of the line was built on the selective resistance principle, with three gaps in series on each leg, the second and third gaps being shunted by water-box resistances.

Four types of overhead grounded wires were erected in the nine-mile zone in one-half-mile lengths, alternating with one-half-mile lengths of unprotected line as follows: Type A, two wires mounted on a cross-arm five feet apart on either side of the top line wire and about 18 inches below it. Type B, two wires supported on standards of $1\frac{1}{4}$-inch iron pipe six feet apart and 18 inches above the top line wire (Fig. 1). Type C, one wire on knobs attached to the pole near the center of the delta. Type D, two wires in the same position as in type B, but supported on pipe pins set in the ends of a cross-arm attached near the top of the pole.

In the above constructions the grounded wires [illegible] ground and to increase the discharge area.

[illegible] were provided with tell-tale papers. To determine the character of disturbances, their extent, magnitude and effect on line and apparatus, ground connections of all protective devices were provided with gaps for the insertion of tell-tale papers. To study the stresses on the line insulation thoughout its length and the behavior of the insulators, each insulator pin at every third pole was grounded through a separate ground wire and tell-tale box supplemented by choke-coils shunted with tell-tale gaps cut into the line wires at various points.

After a number of insulators on grounded pin-had been damaged the pin grounds were removed from four sections of about one mile long each, separated by one-mile sections left grounded to prove whether the grounding was in any way responsible for insulator failures.

Full records were kept of the weather conditions, and particularly of storm data supplied by reports of the United States Weather Bureau and of local observers. Operating and special reports of interruptions to service and damage to system were obtained and the tell-tale papers collected after each storm. These papers were graphically analyzed and are treated of at length in Mr. Vaughan's paper.

The transmission system was started up in December, 1906, and lightning protection records were carried through the following summer. The lightning season opened late in March and lasted into October. Thirty-two storms occurred during this season within reach of the line.

The records show that in 17 out of the 32 storms the service was interrupted and eight of these storms caused damage to insulators, while only one storm affected the station apparatus; this was due probably to a defect in a transformer bushing, but was not sufficient to interrupt the service. Of the 5,500 insulators on the line 42 were damaged. Of these only three were punctured, the rest being shattered. Over one-half the insulators damaged were located at the tops of the poles and about two-thirds were in more or less exposed heights. Thirty-five insulators on grounded pins were damaged and only seven on ungrounded pins. Under overhead grounded wires two insulators near the ends of the line suffered damage. Under lightning rods on the line poles three insulators were damaged, and under lightning rods on separate poles none. One pole was split and two were burned. One very violent storm did the largest damage, 10 insulators being shattered, a pole split and the line completely short-circuited.

A careful analysis of the charts and records shows among other things that points where the line was especially liable to damage are, first, exposed heights, and next, wet bottom lands. Damage was usually concentrated within a distance of a mile or two, with the exception of a few storms which crossed the line at a small angle or traveled along it for some distance. Where grounded and ungrounded pins come on adjacent poles, damage to the insulators generally occurred at the grounded pin, but the damage of a group of insulators on a section of line where all grounds had been removed indicates that grounding the pins probably did not materially increase the danger of damage. Overhead grounded-wire construction materially protects insulators. The lightning rods do not seem to have much effect except in cases of direct stroke.

Further conclusions are: Storms follow no well-defined paths, nor are their effects confined to any particular part of the line. Stresses do not occur at any definite points. In general, the protected nine-mile zone showed an appreciable decrease of insulator stress and activity of devices for distant storms and a very decided shielding effect of overhead grounded wires as well.

The principal trouble is from temporary or permanent breakdown of line insulation by static charges induced in the line by passing storms.

Direct strokes between cloud and ground may occur at any time. Although there were several cases of damage so caused during construction, the first season's operation gives evidence of only one case, and that without damage.

[illegible] concentrated, [illegible] intensity, discharging to ground over insulators with a disruptive effect that tends to shatter, but rarely to puncture them, often without line current following. Line current may or may not follow these discharges; if it follows it may only temporarily ground or short-circuit the line.

Arcs established by insulator spillovers or leakage of charging current through damaged insulators may burn pole structures or further damage insulators and even fuse the line wire. There is no evidence of surges other than the direct effects of grounds or short-circuits, nor is there of stress at any definite points on the line such as from reflected or standing wave.

Overhead grounded wires are of decided value in shielding the line from induced static charges and in preventing insulator breakdowns. A grounded conductor running down the pole is of decided value in preventing splintering of the pole. The selective resistance, multi-gap type of arrester is effective in disposing of ordinary disturbances. The aluminum cell type arrester is in general more sensitive and freer in discharge; it gives great promise for station protection. Horn arresters of the series gap and selective resistance type are fairly sensitive to static discharge as well as to disturbances of lower periodicity, and of special value as emergency devices to relieve the station arresters in case of abnormal discharge. They may be adjusted to be fairly sensitive without interrupting service or necessarily throwing out synchronous apparatus.

The results of these experiments have led to the recommendation that the overhead grounded wire construction (Fig. 2) be immediately extended about 15 miles in sections covering both ends and the more exposed parts of the line; that the use of horn arresters be continued and further adjust-

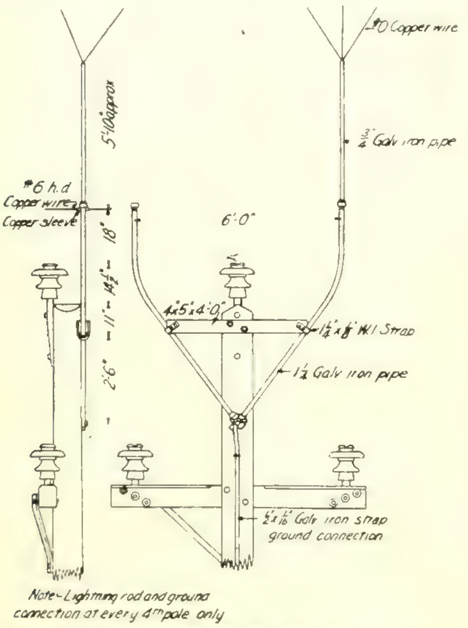


FIG. 2. LIGHTNING PROTECTION ON TAYLOR'S FALLS LINE.

ments studied; that the rest of the station and line protective apparatus be left as it is, and that the system of tell-tale paper and other records be continued during the coming season.

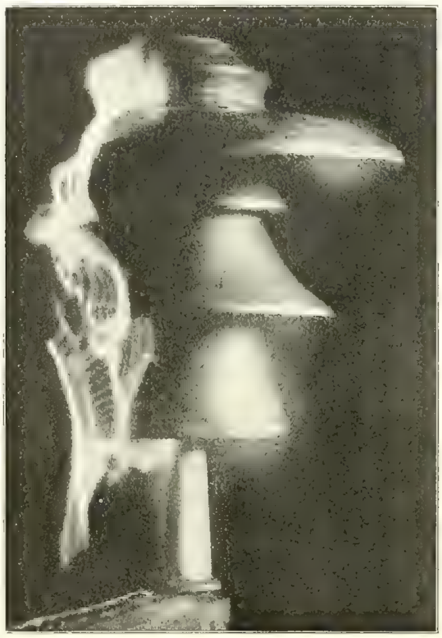
Studies in Lightning Performance

Mr. Neall discussed the general import to high-tension transmission of the data gained in 1907 as to lightning performance on the 50,000-volt Taylor's Falls line of the Minneapolis General Electric Company and on the Presumpscot Electric Company feeders supplying power at 11,000 volts to the Cumberland mills, near Portland, Me.

In the Taylor's Falls situation, line disturbances chiefly are being combated; whereas, in the case of the Cumberland Mills, station disturbances have demanded attention.

Lightning disturbances to a long-distance transmission line may be due to an induced (bound [illegible] or both. The bound charge embodies the well-known principles [illegible] to any insulated body. A modern high-voltage transmis- [illegible] ground at every point; for 60,000-volt service, therefore, it is easily conceivable that, in general, a tremendous [illegible] held there with relatively small leakage. When in [illegible] enormous rush of discharge undoubtedly follows the [illegible]

amplitude depending on the resistance in their path. The tendency of such charges to travel in the transmission line is undoubtedly retarded very much by the skin-effect of the conductors; in fact, at the moment of release of bound charge we may consider that the charge has the choice of dissipating itself in three ways—along the line wires, over the insulators, or both. If the insulation is particularly good the charge endeavors to travel along the conductors. From the data presented by Mr. Vaughan it has been shown that such discharges can be very violent and yet not harm the insulator or produce a short-circuit.



INSULATOR FLASH-OVER UNDER ARTIFICIAL RAIN TEST.

Curiously enough, there is very little trouble reported from lines operating at lower potentials, even at potentials of 30,000 volts. The reason is probably partly this: No line can take a charge much in excess of its maximum insulator arcing-over strength. The result is, therefore, that the higher voltage lines must handle a proportionately larger and higher potential static disturbance.

Judging alone from the data at hand as to its behavior, an overhead grounded wire placed near the line conductors may be considered beneficial. The ideal static protection would be a metallic envelope for the line; but since this is not commercially feasible, it is thought possible to approximate it by supporting several grounded wires above the line. These wires are so placed with reference to the line wires that an imaginary plane extending at an angle of 45 degrees from the wire on either side of the center will just pass over the transmission wire. There are as yet no positive data to show the value of this consideration, but there are data of a definite nature showing the effectiveness of the double-wire overhead grounded-wire protection.

The power of absorption shown by such protection leads to the conviction that if a transmission line were so equipped throughout, very little static disturbance would ever reach the stations; in other words, the overhead grounded wire would not only shield against the line troubles, but reduce consequent station disturbances.

There is evidence to show the value of lightning rods to a transmission line. On a steel-tower construction (solely because of the usually long spans) lightning rods should be placed on each tower; on a wood pole line one of these could be placed at each grounded pole. These rods should perhaps extend four to six feet above the overhead grounded wire and end in spreading tips.

[Continued on page 158.]

Armature Construction for High-speed Direct-current Generators.

The rapidly increasing use of steam turbines is bringing about some changes in generator design due to high speed of operation. In all high-speed rotors it is necessary to provide means for holding in position the portions of the coils which project beyond the core, so that the latter are not displaced or distorted by centrifugal action at high speeds of rotation. It has been proposed to surround these projecting portions of the coils by heavy rings or bands. When rings are employed for this purpose it is necessary to provide some means for supporting and centering the rings and for preventing a movement or displacement thereof axially of the machine.

In rendering direct-current generators suitable for very high speeds, considerable difficulty has been experienced in providing adequate supporting and protecting means for the coils at the commutator end of the armature, for the reason that the commutator necks or leads connecting the coils to the commutator render difficult proper supporting of coil-retaining rings. Accordingly band wires have usually been relied upon for this purpose. The latter expedient is not satisfactory for all types of machines for the reason that at high speeds the band wires are in danger of breaking or becoming loose.

To provide a rigid construction adapted to high speeds of rotation, Bernard A. Behrend has invented a form of armature which was recently patented in behalf of the Allis-Chalmers-Bullock interests. In this armature construction means are provided for securely supporting and retaining in position an end-ring for the ends of the coils which project beyond the commutator end of the core. This end-ring extends inwardly to, or adjacent to, a clamping device or ring for the commutator which supports it in position.

In the two drawings shown herewith this construction is shown in detail. Fig. 1 is a partial elevation of the armature and Fig. 2 a section through the commutator along line (2-2) of the preceding diagram.

On the shaft (10) is mounted the armature core, the laminæ of which are clamped between end-members, only one of which is shown at (13). The shaft is provided with longitudinal grooves or flutes (14) for admitting air to ventilating ducts (15) arranged at intervals between the laminæ. The core carries an armature winding whose end portions (16) project beyond the ends of the core and on the commutator end rest upon a bracket or shoulder (17) integral with the end-member (13). This bracket has an inclined outer surface separated from the coils by insulation (18).

The bars (19) of the commutator are held in position by heavy clamping rings (in this case shrink-rings), two of which are shown at (20) and (20a), respectively, the first being at the end of the commutator adjacent the core. These rings are separated from the commutator bars by suitable insulation (21). The bars are provided with ridges (22) and the ring (20) is provided at one side with a suitable recessed portion adapted to fit over the ridges, so that a movement of the shrink-ring axially away from the core is prevented. The com-

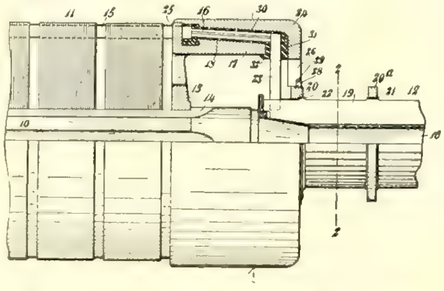


FIG. 1. ARMATURE OF HIGH-SPEED DIRECT-CURRENT GENERATOR.

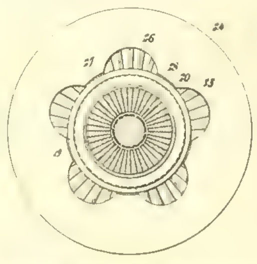


FIG. 2. SECTION THROUGH COMMUTATOR OF HIGH-SPEED DIRECT-CURRENT GENERATOR.

mutator bars are connected to the ends of the coils by radial commutator leads or necks (23).

Surrounding the projecting portions (16) of the coil is a protecting end-ring (24) made preferably of steel. The inner end of the ring engages a recessed portion of the slotted flange (25) of the end-member (13), and the outer portion of the ring extends inwardly over the commutator necks toward the shrink-ring (20). The inwardly extending portion of the ring is preferably provided with ventilating openings (26) forming arms (27). The inner ends of these arms may engage the outer surface of the shrink-ring or there may be a slight clearance between the arms and shrink-ring if desired. As shown, the inner ends of the arms rest

upon the ring [illegible] so that the [illegible], centered.

Shrink ring (26) is threaded [illegible] for a portion of its width, and [illegible] tion is provided with a nut (28) [illegible] notched or [illegible] of the arms of the end ring. The purpose of the nut is to hold the end ring in position and to prevent axial movement [illegible]. Ridges [illegible] commutator bars [illegible] the shrink ring [illegible] being moved along the commutator bars when the nut (28) is tightened.

Other means for preventing movement of the shrink ring (26) can be provided. In [illegible] however, it will be unnecessary to provide any special means, the pressure between the ring and the bars alone being relied upon for the purpose. In the latter case the ring can be placed over the commutator bars from the opposite end of the commutator, and the commutator necks or leads can therefore be riveted to the bars before the latter are assembled.

The end ring is thoroughly insulated from the coils and the commutator necks are likewise separated from the end-ring and bracket by insulation shown at (30), (31) and (32). The entire construction is rigid and comprises but a few simple parts so interlocked as to avoid displacement in any manner due to high rotative speed.

Proposed Subway Construction in Large Cities.

As an appendix to the recent engineering report (Report No. 4) of Mr. Bion J. Arnold to the Public Service Commission of the First District of the State of New York on "The Capacity of the Subway of the Interborough Rapid Transit Company of New York City" the accompanying sectional drawing is given. It shows a typical reservoir station for a future comprehensive subway system for New York city. The crosstown subway passes between the high-level and low-level north-and-south subways. This proposal is of wide interest. Mr. Arnold's comments on the plan are as follows:

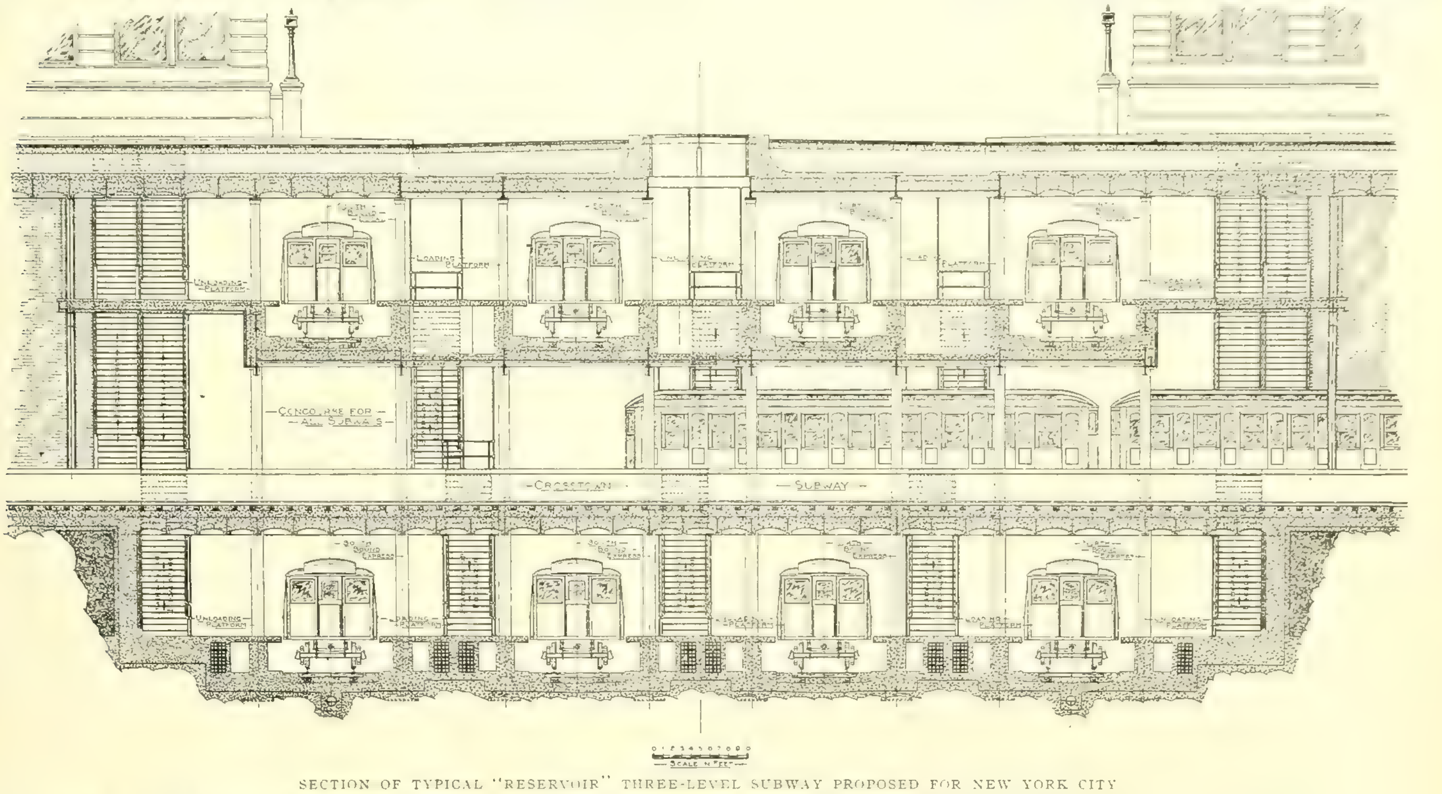
If double tracks are provided at the principal stations of future subways to receive the trains operating over each single line, then much of the delay in handling trains which occurs at the stations in the present subway can be avoided. Under this arrangement, each station will act as a reservoir to equalize and maintain at its maximum the flow of trains between stations, and this will make it possible to operate 60 trains an hour over one line, whereas it is possible to run but 40 trains an hour when the trains remain upon the main line when making station stops.

This idea can best be carried out by not only double-decking the transfer stations, but also, where practicable, double-decking the subway itself—between stations. The express trains should occupy [illegible] be provided with a double set of rails, thus not only providing guard rails, but also avoiding the [illegible] points at each reservoir station turnout.

[illegible] to the trains, should be located a main concourse reached directly by escalators and stairs from the station entrances. For this large common station platform, stairways should lead to separate loading and unloading platforms serving all trains, thus making it possible to use cars with many side doors. During rush hours the number of passengers reaching a loading platform could be controlled by gates at the stairways, and thus this station design provides means of setting up and maintaining a circulation of passengers in and out and to and from the trains which would add much to the comfort of subway travel.

The intermediate level can be taken advantage of to allow crosstown trains to pass directly through the station, as shown by the drawing, thus providing an easy way of transferring from one system to another. Should it ever become necessary to require transfer slips from passengers transferring from crosstown subways to the north and south subways, or vice versa, due either to separate operating companies or to the necessity of making an increased charge for this privilege, this type of station is well adapted for quickly and comfortably handling passengers under such a plan.

The station entrances should be, wherever possible, from the inside of permanent buildings located back of the property line, and not from kiosks, occupying valuable sidewalk space. In most localities the diversion of a stream of passengers through a building, as is now done, for instance, at the Times Square station of the present subway, could be taken advantage of to enhance the commercial value of the property, and this rise in value should be used to reduce the burden of the first cost of the station.



SECTION OF TYPICAL "RESERVOIR" THREE-LEVEL SUBWAY PROPOSED FOR NEW YORK CITY

Many more passengers will be handled each day through many subway stations of this kind than will be accommodated by either the New York Central or the new Pennsylvania New York city terminals, and therefore more importance should be attached to subway-station designs in the future than has been thought advisable in the past.

Recommendations in Mr. Arnold's Report.

(1) The changes required in the present subway to increase its capacity from 30 trains an hour to 40 trains an hour, with a marked increase in its earning capacity, should be carried out; that is, the block-signal system should be improved, a speed-control system developed and the cars altered, all in accordance with recommendations made in previous reports.

(2) The Ninety-sixth Street alterations should include not only the removal of the crossovers, as already approved by the commission, but also the altering of the station itself to provide a local track upon a lower level, allowing the four tracks [illegible] Brooklyn.

(4) The braking of the trains at the station [illegible] the trains.

[illegible] local train during rush hours and the public should be encouraged to use this extra car upon the local trains, which, although not reaching the platforms, could be used for through travel with the idea of adding even more cars to the trains if the public can be educated to take advantage of this increased accommodation.

(6) A series of braking tests showing the distance required to stop a train by means of the emergency stop from full speed should be made in order to secure reliable data for planning the block-signal systems for future subways.

(7) The manufacturers of block-signal systems should [illegible] signal to supplement the present fixed caution signal, as this signal could be installed to advantage not only in the present subway, but in future subways.

(8) If future subways are to be built and operated independently of the present one, the plans should be made with the idea of using multiple side-door cars 18 inches wider than the present cars, thus adding [illegible] 25 per cent to the [illegible] increasing the possible carrying capacity of such subways without proportionately increasing their first cost.

(9) In order that future subways shall not only pay a fair return on their investment but also allow for a satisfactory depreciation reserve, it is essential that such subways be located where there is sufficient density of traffic to justify their being built, and at the same time they should be so designed as to handle the volume of traffic which must be passed through them during rush-hour periods in order to make them self-sustaining.

(10) All future trunk-line subways should be designed with stations on the reservoir principle, that is, with double tracks in each station for each main-line track. This can best be accomplished by not only double-decking the stations, but also double-decking the subways between stations, and by this method secure the carrying capacity necessary to justify the occupancy of the street and at the same time produce a property which will justify its cost. Where a crosstown subway is to be provided for, the stations should be triple-decked. (See drawing.)

Inquiries for copper for the most part are said to be still confined to moderate quantities, but there is a gradual improvement taking place in domestic demand which encourages expectations of better conditions in the latter months of the year. Electrolytic wire bars are quoted at 12½ and 12¾, with Lake product selling at 12¾ and 12⅞ cents.

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...tained from ionium. It is obtained from carnotite, and its activity is about 0.34 of the activity of the uranium with which it is found. It emits an alpha radiation and probably also a beta radiation. Results obtained on the growth of radium in solutions of ionium indicate that it is the immediate substance from which radium is formed. It is, therefore, undoubtedly a disintegration product of uranium intermediate between uranium and radium. The relative activity of radium and ionium in minerals is in agreement with this assumption.

VARIATIONS in the electrical potential of the earth may be determined, it is said, by a new method devised by Mr. M. A. Nodon. The apparatus consists essentially of a very sensitive electrometer which is perfectly insulated and is surrounded by a metallic cage, as in the Faraday ice-pail experiment. The electrometer is charged positively, its charge remaining constant, while the metallic cage surrounding it is connected to earth. The variations in the potential of the earth can thus be determined. During fine weather the potential varies but little, a change of weather being indicated by a variation in the electrical potential of the earth. Heavy storms, cyclones, etc., are foretold by variations that may amount to a hundred volts per minute, or, in case of seismic disturbances, they may reach several hundred volts per second. In this way storms were predicted several hours in advance. Apparatus is now being designed for recording the variations.

WHAT HAS BECOME of Mayor Busse's effort to ascertain what it really costs the city of Chicago to operate its street arc lamps? The mayor started a movement in this direction several weeks ago, but nothing has been heard of it recently. As the mayor says, Chicago has been in the electric-lighting business for twenty years, but because of the defects of municipal bookkeeping—no greater here, probably, than in other American cities—it is impossible to get reliable data as to cost of production or value of plant. What is wanted now is such an accounting as a private corporation would have, showing all the factors which enter into cost—the cost of capital, for example, as well as the cost of raw material and labor, the cost of the use of the plant, or, in other words, depreciation, repair, etc., as well as initial cost. An investigation of this kind will probably show that the real cost of each "2,000-candlepower" arc light is in the neighborhood of $100 a year instead of $60 or less, as indicated by the official reports.

THERE HAS BEEN some comment of late in connection with the electrical inspection work of the engineers employed by the National Board of Fire Underwriters. It is asserted that while new installations, which, generally speaking, have but few serious defects, are religiously inspected, old installations are often neglected. Field men of the insurance companies, who have given careful attention to electrical inspections, have stated that the trouble lies largely in the fact that the inspection bureaus have not the funds to pay for inspection of old wiring. In most places the underwriters' inspectors get a fee for the inspection and approval of new wiring, but they cannot, of their own volition, go upon a man's premises and inspect and condemn his wiring and then charge him for their work. Accordingly, the old wiring is left largely to municipal inspectors, many of whom are careless or perhaps incompetent. The question seems to be whether the insurance companies care to add to their expenses by giving the inspection bureaus money enough to carry on the inspection of old wiring properly.

GARAGES are increasing in number so rapidly that insurance men are paying especial attention to their arrangement from the point of view of the fire hazard. What is considered a model ordinance for the construction of automobile stations has been prepared by Chief Electrician A. M. Schoen of the Underwriters' Southeastern Tariff Association. It [illegible] that the ordinance will be adopted [illegible] to place garages under [illegible] regulation to prevent fire. The storage of gasoline entails, of course, a special hazard of its own. Among the electrical features attached to the ordinance is the provision that the artificial lighting shall be incandescent electric, using weatherproof construction, with controlling switch outside of the pump room. All electric dynamos and motors and charging apparatus not actually a part of the automobile shall be located not less than four feet above the floor. All incandescent lamps, switches, fuses, key sockets, etc., shall be permanently located not less than four feet above the floor line, except that portable lamps enclosed in wire guards and with keyless sockets may be used where needed. Arc lamps must be of the enclosed type, equipped with double globe and swung at least ten feet above the floor.

AFTER A WHILE, perhaps, the Illinois Central Railroad Company will heed the demand of the people of Chicago that it substitute electric locomotives or motor cars for steam locomotives on its lines within the limits of the city of Chicago. One of the reasons why it should do so is set forth in a recent editorial in the Chicago Daily Tribune entitled "Decrease the Nuisance." This relates to Grant Park, lying east of the Illinois Central tracks on the downtown Lake Front—"Chicago's front yard." This park, designed by Mr. Frederick Law Olmsted, is still in the making, but when it is completed a few minutes' walk will take one from the roar and bustle and brick-and-mortar of the business district to cool, green, quiet spaces by the waterside. But it will be necessary to cross the Illinois Central tracks. These cannot be removed, perhaps, but the service should be made as little of a nuisance as possible. Says the Tribune:

> "Even before Mr. Olmsted's picture shall have become a beautiful reality, the right-of-way should be smokeless. The steam locomotives should depart for points outside the city limits and electric motors be substituted for them. That much, at least, the railroad can and must do to make its presence less offensive. It had better begin making preparations for the inevitable. The proceeds of the sale of the new stock which it was voted to issue the other day could not be used for a more desirable purpose than the electrification of the Chicago terminals."

Electrical men, by their specialized knowledge and influence, should be active in assisting to bring about this greatly needed improvement.

EXPERIENCE has shown that lightning is practically the sole cause of interruptions to service and damage to line in any well-constructed transmission system. With the rapidly increasing number and extent of high-tension transmission lines, the subject of effective protection against lightning is therefore becoming more important, and it is fortunate that in recent years this matter has received more adequate consideration.

On account of the diversity and "freakishness" of lightning phenomena, there has been considerable difference of opinion on the character and amount of protection required. What has been needed is a series of carefully conducted and exhaustive tests on the effectiveness of various protective devices in actual service. What is doubtless the most painstaking and complete undertaking in this line is the work done on the transmission line from Taylor's Falls to Minneapolis last summer and reported to the American Institute of Electrical Engineers in the recent paper by Mr. J. F. Vaughan, which is abstracted on another page of this issue.

The chief value of the paper is that it furnishes the data and knowledge of exactly what different protective devices are doing under service conditions, and thus it enables the engineer to determine the comparative effectiveness of these devices. Much credit is due to Stone & Webster for arranging for these tests and to Messrs. Vaughan and Neall for carrying them out so completely. More work of this nature is needed, and the value of its results should justify the expenditure of considerable sums to carry it out. No transmission company should neglect to make a careful study of its system so as to be able to eliminate all disturbances to its line and service.

Increasing Demand for Electric Power in Mexico.

[illegible] which is to increase the capacity of its hydro-electric plant to 28,000 horsepower. It is stated that practically all of this power is already con- [illegible] cans, most of them citizens of Colorado, and al- [illegible] in the hydro-electric-power enterprise, which expenditure, when the enlargements now being made are finished will [illegible] gold.

The initial hydro-electric plant of the company was erected at El [illegible] now generating 10,000 horsepower. The second plant, now nearing completion at El Sabino, will generate [illegible] horsepower. A loop transmission line is being built to supply light and power to [illegible] jected third plant will have a capacity of [illegible] horsepower and is to be built the present year. Waterfalls are utilized to furnish the initial power at each of these plants. The electric power is so much cheaper than fuel that it is rapidly coming into general use by industrial concerns. The average price which the company obtains is $150, Mexican currency, per horsepower per year.

Other projects to be undertaken at once may be briefly mentioned as follows: The Compania Industrial de Orizaba is installing a new power plant on the Rio Blanco at Orizaba, the electrical apparatus comprising two 750-kilowatt alternating-current generators. The Compania de Luz y Fuerza Motriz Electrica de Orizaba is making an addition of 750 horsepower to its plant near Orizaba. Ira Bowles of Batopilas, state of Chihuahua, is preparing to install a hydro-electric plant on the San Miguel River near Batopilas. The company of Americans and Canadians, which was promoted by James D. Schuyler of Los Angeles, will install a large hydro-electric plant at La Joya, on the Conchos River, where 15,000 to 20,000 horsepower can be developed. The Compania de Tranvias Luz y Fuerza de Guadalajara, which operates the lighting and street-railway systems of the city of Guadalajara, is preparing to enlarge its generating stations at La Junta and Juanacatlan, to meet the increasing demand. The Michoacan Power Company has been granted a concession to install a plant on the Zacapu River. Fedrico Ritter is arranging to install a hydro-electric plant on the Nazas River, in the vicinity of Torreon. Many other smaller extensions are being planned.

Central Electric Railway Association.

The last bimonthly meeting of the Central Electric Railway Association before the summer vacation was held at the Boody House, Toledo, Ohio, on May 26th. The attendance was unusually good.

The report of the committee on claims was read. This committee advised that the association form a bureau of information for the purpose of filing and promulgating information concerning dishonest claims, the several companies to supply information covering all claims for accidents, the data to be filed and indexed and the information sent out to the various companies.

The committee on interchangeable mileage reported that the present interchangeable coupon book had been found unsatisfactory, and it was deemed advisable to change to the mileage form of transportation already in use by a number of the interurban roads in Ohio and Indiana. It was voted to delay the adoption of the interchangeable book until one-half the mileage in the district had agreed to the placing of the book in force.

Francis S. Denneen of the Ohio Brass Company of Mansfield, Ohio, read an interesting paper on the subject of "Insulation of High-tension Transmission Lines." The paper elicited considerable discussion. An abstract of the paper is given in this issue.

"The Merit and Demerit System of Discipline" was presented in a comprehensive paper by Frank Hardy, superintendent of the Fort Wayne and Wabash Valley Traction Company of Fort Wayne, Ind. Mr. Hardy said the system consisted of a debit and credit account with each employe, more particularly with the conductors and motormen. Prescribed values in the merits and demerits are given to employes for violation of rules and to itemizing in particular the causes for demerits and [illegible] merits exceed his merits by 100. Mr. Hardy said [illegible] to compile the records for the system, and when properly prepared with the blanks the labor was insignificant when compared with the results obtained.

The next subject, "Employes' Mutual Benefit Associations," was treated of in an interesting manner by H. E. Vordermark, auditor of the Fort Wayne and Wabash Valley Traction Company. John F. Ohmer, president of the Ohmer Fare Register Company, Dayton, Ohio, read a paper on "Tickets as a Fare Medium for Street and Interurban Railway Traffic."

The committee appointed at the Indianapolis meeting to complete the organization of the traffic association held a session previous to the opening of the convention and acted upon a number of items necessary for the completion of the association. This committee reported that the association is now ready for business and that agreements for the maintenance of the association are being signed rapidly.

Lightning Protective Apparatus.

At a special meeting of the Armour Branch of the American Institute of Electrical Engineers held on May 14th Mr. Clive R. Morey, '08, read a paper on "Lightning Protective Apparatus," from which the following is taken:

During thunder-storms electric wires become charged from the atmosphere with an electric potential different from that of the earth. There is then a tendency for a discharge to or from the earth. A charge may accumulate slowly as from a charged mist or fog drifting across the line, or it may be induced by a charged cloud and set free by the cloud discharging to earth. Effects quite similar to lightning are produced by switching. If the discharge be left to find its own path to earth it is quite apt to break down the insulation in one of the vital points of the system. A charge may travel along a line with nearly the velocity of light and when it encounters any apparatus having windings such as generators, motors or transformers it experiences a choking effect. This impedance placed in the path of the traveling wave causes it to pile up and its potential to increase several times, similar to water hammer in pipes. As a result of this sudden rise of potential a discharge usually occurs through the insulation. A choke coil therefore is placed in the line between the arrester connection and the apparatus to be protected.

In order to prevent these waves of high potential from doing injury to the apparatus it is necessary to provide a path which will break down before the insulation it is desired to protect. This device must be so adjusted as to carry away the dangerous charge and then break connection without disturbing the operation of the line when the highest potential is most apt to occur. An ideal arrester has been defined as follows: "An ideal arrester should prevent any rise of voltage dangerous to insulation. It should offer a free path of discharge from line to ground or line to line, and should perform its functions without disturbing the operation of the system. It should put out the arc at the end of the half cycle in which it starts (if alternating current) and should have no discrimination in its protective power as regards the frequency of the disturbance, that is, it should discharge at a certain voltage for any frequency."

It has generally been conceded from the first that an air-gap is the most satisfactory form of resistance to use between line and ground and most arresters have used the air-gap. Among the advantages of the air-gap is the fact that its resistance is variable, depending upon operating conditions. For the same resistance it has less impedance than any artificial resistance. After an air-gap has passed a discharge its resistance is so lessened that ordinary line potentials will break across and some means must be provided for interrupting the arc. Upon the performance of this the successful operation of the arrester depends.

Many methods have been employed for blowing the arc. One of the earliest types of arresters was the gap between horns. The arc was drawn out by being forced to the higher part of the gap through the action of the heated air and repulsion by a magnetic field. In others fuses were used, and in many the distance between electrodes was increased mechanically. Later developments have brought out non-arcing metals and the use of a series of gaps, some of which are shunted with a resistance. Although these developments have been in the right direction, no arrester has yet been produced which is satisfactory under all conditions.

The latest development is the electrolytic cell. Aluminum plates when placed in certain electrolytes coat themselves with a non-conducting film. This film builds up for line voltage and at this voltage [illegible] oped.

Death of Prof William A. Anthony.

[illegible] several leading colleges. He was also the designer of a number of electrical machines and instruments, and a prolific writer on electrical engineering.

He was born in Coventry, R. I., November 17, 1835. He was graduated from Yale and received the degree of Ph. B. in 1857. In 1861 he married [illegible] the school at Crompton, R. I., and at different times was connected with the Providence Conference Seminary, the Delaware Literary Institute of Franklin, N. Y.; Antioch College, Ohio; Iowa Agricultural College, and Cornell University. He had been with Cooper Institute since 1894.

Professor Anthony was a member of the American Institute of Electrical Engineers, of which he was president in 1890-91. He was also a member of Franklin Institute, Philadelphia, and the American Social Science Association. He was co-author with Prof. C. F. Brackett of the "Manual of Physics," and was the author of "Lecture Notes on the Theory of Electrical Measurements." Professor Anthony leaves a widow and one son, Charles C. Anthony.

Electrical Exports for April.

Electrical exports from the United States for the month of April amounted to a total value of $1,153,013, a decrease of $179,385 as compared with April, 1907. Exports classified as electrical appliances increased slightly as compared with April, 1907, but there was a large decline in the export of electrical machinery, so much so that April's exports of electrical appliances exceeded in value that of electrical machinery. The figures are as follows: Electrical appliances—April, 1908, $586,427; April, 1907, $583,780. Electrical machinery—April, 1908, $566,586; April, 1907, $748,618.

The principal countries to which electrical goods were exported during April are:

Electrical appliances — Brazil, $88,035; British North America, $82,699; Mexico, $75,950; United Kingdom, $73,066; British Australasia, $26,073; Central American States and British Honduras, $23,552; Japan, $21,200; Cuba, $19,631; Philippine Islands, $19,308; Argentina, $17,829; Belgium, $16,096; France, $9,709; Germany, $8,552; British Africa, $6,881.

Electrical machinery—Japan, $187,693; United Kingdom, $50,504; Mexico, $48,891; Brazil, $42,075; British North America, $38,241; Germany, $27,086; British East Indies, $23,039; British Australasia, $17,147; Argentina, $13,892; Cuba, $10,043; Philippine Islands, $9,646; Central American States and British Honduras, $6,932; British Africa, $6,896; France, $6,155.

Telephone and Telegragh Investigation.

A resolution was adopted by the United States Senate on May 28th directing the secretary of the Department of Commerce and Labor to "institute an investigation into all the telegraph and telephone companies engaged in the conduct of an interstate business as to the methods used in handling the public's business, the wages paid telegraphers, telephone operators, and other employes of such corporations," and also to get a statement of the receipts and expenditures of the companies.

The inquiry will probably be made in part by the Bureau of Corporations and in part by the Bureau of Labor. Secretary Strauss is inclined to believe that much of the information called for by the resolution may be obtained without great difficulty.

The city of Carrollton, Miss., will receive bids until June 15th for the construction of an electric-light plant. R. C. Huston of New Orleans is the engineer in charge.

Lightning Protection Discussed in the Light of Practical Experience.

[illegible] Page 451.

The importance [illegible] grounds for the overhead grounded wire [illegible] great care cannot be exercised [illegible] Even on the grounded wire the passage of the charge to earth is apparently impeded, even by the short distance it had to travel along the line. For this reason it is clear that grounding at every pole is beneficial to the discharge.

It is an open question of economy whether to equip a line completely or partially with overhead devices; but in consideration of the charges which they may be called upon to carry at any point, the whole line protected is theoretically and generally the safer policy.

So far as attempts have been made to protect against line distubances by larger insulators, or special features at insulators, such as horns to modify the effect, it is clear there is no reduced interruption to service itself when discharges actually occur. For this reason Mr. Neall prefers where feasible any protection scheme which aims to prevent the static disturbances getting on the line at all.

The lively operation of the station protective apparatus, as evidenced by the action of the series and shunted gaps and the heavy discharges over the electrolytics, indicates a considerable strain to ground, which for the present must be considered effectively handled by the protective apparatus.

In consideration of what appeared to be pronounced line-to-line characteristics, each protective apparatus equipment on the Presumpscot system was supplied with extra gaps and fuses (until best adjustment should have been accomplished) and in one case low-equivalent arresters were placed across the line. In addition to this the regular low-equivalent arresters between line and ground were shunted with gaps and fuses, two each, around the shunt and series resistances in series. The whole system was carefully equipped with tell-tale papers so that nothing could happen without leaving a record.

The results on this system show improved service during lightning storms. When the arresters operated to ground there would often be a complete action over the low-equivalent arrester between line and ground as well as over the gaps and fuses in shunt thereto. In any given discharge not all the fuse paths to ground would operate. Fuses did not always blow even though a discharge had passed over them. The action over the fuse paths was apparently freer than over the arrester.

A record was established of the existence of line to-line disturbances in addition to those disturbances usually considered in lightning-arrester operation. These disturbances were found to be taking place during "uneventful" periods of operation, with nothing to show from the general indications why they had happened.

Indications existed that line accidents, such as the wind blowing the wires together, will cause a wave of phase-to-phase disturbance to travel a long distance and operate the phase-to-phase protection; that on the closely adjusted gap-sets the fuses invariably blew; and that some phase-to-phase action nearly always accompanied phase-to-ground operation.

From a summary of the results on the Presumpscot system the conclusion was reached that proper line-to-line protection is as essential as line-to-ground protection, and that the line-to-line operation is likely to take relatively considerable time, and therefore that in the long run high and stable resistance in the discharge path is necessary for uninterrupted operation. A shunted gap equipment, however, may be valuable.

Since phase-to-phase protection can be easily added to any multi-gap arresters not already so provided for, its adoption is not difficult. For this purpose Mr. Neall favors electrolytic arresters arranged in star with a common jar or jars to ground, since this does not impair the line-to-ground protection and adds to the phase-to-phase.

Mr. Neall's conclusions are:

Lightning disturbances on a line are more than likely to be local, varying approximately from 1,000 feet or less, to several miles, the longer areas being [illegible].

They are likely to happen at any part of the line.

A direct stroke of lightning is not necessarily harmful; it depends upon the quality of the stroke, etc.

A line may be affected by a bound charge and direct stroke simultaneously. There is as yet no [illegible] separately.

[illegible] two wires, or more, above the line wires is desirable.

An overhead grounded wire should be grounded [illegible]

[illegible] greater the possible disturbance from lightning to the line. High-voltage lines, therefore, need, more than low-voltage ones, overhead grounded wire or its equivalent.

Lightning rods added to the overheaded grounded system probably add to the protective power.

Shattered insulators are liable to occur in every severe thunderstorm, but not in light ones. Puncture is more probable with power on the line at the time.

Insulators should be carefully selected for the service, to test not less than two times normal voltage between line and pin, with pin grounded. The equivalent spark-gap should be higher than any arrester path to ground on the line.

Horn lightning arresters should be employed for extraordinary service only. The general arrangement known as the multi-gap selective path type promises to be of value.

Lightning-arrester stations to discharge line disturbances become increasingly expensive and of questionable assistance the higher the voltage transmitted. Their total number depends on the length of line.

Wood poles may be effectively protected against splintering from lightning discharge by providing them with a small metallic conductor to ground.

Electrolytic lightning arresters have so far behaved creditably, particularly in sensitive relief of grounds, but do not indicate a complete superiority over other types.

Line-to-line protection is desirable.

Apparently there cannot be too much protection on a plant. Every lightning arrester added plays a part, but practically there is a limit. For many reasons it is obviously desirable to keep the station protection as simple as possible. It is as yet impossible to define what this should be.

If a full measure of line protection is added, such as overhead grounded wires, the stations will, in turn, be much relieved.

Discussion

Harold W. Buck of New York city opened the discussion by stating among other things that it has very conclusively been shown that these line troubles have been very much reduced by means of the overhead ground wire. It is not only shown in this particular system, but the experience all over the country with transmission lines where the overhead ground wire has been properly installed shows a similar corroborative evidence. The function of this ground wire is perhaps double. It allows the induced charge, so to speak, to accumulate on the ground wire instead of accumulating upon the transmission wire itself; so that when the cloud induces this charge, the corresponding charge on the ground wire can discharge itself through the ground connections on the pole instead of having to spill over the insulators. There is perhaps another important function of this overhead ground wire in shielding the wire from induced currents due to neighboring lightning discharges which are presumably of high frequency. The guard wire forms one side of the circuit and the ground the other; so that we really have a short-circuited shield against induction on the line itself, the ground and the shield wire being connected electrically. If this is so, it would seem to be of decided advantage to have two overhead ground wires rather than one, having the connection made between those two shield wires at every pole. Then we would have a shielding effect on the vertical plane and also on the horizontal plane against induced charges in the transmission wire. These short-circuited loops in fairly close proximity to the transmission wires might represent some loss due to the normal frequency of the transmission wire; but it is doubtful whether that would be enough to be very serious; whereas with the frequency of the lightning discharge, the possible current might be very high, indeed, and have a decided shielding effect against the transmission. The evidence of the spilling over of accumulated charge on the insulators seems to show that the actual magnitude of the current in this ground wire is very large indeed. It is interesting to note in this paper that certain discharges have been noticed on the secondaries of the transformers which accords with the experience of Mr. Buck and that of other engineers. There have been a number of cases of overhead lines passing through transformers into underground cable systems where quite frequent cable punctures have resulted simultaneously with thunder storms on overhead lines. This seems to indicate the necessity of having lightning arresters of some form on the secondaries as well as the primaries.

Percy H. Thomas of New York city noticed that the punctures in the tell-tale papers were just as severe when there was no generator connected with the line as at any time. These punctures show on examination the fibers of the paper unburned, being therefore as purely static discharge as anything ever seen. The spillovers are cases where a static discharge has passed over the wire to the pin from the surface of the insulators and not an induced charge. In only a small percentage of these have there been insulators injured.

[illegible] of Schenectady, N. Y., said the authors were fortunate in obtaining records on an idle line. The only data of great value in the study of lightning potential should be taken on an idle line and furthermore should be collected on tapes moving by clockwork so as to separate the punctures due to each cloud discharge. A comparison of the aluminum arrester and the resistance horn-gap arrester will show the limitation of the latter and the uselessness of its further development. At 60,000 volts every ampere of discharge represents roughly 60 kilowatts per phase, or 180 kilowatts. If an arrester will not discharge 100 amperes at least, it will not take the usual run of heavy discharges. With this rated discharge the generator would be called upon to furnish 18,000 kilowatts. On the other hand, if an aluminum arrester is used the energy taken from the generator will be less than 20 kilowatts and the rated discharge of lightning will be several hundred amperes at the same abnormal value of potential. The valve action of the aluminum arrester prevents almost entirely the flow of dynamic at normal potentials and has a free discharge only at normal potential. This information is sufficient to show the futility of using the resistance type of horn-gap arresters. Furthermore, the current taken by the aluminum arrester from one phase to ground is leading, the same as the capacity current of the line or cable, and consequently one phase may arc continuously between line and ground without setting up surges on the system. It should be noted that the aluminum arrester actually maintains the voltage and thus prevents grounding the line conductor.

W. N. Goodwin, Jr., declared that the only feasible possibility of entirely protecting an overhead power circuit lies in the development of an insulator which will not puncture, and while having a fairly low spillover will not shatter. This perfection in the petticoat type of insulator is probably out of the question, but he believed can be attained by a properly designed and proportioned insulator of the suspension type. Such an insulator would be the equivalent of a line arrester at each pole or tower on the line.

President H. G. Stott recalled an experience he had about 11 years ago when the Niagara transmission lines first started. It was the first, or one of the first lines equipped with the overhead ground wire. After a few months' experience with this protection it was decided to take it down, as the choice of two evils was that the lesser one was to take it down to avoid the troubles due to the ground wire rather than the benefits that it might give. That might have been due to poor construction work in the ground wires themselves, as they were continually breaking and short-circuiting the lines. Now, 11 years afterward, it was shown tonight, that as the result of a most elaborate series of tests, apparently the ground wire gives us the most certain protection. If you think of it in a very practical way there is every reason why it should. No one ever heard anywhere of an underground cable being struck by lightning. That means that if you can get the earth potential, or the ground itself, above your conductor you are safe. We cannot possibly afford to bring our cables underground. The cost of burying a 60,000-volt line 100 or 200 miles long is absolutely absurd from a financial or commercial standpoint; but now we can do the other thing, and instead of putting the wire underground we can put the ground above the wire. It seems that the most perfect protection will be gotten where we have the most perfect network of ground wires above our conductors, and I think everything tonight points to that fact. Another point is somewhat emphasized, and that is, to avoid ordinary troubles you have got to have a high factor of safety in all apparatus. Troubles with underground cables are almost unknown outside of mechanical damage and damage to joints and that sort of thing; and the reason is that those cables are made with an extremely high factor of safety. For instantaneous voltage it is 10 to 1. Just as it is with human nature—if a man is in a broken-down condition every few germs that come along will give him a new disease; but if he is strong enough they won't affect him at all. We have got to make our system germproof, as it were, and have a very large factor of safety on the insulators. That and the ground wires are going to be the solution of our overhead work.

Toll-line Discussion in North Dakota.

The North Dakota Independent Telephone Association met in Fargo, N. D., May 26th for the third annual gathering. Among the things discussed was a proposition to permit all toll companies to connect with a single exchange where there is but one in a town and to give the patrons the right to select over which line they will do their long-distance talking. This would do away with the temptation of a long-distance line seeking entrance to a town to encourage or attempt to form a competing local exchange. There has been talk of legislation to compel this, and this may be done at the coming session of the Legislature.

The United Amusement Company of Baltimore, Md., has contracted with the Consolidated Gas, Electric Light and Power Company of Baltimore for 40,000 incandescent lamps to light its park. A sub-station will be erected in the park, taking current from the Westport plant.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

[illegible]

Special Equipment and Methods.

[illegible] Room

In large test rooms [illegible] of meters are [illegible] all the time [illegible] of high capacity [illegible] lamp-bank testing [illegible] away from the testing switchboard [illegible] the heat of the lamps and the [illegible] stantly [illegible] glare in the eyes of the test-room force. In some companies the lamp bank is placed in a separate [illegible] room, with the lamps mounted on an iron [illegible] frame with asbestos insulation.

A [illegible] arrangement for testing [illegible] [illegible] pany [illegible] of [illegible] regulator [illegible] clock fitted with [illegible] contact device [illegible] telegraph [illegible] sounder [illegible] testing [illegible] watches [illegible] with [illegible] ond [illegible] ticked off [illegible] standard clock. All watches showing an error exceeding one-fifth second, or [illegible] per cent, or imperfect operation in [illegible] other respect, are turned in for repair.

In at least one very large city central station

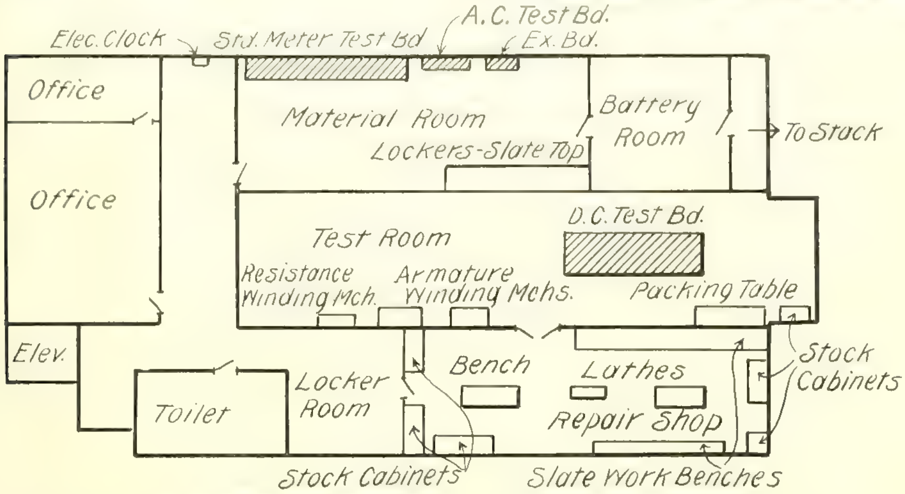


FIG. 14. METER TEST DEPARTMENT OF NEW YORK EDISON COMPANY.

In the test room of the New York Edison Company a couple of electric fans are made to serve the double purpose of ventilating the lamp bank room (which contains 1,100 lamps, and would without such ventilation become intolerably hot) and at the same time drawing off the acid fumes from the storage battery into an adjoining room (see Fig. 14). The fans are placed at apertures in the partition between the two rooms, near the floor, and the construction of the lamp bank—painted iron frame and connections, with asbestos insulation—and the concrete floor, walls, and ceiling of the room, offer no opportunity for corrosion by the acid fumes drawn into the room by the fans. A hole near the ceiling of the room allows the air to escape into an old, disused stack.

STORAGE BATTERY FOR TEST-ROOM POTENTIAL.

Instead of making connection to the mains to supply the potential circuits of direct-current meters under test, in some companies a storage battery is provided for the purpose, in order to obtain a constant potential free from the fluctuations on the mains. The battery should be in duplicate, so that when one set is in use, connected to the potential bus of the testing boards, the other may be placed on charge. Obviously the cells used need only be of small ampere-hour capacity.

The potential battery of the New York Edison Company consists of 140 cells of 7.5-ampere capacity at the eight-hour discharge rate, and is connected to the testing boards with end-cell leads to give any potential up to 250 volts. The battery is connected on the three-wire system, so that when used for testing 120-volt meters one side may be used for potential excitation, leaving the other side available for delivering any current up to the maximum discharge rate. Switches and instruments for controlling the charging of this battery are installed on one of the testing boards.

STANDARD CLOCK AND SOUNDER.

In several of the larger central-station companies, systematic means of checking the stop-watches used by the force of meter inspectors have been devised. As mentioned elsewhere, even a high-grade stop-watch cannot be depended upon to stand the wear and tear of the incessant use that it receives in house-to-house testing of consumers' meters.

NOTE.—This serial article, begun in the Western Electrician of April 4, 1908, is an advance publication of a portion of a forthcoming book by Mr. Baker on the general subject of "Electric Meters." It will be understood that the present serial refers to watt-hour meters used on customers' premises.

system having a main meter-testing laboratory and several sub-stations scattered about the city—each one being a meter stock room and headquarters for the meter testers operating in its locality—the standard clock at the laboratory delivers seconds impulses by wire to sounders at the different sub-stations.

[*To be continued.*]

Lord Kelvin as a Teacher.

In his mathematical physics lectures—aye, even in his elementary lectures—the suggestions that he poured forth were much above the heads of the ordinary undergraduates—over 100 in this class—and they gained little by coming to them except a register of their attendance, necessary for their degrees. For, as soon as he turned around to write on the blackboard, the students, row by row, began to creep out of the lecture room through a back door behind the benches and steal downstairs, their bodily presence following their mental presence which had left as soon as the reading of the roll-call was finished. From time to time Thomson put up his eye-glass, peered at the growing empty space, and remarked on the curious gradual diminution of density in the upper part of the lecture room.

This class consisted mainly of divinity, medical and law students, who, of course, should have been taught the elements of natural philosophy by some assistant provided by the university. To waste the time, energy and extraordinary original power of a genius like Thomson on such teaching was like using a razor to chop firewood. The junior clerks in Downing Street require instruction, but the prime minister is not expected to personally hold daily classes for them. And yet, during the past 80 years, there have been many prime ministers, but only one William Thomson.

But to those, like myself, who, after receiving some scientific training, had come from other countries to hear Thomson's talks, his suggestions, his buoyancy, were like the rays of brilliant May sunshine following April showers. The ideas of those students sprouted as never they had done before. The more thoughtful gazed with eyes of wonder at Thomson developing an original paper during a lecture on anything that he might be talking about, we knowing that any notes or calculations that he might previously have made were on the back of some old envelope and left probably with his great-coat in the hall. "If you want to know what's in books go and read them for yourselves. I am telling you what is not in books," he used to remark at those lectures at the old University of Glasgow (now a railway goods station).—From an article on "Kelvin in the Sixties," by Prof. W. E. Ayrton, in the London Times Engineering Supplement.

QUESTIONS AND ANSWERS.

Choice of Primary Batteries.

[illegible]

[illegible]

The data given [illegible] however [illegible] that each cell [illegible] rated [illegible] cells are connected in series in each case, also that each cell is rated at 20 amperes. If the latter were a reliable figure, the cells would have to be in parallel, so that six of them could give 120 amperes and nine give 180 amperes. Actually a primary battery can give 20 amperes only for a limited time on short-circuit. Therefore these cells could not carry a 60-ampere load except for very brief intervals. For this service at least three sets should be put in parallel, each having six cells in series.

Compound Motors.

A. N., St. Paul, Minn.: I have a 10-horse-power compound motor running on 110 volts direct current. It drives a hoist and is very erratic. As it picks up the load it seems to increase in speed somewhat, and when the load is no more than about six horsepower it will get stuck suddenly and blow the fuses. Several times it has shown a tendency to race. There are no grounds or short-circuits on the machine. What can I do for it?

ANSWER.

Compound motors are of two kinds, cumulative and differential. In the first class the series field helps or adds to the effect of the shunt field. In the second class the series field opposes the shunt field.

In cumulative compound motors the speed drops as the load increases, but the turning power or torque increases with increase in load. These motors are used for hoists, elevators, etc., where a large torque is required at times and where the speed is not so important as long as it does not become too high. The motor referred to should be of this class.

In differential compound motors the speed remains practically constant at all loads to about full load. These motors are designed for use where a very constant speed is necessary, as in textile looms. As the series field is strengthened by an increase in load, the resultant field is diminished, which compensates for the decrease of counter electromotive force. A considerable overload may stall a motor of this kind because it diminishes the torque.

From the foregoing it is evident that the motor in question has its series field connected wrong, i. e., it is running as a differential motor instead of as a cumulative motor, as it was designed. All that will be needed then is to reverse the connections of the series field.

Illinois Independent Telephone Association.

The Illinois Independent Telephone Association held its fourth annual meeting last week at Champaign, Ill. Among other matters brought before the convention was that of combatting the tendency toward Bell toll-line connections, and a committee was appointed to further the extension of Independent toll lines. The convention closed with the election of the following-named officers: President, Manford Savage of Champaign; vice-president, W. H. Bassett of St. Louis; secretary, C. A. Camp of Henry; treasurer, A. T. Loehr of Carlinville.

The United States Civil Service Commission announces an examination on July 1, 1908, to secure eligibles from which to make certification to fill a vacancy in the position of assistant engineer, at $1,400 per annum, in the office of the secretary of agriculture, and vacancies requiring similar qualifications as they may occur. Applicants should at once apply for application form 1093.

The Status and Commercial Possibilities of High-efficiency Lamps.[1]

[illegible]

[illegible] their revenues and play havoc with them generally, the large majority of those who have expressed themselves seem to agree that the tungsten lamp will prove of immense benefit to the industry, as supplying a vehicle which for the first time will permit of real competition, as far as price is concerned, with gas and gasoline, and which, from its high efficiency and economy, will raise the standard of lighting, so that not alone will more customers be secured but present customers will rather utilize this lamp to secure more light for the same money than the same light for less money.

As the advent of the tungsten lamp and the questions raised thereby are of immense importance to the industry at this time, the following quotations from replies received will doubtless prove of interest as expressing the varying opinions of managers of central stations of all sizes and from all parts of the country.

1. *From Iowa.*—Tungsten lamps will in time displace the arc lamp for interior use; also the Nernst lamp. They will make gas-arcs run for their life. The 100-watt frosted lamp and shade placed within 18 inches of the ceiling in any ordinary living room makes the most perfect artificial light known.

The 40-watt lamp will be the salvation of the lighting load and will quickly stop the heavy inroads of gas-mantle lighting. At first the revenue will doubtless be lowered, but the more universal satisfaction over electric illumination will result in a far larger use of electric lighting, especially for long-hour business now monopolized by gas.

2. *From Connecticut.*—We look forward to the advent of tungsten and other high-efficiency lamps as a solution of many of our difficulties. We find that the greatest criticism that we have to contend with is that the 16-candlepower lamp is too small a unit and that, at the rates we feel it advisable to charge, a 24 or 32-candlepower becomes too expensive. Practically all of our customers are of the same class, and our experience with a few that we have changed over shows us that the high-efficiency lamps, while reducing the bills a little, do not begin to reduce them in proportion to the amount of current saved and do give us dissatisfied customers. Of course we have country conditions which vary widely from those in the city. None of our customers use as much light as they would like, and we feel that giving them more light and having them satisfied without reducing our rates will on an average be much more profitable to us than reducing our rates and, in spite of the reduction, having our customers dissatisfied on account of the quality and amount of light. As, however, the tungsten lights do produce a saving, and as they do not seem to appreciably blacken or decrease in efficiency before they burn out, the stock arguments for free renewals do not seem to us to hold good in this case, and the customers should pay for the lamps at the cost to the station.

3. *From Ohio.*—Good effect. I believe if you can get a rate for current to cover, it is best to furnish free renewals. If not, you must charge for them.

4. *From Pennsylvania.*—I had tried at different times to make a permanent customer of a barber shop using Welsbachs and natural gas, but always failed to hold the business. I recently installed four 100-watt tungsten lamps fitted with Holophane bowl reflectors. I told the proprietor what the installation would cost him, what lamp renewals would cost, and about what his bill would be at 10 cents per kilowatt-hour, and that if the service was not entirely satisfactory the four days' trial would be free and lamps removed without cost to him. At [illegible] I found all the gas fixtures removed and was told to send the bill for wiring, as he got just what he had been looking for for years. I believe the tungsten lamp will be a great benefactor, provided the lamp people will confine their heavenly ideas to their religious be- [illegible]

[illegible] impossible to get with carbon lamps. They will [illegible] when the price is somewhat reduced, the gas and [illegible]

these lamps. Work on the new consumer and not on the old unless he is dissatisfied.

6. *From Illinois.*—I believe it will enable us to regain a very large part of the business we lost by gas and to keep what we have. While the earnings per customer may decrease some, the number of customers will increase so that the gross income will be much larger. We are also using it to replace flat-rate commercial jobs, and while it reduces the bill possibly one-third it also reduces the current used to less than half, and we are securing a much better income per kilowatt. I feel, however, that the first cost of the lamp is too high.

7. *From Texas.*—If lamps will stand shipment and handling and burn 800 to 1,000 hours, we believe interests of central stations lie in encouragement of their use. The more illumination customers can get for a given amount of money the more they will take. Neither gross income nor generator load will decrease, but a large number of customers will be added, and dark spots indoors as well as outdoors will be illuminated.

8. *From Missouri.*—We welcome the coming of the tungsten lamp and believe that ultimately it will be of great benefit to the electric-lighting industry. We have always believed in giving our customers all we could for their money, and have found that a very large percentage of them prefer more light for the same money rather than the same light at a lesser price. Temporary hardships may be worked on some companies.

We believe plants in small towns and cities will be especially benefited by the use of tungstens, as gas and gasoline plants will no longer be strong competitors.

9. *From New York.*—These lamps are a decided step in the advance of the art. When competition among manufacturers brings prices to a lower level it means a good deal to the lighting company in reducing an economical customer's bill. But the majority of patrons will demand more light, and we believe the lighting business will always be a field for legitimate profits.

We have always charged cost price for all kinds of lamps; particularly now, with the advent of new and varied kinds, this policy works out best. A lighting company sells power for lamp or motor and should not be asked to supply the means of consumption any more than a groceryman should furnish lamp chimneys when he fills your kerosene can.

10. *From New Mexico.*—The change from carbon filament to the more economical lamp will be so gradual that central stations will not feel any detrimental effect, but rather a beneficial result, allowing them to handle more connected load (in lamps or candlepower) with the same investment for station and overhead equipment. More light for the same money to the consumer will make electric lighting more popular than ever and increase the central station's revenue in a marked degree.

Anything that will reduce the cost to the consumer should be welcomed by the central station, particularly when the cost of production is not increased. Free renewals of the higher priced and efficiency lamps should be discouraged till such a time as the first cost of them is down to the carbon-filament lamps.

11. *From Vermont.*—In communities of less than 30,000 people I believe it will eventually decrease the current consumption; that is, if we install lamps of less than 60-watt size on our lines. Even then, there will be some reduction. I believe we all should stick to sizes of 60-watt and larger, which will give the customer a considerable increase in candlepower for present consumption. If possible, I should like to see manufacturers stick to the large sizes only—50, 60, 80 watts, and so on.

I am a great advocate of Holophane shades in aiding the customers to get useful light from the current they pay for.

I believe that new-type units should be sold direct to customers, with a maintenance or renewal charge of so much per lamp installed per month, to take care of burn-outs.

12. *From Wisconsin.*—We are pleased with the tungsten lamp, and believe that when the price is reduced to 50 per cent. or less of the present price it will result in a much greater use of electricity for illumination and a greater profit to the central station.

13. *From Pennsylvania.*—We feel that the use of these high-efficiency lamps will have the same results to the electric-lighting industry that the Welsbach light had on the gas-lighting industry, and the proper way to meet the situation is to educate the public along these lines.

14. *From Wisconsin.*—At present price of tungsten, inroads will be small. In case a large proportion of tungsten lamps were in use should have [illegible]

15. *From Alabama.*—It seems to us the best business policy to encourage the use of the most economical lighting unit that it is possible to obtain. We welcome heartily a 1.25-watt-per-candle lamp [illegible] efficient unit. An extended use of tungsten lamps [illegible] however, with reduced revenue the saving in sta- [illegible]

cient unit like the tungsten calls for better and better illumination, and is bound in the end to be of benefit to the central station. We believe the best way to meet the situation is to have our customers fully informed on the true state of affairs in the lamp situation, and we believe this information should come from the central-station management first.

16. *From Colorado.*—Think they should be taken on gradually, and if judgment is used, due to increasing standard of illumination, there will be little harm done to sales of current by central station.

17. *From Virginia.*—I believe they will help the electric-lighting industry. The rate should, in my opinion, be a readiness-to-serve rate, and the lamp installation and renewals should be charged for in this readiness-to-serve rate. With such a rate and the high-efficiency lamps, the consumers will use the service for a longer period, and, with the increased number of consumers that can be supplied off the same feeders, this will mean a larger revenue for the central station.

18. *From Connecticut.*—We are a little uncertain as to the effect. Judging, however, from the experience of gas companies with Welsbach mantles, we believe it will tend to greatly increase the use of electricity for lighting purposes. We believe the only thing to do is to furnish the lamps and tell the facts to customers. The lamps will be used anyway, and the electric-light companies might as well face the situation gracefully and accept it cheerfully.

We are also beginning to believe that a change in the rate system, from a flat meter basis to a readiness-to-serve charge, plus a low rate for current, will increase the amount of artificial lighting done, and, taken together with the advent of the tungsten lamp, will greatly increase the amount of our business. We hope this will be accomplished without too great a sacrifice to net income.

19. *From Washington.*—The consumer is interested in getting the most and best light he can for the least money. Consequently he will use high-efficiency lamps in preference to others if their lasting qualities prove reasonably good. It is probable that the decrease in current consumption per candlepower consequent upon the adoption of high-efficiency lamps will encourage greater brilliancy in lighting and also greater waste of current. So that while a general and rapid adoption of high-efficiency lamps might materially reduce the demands on the central station and leave a surplus of machinery, temporarily, it is also probable that this would soon be offset by a more general use of electric lights by people theretofore using other illuminants, and cause more lighting to be done by old consumers. The financial feature (central-station revenue) would likewise adjust itself. There might be some cases where readjustments of rates would be advisable. On the whole, better light at less cost will in the end have a beneficial effect on the business, both from the standpoint of more general use of electricity for lighting and greater profits to the central station.

20. *From Washington.*—In all probability the introduction of the tungsten lamp will result in benefit to the industry. It will make competition with other illuminants much easier, and yet it may possibly result in decreasing the revenue from some consumers. It will enable us with the same investment to greatly increase the number of consumers served. In all probability, increased use of lights will result from decreasing the cost per unit of illumination, and the effect upon the industry will probably be that which the introduction of the Welsbach mantle had upon the gas industry.

One of the serious problems that seem to confront the central stations in the use of tungsten and other high-efficiency lamps is the question of renewals, and the writer's judgment is that it will be better, as they are gradually introduced, to charge the actual cost of the lamp to the consumer rather than to attempt to charge the difference between their cost and the cost of the lamp now supplied.

Since the carbon-filament lamp consumes nearly three times per candlepower what the tungsten lamp consumes, the reduction in the price of the tungsten lamp to compensate for the free renewals of the carbon-filament lamp would only amount, theoretically, to five or six cents, and this would not be understood or appreciated by the consumer, so the full price might just as well be charged.

21. *From Washington.*—We believe that high-efficiency lamps will have a stimulating effect on electric-lighting business, and will tend to make it expand more rapidly; that they will be introduced gradually enough so that there will be no necessity for any company to notice any resulting decrease in load, even in communities that are growing very little. We believe that any tendency to a decrease in load will be more than offset by the increased demand for light on account of its decrease in cost. We believe that no company need fear the results of a progressive policy in regard to the use of new high-efficiency lamps. With companies furnishing free renewals we believe that an extra charge should be made for renewals of high-efficiency lamps, which will make the cost to the company approximately the same as with ordinary lamps, which are renewed free.

[illegible]

mon advancement. Labor-saving machines may have [illegible]

on the few individuals in proportion to their in- [illegible]

[illegible] something else.

"The greatest good to the greatest number" and "the survival of the fittest" will determine. Each must regard his brother's good, and we must co-operate with all the people.

24. *From New Jersey.*—Believe the company should control sale of the lamps in order to [illegible] light for same money, rather than allow manufacturer's agents to sell lamps on basis of [illegible] for less money. Do not believe in introducing tungsten lamps below 80 candlepower, 100 watts.

25. *From [illegible].*—Now is the chance to get away from the free renewal basis. Best thing for the central station to secure pay for lamps, same as gas company does for mantles. [illegible] argument to contrary, but our experience says, "Charge for every lamp." Stations we know operating upon this basis make most money and sell highest amount current per capita.

26. *From New York.*—Free renewals with the tungsten lamps will be unnecessary.

27. *From New York.*—Beneficial. Let central stations sell these lamps to customers at a profit.

28. *From Massachusetts.*—We are very sanguine that a new era is dawning. Our policy is free distributions where the use will do us most good, viz. the replacement of gas by agreement to use electricity for at least one year, and free or partly free wiring.

29. *From Michigan.*—Will drive electric arc lamps out of commercial houses, and we welcome it.

30. *From Minnesota.*—Two thirds of all received were broken and defective.

31. *From Indiana.*—Believe rental basis will be the solution; 100-watt lamp, 50 cents per month.

32. *From New York.*—Disturbing for a time; may require readjustment of rates. In our case believe final result will be increase of business. Too early to formulate plan of action to meet new conditions which are uncertain.

33. *From New Hampshire.*—Believe it will have a tendency to cut out free renewals.

34. *From Tennessee.*—Lighting companies should begin immediately to sell the lamps and in no way to directly discourage them to the customer, but rather to encourage them, so that the company will not appear in the light of holding the bills up. The manufacturer, however, should not reduce the price of the lamps too fast, but should, by holding the price up, cause the lamp to come slowly into service.

35. *From Michigan.*—We believe the commercial advent of the tungsten and other high-efficiency lamps will ultimately increase the standard of illumination. Customers will, in general, consume the same amount of electrical energy for lighting purposes, thereby obtaining better illumination for the same amount of money.

36. *From Maryland.*—In view of the low rates here, the advent of the lamps would have a bad effect.

37. *From Connecticut.*—Present high cost of tungsten lamps restricts their use. Believe they will soon be sold much cheaper. Think they will benefit the business ultimately. We feel that with the use of lamps costing more the time has come to educate the customer to pay for his lamps.

38. *From Pennsylvania.*—We believe the lamp is too expensive and fragile to be used generally.

39. *From Montana.*—The facts appear to be that lamp renewals will cost us two to three times more than with the carbon-filament lamp, that one-third the current consumption will do the same work for the consumer and that furnishing the same amount of illumination will produce but one-third the present revenue. As to the expected greatly increased illumination, who knows? This is all guesswork. How many plants can stand a 66 per cent. loss of revenue?

I do not care to test out the chances involved, so long as I am not compelled to. Should like to see the result of adoption of the new lamps by plants that have keen competition and those whose large profits might warrant them in taking the chance (if there are any such).

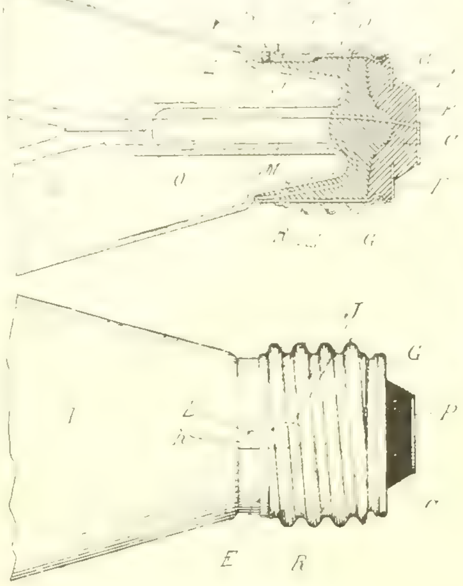
[*To be concluded.*]

New Locking Base to Prevent Lamp Removals.

[illegible] siderable.

Several locking collars and locking sockets have been devised with more or less merit. However, in both cases the purchaser is required to purchase extra apparatus, and in the case of the locking [illegible] it.

[illegible]



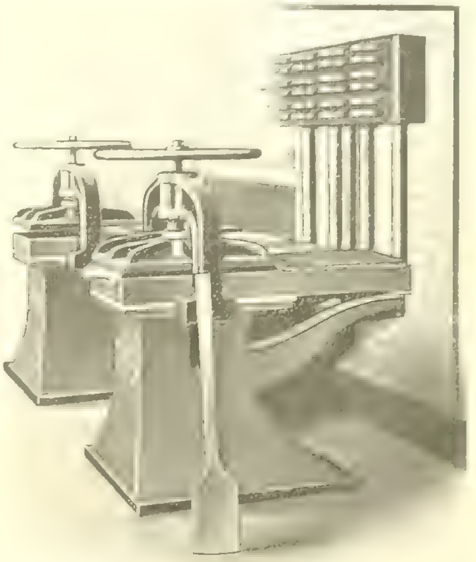
NEW LOCKING LAMP BASE.

effectively prevents the removal of lamps except by some person authorized to do so. This base was shown at the recent National Electric Light Association convention in Chicago, and it is understood that several of the manufacturers expect to put out lamps in the near future carrying this new base. The external appearance of this lamp and base can hardly be distinguished from those now in use, and the lamp can be used in any socket now on the market, in any position and in any shade-holder. The accompanying cuts will explain the locking mechanism, and also shows the appearance of the base and lamp complete.

In the illustrations (P) is the central contact of the lamp proper, (F) being a cylindrical brass collar occupying the position of the threaded cylinder on an ordinary base, that is to say, it carries contact (P) through the medium of the glass cement, as in the ordinary base, is cemented to the lamp proper and has soldered to it one of the leading-in wires. (R) is a cylindrical worm thread held in position on (F) so that it can be moved in a longitudinal direction but is free to revolve upon (F). (S) is a screw engaging (F), and when drawn down in position the head of the screw clamps the sliding collar (R), holding it permanent with (F) and the lamp. This is the condition when the lamp comes from the factory, and it can be placed in any Edison socket. If it is desired to securely lock the lamp in this socket after it has been installed the screw (S) is removed, whereupon the lamp proper carrying contacts (F) and (P) may be revolved freely in either direction without changing in any way the relation of the lamp base and the socket, as the worm-threaded cylinder or collar (R) remains in position with the threaded portion of the socket and cannot be removed until the screw (S) is again inserted in position and drawn down clamping (R) to (F). By using a left-hand thread on the screw (S) it will be seen that it is impossible to unlock this base with any ordinary screw, neither can it be

Electric Heat Applied to Stereotyping.

[illegible] drier, illustrated herewith. The stereotyping proc- [illegible] minute counts, and much experimenting at great [illegible]



ELECTRICALLY HEATED STEREOTYPER'S MATRIX DRIER.

ducing the time. With the other methods developed to the utmost, the electric method shows a saving in time of from 50 per cent. to 60 per cent.

In addition to the saving in time, the Hadaway matrix drier presents a number of advantages over the older types. The bed which contains the heating element is solid and has no tendency to give like the cored bed. The liability of the bed to explode from excessive pressure is entirely eliminated. Electric heat can be more closely regulated and is absolutely reliable.

The heating element consists of a steel resistance grid embedded and hermetically sealed in fireproof insulation in a heavy bed-plate, immediately below its upper surface. As a result of this construction the surface of the bed-plate attains a very high temperature, and the solid metal below serves as a thermal storage reservoir. The cold form draws the heat very rapidly from this surface, so that the type is very quickly brought to the temperature required to thoroughly dry out the matrix.

The grid is practically indestructible. The fireproof insulation does not deteriorate when continually subjected to high temperatures. It has a high dielectric strength and good heat-transmitting qualities.

This device is manufactured by the Westinghouse Electric and Manufacturing Company.

Forest Surveys in Georgia.

An important step in the general movement to bring many of the rich stands of timber in the South under a scientific plan of forest management is the offer made by the School of Forestry of the University of Georgia, at Athens, Ga., to furnish timber owners experts who will examine and report upon any of the forests in the state. The object of the offer is to collect information in regard to the forest resources of the state, to spread a knowledge of forestry and to improve forest conditions. The forest school will furnish the experts free, and the only expense which will be borne by the forest owner will be paid for the traveling and subsistence expenses of the expert while making the examination.

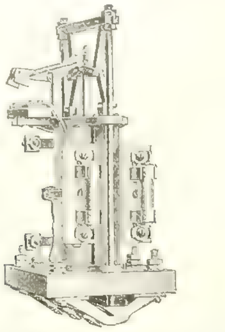
Recent Developments in Remote-control Oil and Air-break Switches.[1]

[illegible]

[illegible] in the use of remote-con[illegible] has developed the [illegible] adapted to a great variety [illegible] primary design was to render the use of current either more safe or convenient, practice has also shown their use to be [illegible]

[illegible] The choice of oil or air-break types depends upon the conditions to be met, and when attemping to define the dividing line the following may be considered:

Extensive [illegible] and actual service have determined that rupturing the arc of an alternating-



NEW REMOTE-CONTROL SWITCH

current system in air is liable to cause surging in the system and consequent dangerous rises in potentials which tend to ultimately break down insulation designed for the normal operating pressure. It has been shown by oscillograph records that the oil circuit-breaker or switch invariably opens an alternating-current circuit at the low point of the wave, or practically at zero current, and for this reason can as a rule be depended upon to introduce no destructive surges or disturbances in the line. The oil type of switch is therefore more suitable for the control of circuits operating at potentials in excess of 1,000 volts than is the air-break type. Again, the oil-type switch is, for given voltages, more compact than the air-break type, a point of considerable importance when the installation space is limited.

Proper Application of Circuit-breaking Devices.—In selecting a type of breaker for any particular installation it is necessary to first determine the ultimate capacity of the installation and the total power which may be supplied to the circuit-breaker from all sources. As a rule a circuit-breaker should be selected whose ultimate breaking capacity is at least as great as the ultimate capacity which may be supplied to it under short-circuit conditions. When considering the ultimate capacity of a system it should be remembered that any source of electrical energy has, under short-circuit conditions, a reserve power greatly in excess of the normal capacity, and the circuit-breaker in addition to being required to rupture the energy of its own particular circuit is under severe short-circuit conditions also called upon to interrupt the entire energy of all that part of the generating system of which its particular circuit is an element.

A long series of tests conducted under actual operating conditions has determined the fact that a circuit-breaker designed and constructed ordinarily to control and open a definite circuit will not necessarily open a circuit of corresponding capacity under short-circuit conditions when the source of energy has a reserve power relatively large in comparison with the normal capacity.

With the above in mind it will readily be seen that the selection of circuit-breakers is a subject requiring careful attention on the part of engineers, although a fixed rule for selecting a breaker having an ultimate capacity equal to the ultimate capacity of the system does not always apply in cases [illegible] stations are tied together [illegible]

In such installations it will be found impossible to concentrate all the energy at certain stations or points in the system, owing to the drop in the [illegible] it is frequently possible to use circuit-breakers which have [illegible] much [illegible] than the ultimate capacity of the sources of power con[illegible]

[illegible] remote-control [illegible] will be found applic[illegible] installation. One [illegible]

toggle and in an open position by gravity, there being no intermediate point in which it can remain.

This switch has been found useful in controlling arc-light circuits operating from sub-stations located some distance from the main station, or from points where an attendant is available. By using a time switch in connection with the remote-control switch the arc lights can be switched on or off at any predetermined time, thus avoiding the expense of a station attendant.

The largest field, however, for the new type remote-control switch is for use in controlling the distribution systems of large isolated plants. If, when first planning an installation, the engineer in charge considers the use of remote-control switches, it will be found that they have a vital bearing on the design of distributing systems, inasmuch as their use permits the engineer to plan his wireways from service entrance to distributing panels without considering the switch outlets, so that the entire building may be supplied with one unbroken feed or its equivalent.

The remote-control switch may be located on panel boards or at any desired points, and may be controlled from as many points as desired by means of flush push-button switches connected multiple to a pair of No. 14 wires.

Reduces Current Consumption.—This method of construction can frequently be made to show a saving of 50 per cent. in copper and conduit over the indirect method of wiring, when arbitrary switch locations are usually a long distance from the natural centers of distribution, as well as offering such a ready method of handling either small or large groups of lights that there is no excuse for wasting current on account of inconvenient switching methods.

Lights Only Burned When Needed.—In one auditorium lighted with an equivalent of 2,000 16-candlepower lamps and controlled by type D-2 switches the contact buttons are located in four points in the hall, one of these points being a keyboard on the speaker's desk. This arrangement has proved so satisfactory that a saving in current is made each year that is at least equal to twice the cost of the remote-control switch equipment.

Motor Control.—The control of small alternating-current motors in vacuum-cleaning plants and automatic refrigerating installations, as well as the thermostatic control of motors in chocolate mixing and other manufacturing processes of a hazardous nature, are problems that are readily solved by the use of remote-control switches.

Fire Protection.—Many times it is desirable to control the entire current supply of a building from a point at which the entrance switch could not conveniently be located; but as a flush push-button or key switch can be located at nearly any point, a system is possible in which the last man to leave the building presses a button, thereby removing all danger of electrical fires as well as preventing waste of current from lights which have accidentally been left burning.

Show-window Control.—A very popular application is that of window-light control, the key switch being located on the outside of the building so that the watchman may extinguish the lights without entering the premises; or, where the distances are not too great, the control of a considerable group of switches by a pair of small wires running direct to the central station.

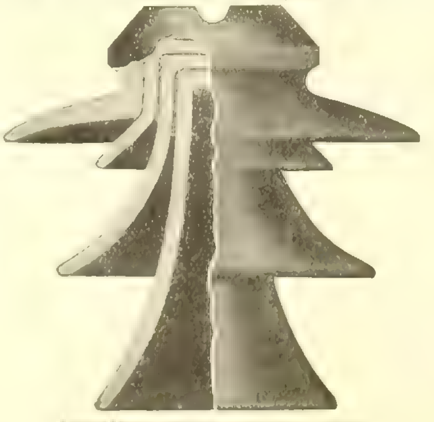
Gas-fired Porcelain Insulators for Transmission Lines.

The insulator, being of vital importance to the transmission engineer who desires to offer to his power users uninterrupted service, is worthy of the best efforts of both engineer and manufacturer.

With this idea in view, as well as that of economy in manufacture, the New Lexington High-voltage Porcelain Company of New Lexington, Ohio, has adopted natural gas exclusively for the kilns in which are fired the insulators for transmission-line service, manufactured by it.

The use of the gas fire is said to benefit the insulator very materially, in two distinct ways.

First, it eliminates from the glaze of the insulator all the impurities which are found there, when the insulator is burned in a coal-fired kiln. There may be a considerable amount of metallic substance in the impurities, but the principal difficulty, according to the New Lexington company, is experienced from the fact that coal contains sulphur, and this is deposited in the glaze of the insulator and causes it to arc over under test at a lower voltage than it otherwise would. After this arcing streaks may be found on the surface of the insulator, which look somewhat like crazing. These marks it is impossible to rub off, and they act as a tell-tale for sulphur in the glaze.



GAS-FIRED PORCELAIN INSULATOR

Second, it can be readily understood that it is much easier to regulate 12 gas burners, by merely turning the valve a little, one way or the other, so that the temperature in all parts of the kiln will be the same, than it is to regulate 12 coal fires to accomplish the same result. Therefore, by using the gas fire a more even temperature is obtained throughout the kiln, and when the insulators are drawn from the kiln they will be of uniform color and vitrification, free from foreign matter, and in general are said to have a cleaner and neater appearance than is possible with the use of coal.

The Iwan Auger.

The accompanying illustration shows the style of the 10, 12 and 14-inch Iwan post-hole auger, which differs slightly in shape from the smaller sizes. This size is of special interest to telephone,

IWAN POST-HOLE AUGER.

electric light, power and railway companies, which require an auger for large holes. The handle of the 12 and 14-inch auger is usually five or more feet long, and it is frequently necessary to start the hole for about a foot with a spade, so as to bring the handle of the auger within easy working height. The 14-inch auger weighs about 24 pounds and takes up about a foot of earth at each filling. While one man can operate this large tool, it is better for two to work it in very stiff soil, and even with the extra man it digs as rapidly as four men could with the old-fashioned spade and telegraph spoon. Iwan Bros. are located at Streator, Ill.

GENERAL TELEPHONE NEWS.

A government telephone line is being constructed to connect Niopet, Wis., with the Menominee reservation.

Commencing June 1st the Northern Pacific Railroad dispatches all its trains between Staples and Dilworth, Minn., by telephone.

The Western Electric Telephone Company of Mason City, Iowa, has acquired the Northern Telephone Company for $15,000.

A telephone system is being installed between Galesburg and Savannah by the Burlington Railroad for the use of its train dispatchers.

The Farmers' Co-operative Telephone Company of New Holland, S. D., has been incorporated with $10,000 capital. J. G. Van Zee is one of the incorporators.

City Auditor McDonald of Toledo, Ohio, is opposing the furnishing of free telephones for the use of various clerks in the city departments. He contends that the amounts so expended by the board of public service is illegal.

Actions have been brought against the American Telephone and Telegraph Company in the United States Circuit Court by Oakes Ames of Milton and Frank W. Breed of Cambridge, Mass. Both cases are based upon the allegation that the plaintiffs have suffered damages through the acquisition by the telephone company of companies in which they were stockholders, viz., the Telephone, Telegraph and Cable Company of America and the New York Telephone and Telegraph Company.

Electric Power in a Table Factory.

The new plant of the Virginia Table Works at Marion, Va., affords many opportunities for a study of modern woodworking plant design. The factory is completely equipped with electrically driven wood working machines, and illustrates the advantages of the electric drive for this class of machinery. This concern manufactures both medium and high-grade hardwood tables exclusively.

[illegible]

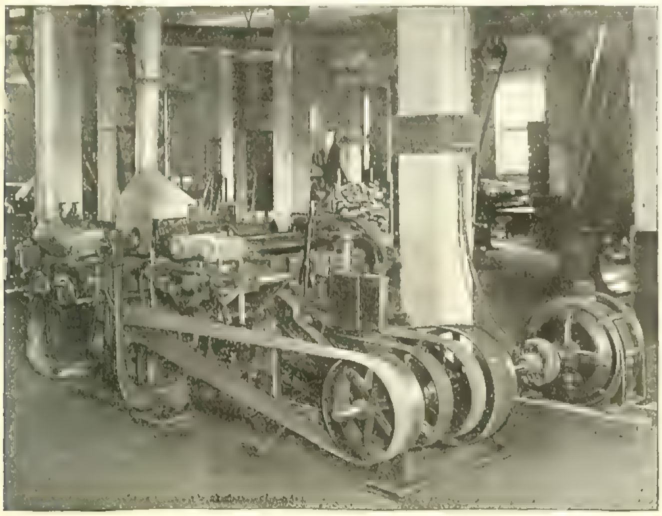


FIG. 1. 20-HORSEPOWER MOTOR DRIVING A NINE-INCH MOLDER

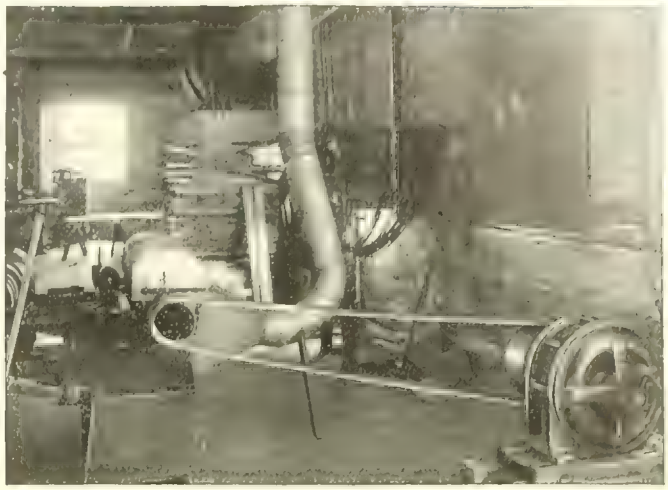


FIG. 2. 10-HORSEPOWER MOTOR DRIVING A TABLE LEG MACHINE

The main building is a two-story structure. All of the machinery is on the first floor. The second story contains the carpenter and cabinet shops, in which the tables are assembled before shipment.

Besides the main building, there are two wings, one a single-story structure containing the boiler room and dry kilns, the other a two-story building containing on the second floor the varnishing and finishing rooms, and on the first floor the offices and shipping departments. The boiler room contains a 60-horsepower boiler, which furnishes low-pressure steam for the heating system and dry kilns. The fuel, consisting of waste material from

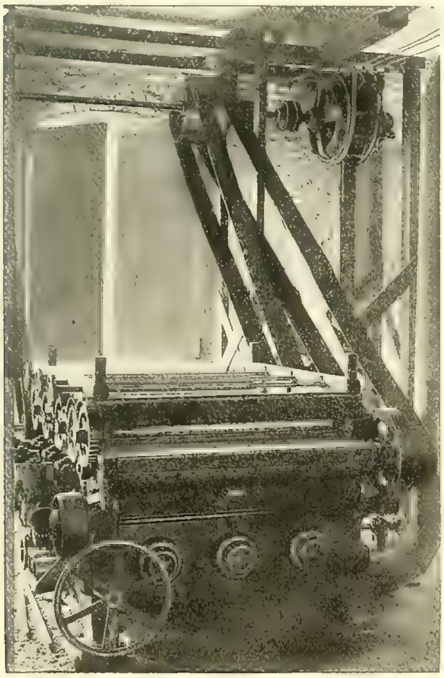


FIG. 3. TRIPLE-DRUM SANDER DRIVEN BY 25-HORSEPOWER MOTOR.

the shops, is conveyed to the boiler room by an exhaust system. The James D. Lalor Engineering Company, Washington, D. C., was the engineer in charge of the design and general layout.

In deciding upon the adoption of the electric drive for this plant many factors were taken into consideration. The initial cost of both the electric drive and the mechanical drive was found to be approximately the same, but when the company learned that power could be purchased from the local lighting company at two cents per kilowatt-hour it figured that with the adoption of the electric drive there would result a large saving in the power cost. This point has been borne out, now

type of motor and the consequent reduction of the fire hazard is also an important point in their favor.

The fact that in this type of induction motor the starting resistance is contained within the revolving member, thus eliminating the separate starting compensator, contributes to a wiring arrangement that is remarkably free from complication. A main switch with the necessary fuses is all that is required. The wiring throughout the plant is done in a neat and substantial manner.

The electrical transmission throughout the mill is at 220 volts; three-phase, 60-cycle alternating current being supplied by the local lighting plant. Although the total generating capacity of this plant

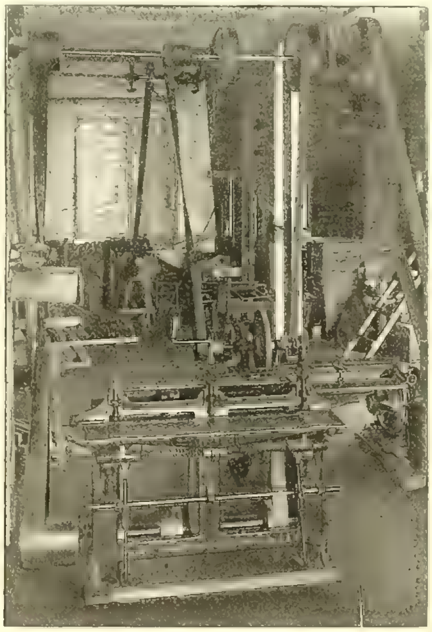


FIG. 4. 10 HORSEPOWER MOTOR DRIVING A GROUP OF NINE SMALL MACHINES.

is only 100 kilowatts, or about 134 horsepower, power is supplied not only to the table works but also to several small factories in the town. While this, of course, can be accounted for by the fact that all of the machines in the different factories are rarely in operation at the same time, still it is an excellent illustration of the inherent reliability and that desirable characteristic of modern electrical machinery, viz., the capacity for temporary heavy overloads.

With one exception the individual drive is used throughout. In many cases the motor is direct-connected by means of flexible couplings either to an extension of the machine shaft or to a countershaft

chines are located to better advantage than would be possible with long line shafting, and the flexibility of control is greater. The president of the concern expressed his views of the electric drive as follows: "We are very much pleased with the motor drive and everything is going along successfully. I do not hesitate to say that I would not change to any other drive I know of, even at much less cost."

Comparative Tests of Carbon, Metallized Carbon and Tantalum Filament Lamps.[1]

By T. H. Amrine.

At the present time there are only three types of incandescent lamps having a wide enough commercial use to make them important factors in incandescent lighting. The first, and by far the most widely used, is the familiar carbon-filament lamp, which in ordinary sizes gives an efficiency seldom exceeding 3.1 watts per candlepower with an effective life of approximately 500 hours. The second type is also a carbon-filament lamp, but the carbon by the process through which it passes in manufacture is given somewhat the characteristics of a metal, and for this reason is called the metallized-filament lamp. The manufacturers have claimed for it an efficiency of about 2.5 watts per mean horizontal candlepower. In the third type the filament is made of the metal tantalum, and there is claimed for it an efficiency of about two watts per candle.

It is the purpose of this bulletin to give the results of tests made upon these lamps in the laboratory of the electrical engineering department of the University of Illinois, with the view of bringing out, if possible, the good points of each lamp, together with any other facts that will help in the selection of the proper type for any particular purpose. Especial care was taken throughout all the work to make the conditions under which the tests were conducted exactly the same for each type of lamp in order to have a fair basis of comparison between types. Although comparative rather than absolute results have been particularly striven for, it is felt that dependable quantitative values have been obtained.

Summary.

As a summary, it might be well to consider separately the three lamps and compare them with respect to the following considerations:

1. *Efficiency.*—In the matter of efficiency alone, this test, as well as all other tests which have been made with these lamps, shows conclusively that the metallized lamp is much superior to the carbon, and the tantalum is as much superior to the metallized. The difference between 3.1 watts per candle and 2 watts per candle, about 28 per cent., is sufficient to outweigh almost all other considerations.

1. This is part (opening paragraphs and summary) of a bulletin of the University of Illinois Engineering Experiment Station, dated September, 1907. The author is first assistant at the Experiment Station. For some reason the tungsten lamp is not included.

[illegible] candlepower [illegible] of 22.5 [illegible] lamps [illegible] be operated with [illegible] 16-candlepower [illegible] power plant which [illegible] overload of carbon lamps would, if the carbon lamps were exchanged for the same number of candlepower of the newer lamps, be operating at about normal load with the consequent advantages. In the same way a method is provided to lighten overloaded feeders without any decrease in the candlepower of light furnished.

2. *Cost of Operation.*—The curves show that upon well-regulated circuits each type has a field of its own within which it is the most economical. For very low costs of power the carbon lamp gives the best economy. Hence, particularly for persons who generate their own current, it would not pay to change from carbon to the higher efficiency lamps, because in this case either the cost of power is low or else the fuel bill, the only item in which there would be a saving by using high-efficiency lights, is not large compared with the other expenses, such as attendance charges, taxes and interest. When the cost of energy is high, as it is in most cities, the tantalum lamp would be the best to use. The metallized lamp seems to be restricted to rather narrow limits of power cost and to good operating conditions. The newer types of lamps would have a great field in lighting railroad trains and steamships, where the cost of power is always high, if filaments were robust enough to withstand the shocks and vibrations that are usually present. It seems that it might be possible and advisable for manufacturers to develop series tantalum lamps for this purpose. The filaments that would be used in a series lamp would no doubt be strong enough to withstand the vibrations and jars found in this service, and their economy of current consumption would make them much preferable to the carbon lamp.

3. *Maintenance of Candlepower and Efficiency.*—In regard to maintaining candlepower and efficiency, the newer lamps make by far the best showing, the two being almost the same in this respect. The metallized and tantalum lamps have a drop of, respectively, 20 and 19 per cent. in candlepower in 1,000 hours under condition A, while the carbon drops 32 per cent. in the same time and under the same conditions. The change in efficiency for the three lamps is in about the same proportion. [Condition A represents best conditions under steady, well-regulated voltage from storage battery; condition B means adverse conditions under badly fluctuating alternating current.]

4. *Life.*—Comparing the lamps upon the basis of average life to 80 per cent. of the original candlepower, which is standard for the carbon lamp, the following results are obtained:

Condition.	Life in Hours		
	Carbon	Metallized.	Tantalum
A	400	[illegible]	820
B	225	350	50

This method of comparison is, if anything, unfair to the higher efficiency lamps, because, owing to their higher first cost, the smashing point should be after the lamps have reached a candlepower considerably less than 80 per cent. of the original. It serves, however, to show the superiority of the newer lamps in this respect.

5. *Quality of Light.*—The quality of the light from the metallized and tantalum lamps is much the same, both being considerably whiter, softer and more pleasing to the eyes than that of the carbon lamp. Being a whiter light, the newer lamps show more nearly the true values of colors than the carbon lamp, and hence are superior for lighting dry-goods and clothing stores, art and picture galleries and other places in which colors must be judged. The intrinsic brilliancy of the three kinds of filament is approximately:

Carbon, 140 candlepower per square inch.
Tantalum, 165 candlepower per square inch.
Metallized, 190 candlepower per square inch.

On account of the great intrinsic brightness of the [illegible] filaments, particularly the metallized, it is not advisable to use these lamps for [illegible] lighting when they are placed low enough to [illegible] unless they are provided with [illegible] globes.

6. *Distribution of Light.*—The distribution of the carbon and metallized lamps is so nearly identical as to admit of little choice between them in this [illegible]

[illegible]

downward distribution by placing the greater part of the filament horizontal, as has been done in many of the "downward-light" lamps on the market, is an inefficient method. It is true that these lamps throw the maximum of their intensity further down from the horizontal than an ordinary lamp, but in so doing just as much light is thrown upward, where it is mostly lost in the base, and on the ceiling by absorption and improper reflection. To get light where it is needed, and do it most efficiently is accomplished by mounting the filament so that as nearly as possible the entire length of it is parallel to the axis of the base, and then using good reflectors. The tantalum lamp meets this requirement very well, as is shown by its low-tip candlepower, which indicates a small loss of light in the base. The intensity at angles, even up to 30 degrees from the tip, is low in this lamp. The same condition would be shown at the base if the distribution were not changed by its presence. Near the base all light that has its course changed downward by reflectors must strike the reflector at a large angle. This, of course, is a condition that favors absorption and losses. With the tantalum the radiation in these unfavorable directions is less than in the other two, and is superior for that reason if reflectors are used. When the lamps are used bare, the carbon and metallized give a greater candlepower downward where it is generally needed than does the tantalum lamp.

7. *Susceptibility to Voltage Variation.*—For use upon poorly regulated feeders or at the end of long feeders that are sometimes heavily loaded, the metallized and tantalum lamps will make a much more uniform and pleasing light than the sensitive carbon lamp.

8. *Ability to Withstand Rough Usage.*—It is in this particular that the carbon lamp stands supreme. Long experience in making them has enabled the manufacturers to make a carbon filament that will withstand almost any reasonable usage. The filaments of both the metallized and the tantalum lamps are easily broken, especially after they have been burned for a while. The filament of the former is so fine that jars such as would be caused by screwing the lamp into or out of the socket sometimes make the two halves of the filament cross each other near the top. This short-circuits about one-third of the filament, and if the current is turned on, the lamp then burns at about three times the normal candlepower. This, of course, greatly reduces the life of the lamps if the filaments are not separated. They may be shaken apart by tapping the lamp, but usually not before the filament has been materially weakened by burning at the high candlepower. The filament of the metallized lamp is easily set to vibrating in an annoying manner. Often while working with them the vibration of the filaments was such that the flicker was easily seen on a piece of white paper at a distance of four or five feet from the lamp. It was only in some positions about the lamp that this was noticeable, but in these positions it was very pronounced and disagreeable. It seems to be caused principally by the reflections from the bulb of the lamp. The motion was in this way magnified. No such effect could be obtained from the carbon or tantalum lamps. The carbon filaments were stiff enough to resist the vibrations, and the way in which the tantalum filaments were mounted prevented any vibration in them.

CONCLUSION.

From the study of these lamps it appears that the carbon-filament and the tantalum-filament lamps can cover adequately all the phases of incandescent lighting that are now covered by the three types. For low power costs and for rough or unusual uses and for small candlepower units the carbon lamp is best, and often the only one that can be used. For higher costs of power upon poorly regulated circuits and for lightening the load upon overloaded stations the tantalum lamp is best. It is not recommended by its manufacturers for use upon alternating current, yet the results obtained show that although it does not do so well upon alternating current as it does upon direct-current circuits, it still gives better economy for the higher power costs than the carbon lamp. The principal fault of the metallized lamp is that of mechanical weakness, which probably does not exist in the larger sizes, where a heavier filament is used, so that for units of 40 or 60 candlepower or above this type of lamp is very satisfactory.

Georgia Electric-railway Project.

For the purpose of securing $[illegible] bonds the Atlanta (Ga.) and Carolina Railway Company, proposing to build an extensive electric railway, has filed a deed of trust with the clerk of the court in [illegible] Company and [illegible]. The deed includes all franchises [illegible] to be erected, including [illegible] the Atlanta and Carolina Construction Company filed a deed conveying its franchises and rights to the Atlanta and [illegible] Railway Company.

CORRESPONDENCE.

Continental Europe.

Paris, May 23.—At the annual spring exhibition of the Société de Physique at Paris there was to be seen a number of apparatus of interest. One of these was the new Abraham rheograph for projecting current waves upon a screen. The instrument which was here shown gave a very clear view of the waves which were taken in the present case from the city mains. It was constructed by the Carpentier establishment, which also showed a galvanometer of the Abraham type for measuring very small currents; also an induction coil, which was one of the attractions of the show, as it is no doubt the largest which has been built as yet in France. It gives a 50-inch spark and is constructed on the Klingelfuss method, with flat spools. A coil which was built in Switzerland on this principle gave a 60-inch spark. The present induction coil weighs 770 pounds without the condenser. The same establishment showed a pair of photo-telegraphic instruments on Dr. Korn's principle, which were in working order. The Belin and Carbownelle apparatus were also to be seen.

An electric forge system has been applied very successfully in one of the mines at Transvaal, known as the Village Deep Mine. Heretofore the tools had to be sent up to the surface in order to be put into shape, and this operation is quite frequent. Besides, the local blacksmiths had not the necessary skill for handling the tools and often injured the steel in the heat. The difficulty was overcome by installing a number of electric forges within the mine itself, so that the tools no longer need to be sent to the surface. The new system has proved to be a valuable one in many ways, as the heat can be very well regulated and the operation is economical. The metal is not injured by the heat in this case.

In Dalmatia there has been erected a hydraulic plant of some size at Manoilovac. A good part of the current is used in the large calcium carbide factory, which is located at Sobenico. Power is secured from the Kerka River, on which a 110-meter fall is secured. The water is taken off by an underground flume about a mile long to a settling basin, and from this four penstocks lead to the same number of turbines. The latter are of the Francis type and are rated at 6,000 horsepower, making a total of 24,000 horsepower for the plant. Three-phase alternators are coupled to the wheels, and these machines are designed to give 30,000 volts directly. The pole line running from the station is about 20 miles long, and it leads to the carbide plant, where most of the current is used for the furnaces. Here are located 12 single-phase transformers which give a current of 50 volts for the plant. At present there are 24 carbide furnaces running, but during the present year eight new furnaces are to be erected, and for this purpose the hydraulic plant will have new machines added so as to bring its capacity up to 30,000 horsepower. At present the furnaces are turning out 35 tons of carbide per day. The electrical apparatus is furnished by Ganz & Co. of Budapest, and the entire plant is owned by the Dalmatian Hydraulic Power Company of Trieste.

It is proposed to adopt the electric system upon a number of railroads in Bavaria, in the regions of Augsburg and Munich. The single-phase system will be employed, using electric locomotives as well as motor cars. Current will be obtained from different hydraulic plants in the region. A. DE C.

New England.

Boston, May 30.—The bill to permit the Boston Elevated Railway Company to acquire the ownership of the West End Street Railway Company, heretofore operated under a lease by the Elevated, which had 14 years to run, has passed the State Legislature and was signed this week by the executive. This will involve the issue of new capital by the purchasing company amounting to $6,400,000 preferred and $9,689,250 common, this being the outstanding capital of the West End company. The Boston Elevated company's capital authorized previously was $15,000,000, of which $13,300,000 is outstanding. There are also $11,000,000 debentures authorized, of which $7,500,000 have been issued. The estimated saving to the Boston Elevated by the transition from lease to consolidation is $300,000 annually, or about two per cent. on its stock.

The Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers has elected officers as follows: President, F. A. Spencer, '08; vice-president, J. M. Harvey, '09; secretary-treasurer, W. D. Stearns, instructor; executive committee, Prof. H. B. Smith, C. F. Putnam, '09, and R. G. Gold, '10. During the year 14 meetings were held with an average attendance of 115.

American Telephone bonds have been given an uplift by the action of the Massachusetts Legislature in making them a legal investment for savings banks of the state.

The Massachusetts Highway Commission, which has supervision over telegraph and telephone companies in their use along the highways, has been granted an appropriation of $20,000 to cover the

[illegible]

[illegible] ing, on the 24th of the month, and the club will make a trip to [illegible] E.

New York.

New York City, May 30.—[illegible] Transit Company [illegible] with the city for the [illegible] the East River at Forty-second Street. E. P. Bryan, president of the company, [illegible] two ago to Chairman Willcox of the Public Service Commission, pointing out that the Frawley bill had conferred power on the commission to consider the matter, and asking him to discuss the matter on the basis of [illegible] February. This suggested that the city should pay the builders of the tunnel about $7,230,470 [illegible].

It was also proposed that the city should undertake the operation of the tunnel in connection with the New York and Queens County Railway Company, the surface lines of which communicate with the tunnel. The expenses of this would, it was suggested, be arbitrarily fixed and divided between the city and the company. One five-cent fare was to be charged from Forty-second Street to any point on the lines of the Queens County road.

Orders were issued yesterday by the Public Service Commission to the New York Central to increase materially its local Bronx service. Twenty-three northbound trains instead of 16 will now stop at all important stations in the Bronx, and 24 instead of 15 southbound.

An offer has been made by the Interborough Rapid Transit Company to the Public Service Commission to construct, equip and operate a railroad between Fulton Street and Flatbush Avenue, Brooklyn, and Canal Street, Manhattan. The line would run for about three-quarters of a mile as a subway under Flatbush Avenue and its extension, and would emerge to the street level at the Manhattan Bridge Plaza at Nassau and Sands streets. It would cross the Manhattan Bridge on the lower tracks, and would then become an elevated line, joining with the Third Avenue road. The company would charge only one fare of five cents from Atlantic and Flatbush avenues over the new road to any station on the Manhattan Elevated lines. The road would have two tracks, and would, it is asserted by the Interborough officials, save a great deal of time for Brooklynites wishing to reach the financial parts of the city. This proposal conflicts with the proposed Fourth Avenue Subway plans. It asks for two of the tracks over the Manhattan Bridge, which would have been used for the Fourth Avenue plan, and then takes the streets of the first and part of the second sections of the Fourth Avenue line.

The construction of a subway from the Williamsburg Bridge to Lafayette Avenue, Brooklyn, the building of another tunnel under the East River at Beekman Street, and the diversion of the proposed Broadway and Lexington Avenue line so as to take in the Centre Street loop line, were some of the schemes proposed yesterday to help the Public Service Commission to find a way out of the difficulty in which it finds itself.

The Brooklyn Rapid Transit Company has refused to operate the loop subway line along Centre Street from the Williamsburg Bridge to Brooklyn Bridge, and the commission finds itself saddled with two expensive links in a transportation line which leads nowhere. While Brooklyn is clamoring for transportation facilities and the city declares it cannot find the money to build them, the commission has the Williamsburg Bridge and the Centre Street loop without proper connections for relieving the situation.

The plan projected by the old Rapid Transit Board was for a loop line connecting the two bridges on both sides of the East River. On account of the expense it was decided to construct the Manhattan end first, and during the consideration of the scheme it was always assumed that the Brooklyn Rapid Transit Company would operate this portion of the line as a part of its regular Brooklyn service. Controller Metz said a few days ago: "If the Brooklyn Rapid Transit is not willing to operate the loop, the city has spent $9,000,000 for a lemon, and we are so much in a hole. The only solution is to build the Broadway-Lafayette Avenue loop in Brooklyn. If we had built the elevated loop it would have been running now, and the Brooklyn Bridge problem would have been solved." W.

Indiana.

[illegible] Louisville and Indianapolis Traction Company con[illegible] and Springfield Traction Company, has interested [illegible] Berry of Spencerville, in the proposed extension of the company's road from Decatur to Lima, Ohio, [illegible].

Limited through service from Bluffton to Indianapolis has been inaugurated by the Indiana Union Traction lines. This gives a limited service [illegible] Fort Wayne [illegible] Wabash Valley Traction Company at the same time put on limited cars between Bluffton and Fort Wayne. There will be five trains each way a day, which is deemed amply sufficient to compete with the Lake Erie steam line.

The Winona Interurban Railway Company claims to be the only line in the world that does not run cars on Sunday, and whose receipts are used exclusively for educational purposes. With two exceptions the officers serve without pay. The business done on this system equals that of any other system in the state in proportion to mileage. When completed the investment will amount to over $2,000,000, with a capital stock of only $16,000. Its bonded debt amounts to from $21,000 to $26,000 per mile. H. J. Hitz of Pittsburg is president and the Rev. S. C. Dickey general manager.

The Poseyville Light and Power Company has filed articles of incorporation and proposes to construct an electric-light plant in Poseyville. The capital stock is $10,000 and the directors are headed by Frank K. and August Seib.

The United Gas and Electric Company of New Albany has broken ground for the erection of a large plant to be equipped with modern machinery for producing and distributing gas and electricity for heat and power purposes.

The public-utility companies of Indiana have had their taxes reduced to the amount of $1,250,067 less than last year. The principal reduction was made in the assessment of properties of telegraph companies, due to a decrease in the earnings alleged to be due to telephone competition. The interurban railway companies, with the exception of the Fort Wayne and Wabash Valley Traction Company, were given a reduction. S. S.

Illinois.

Peoria, May 30.—There is a report that the Cincinnati, Hamilton and Dayton Railroad, between Decatur, Ill., and Indianapolis, Ind., is to be converted into an electric road. Certain interests were planning the building of an electric road to parallel the steam line, and this is said to have been the cause of a good offer to the promoters of the electric line to purchase the steam road.

The Illinois Traction Company will remodel the old car barns on Monroe Street in Springfield, converting them into an interurban passenger and freight station. At the rear of the station commodious repair shops will be built to take care of the repairs that will have to be made locally.

A first mortgage, given by the Chicago, Ottawa and Peoria Railway Company, has been filed for record at Streator. The mortgage is given to the Central Trust Company of Chicago, and makes the trust company trustee for $5,000,000 five per cent. bonds to be issued by the company. This precedes the building of the line to Streator by the Illinois Traction System, of which the company is a part.

The building of a power plant at Michigan City by the Chicago, Lake Shore and South Bend Railway is understood to mean the running of the cars of the company to Niles, along the route of the Michigan Central, and the ultimate building of the line into Kalamazoo, Mich. The plant will cost $1,000,000 and will be able to furnish more power than will be required to operate the present line of the company between Chicago and South Bend.

One result of the local-option law is seen at Virden, this state, where the city is unable to meet the bill of the local lighting company for street lighting, amounting to $300 per month. The local business men will be taxed to pay for the lighting, according to a meeting held by the Commercial Club.

The People's Mutual Telegraph Company of Chicago has been incorporated with a capital of $25,000. The declared purpose is to do a general telegraph business. The incorporators are Walter F. Sommers, Michael Feinberg and Sol Salins.

The Milford Telephone Company of Milford, with a capital of $25,000, has been incorporated by C. H. Dawson, A. J. Hall and M. F. Dawson. V. N.

[illegible]

[illegible]

The survey of the proposed Des Moines and [illegible] Sioux City, Iowa.

[illegible] Falls, Minn., has offered to furnish Brainerd, Minn., with electricity.

It is proposed to consolidate the electric power plants of the Yellowstone Valley and Southern [illegible] River Power Company from Madison River Valley to the Dakota state line. R.

Pacific Slope.

San Francisco, May 27.—The Palace Hotel Company has awarded the contract for the electric wiring, etc., for the new eight-story hotel to the John G. Sutton Company of San Francisco. It is understood that the wiring job alone was taken for less than $50,000, but that the work of installing the temporary electric power plant, which is to be used while the building is being completed, will increase the total contract price to about $60,000. This includes, also, 170,000 feet of conduit, switches and receptacles for lighting, as well as wiring for telephone and fire-alarm systems. Charles C. Moore & Co. were awarded the contract for the steam-boiler plant and the installation of piping and auxiliaries, etc., for $49,900. The Westinghouse Electric and Manufacturing Company took the contract some time ago for two large direct-current generators for the plant. Oil fuel is to be used throughout the power plant.

The much mooted ordinance regulating the rates of the Pacific Telephone Company in San Francisco during the coming fiscal year has been passed to print by the board of supervisors by a vote of 15 to 1. Supervisor Murphy presented figures purporting to show that the proposed rates would allow the company about nine per cent. on an investment of $6,818,692.

The Telluride Power Company has filed a $10,000,000 trust deed with the county recorder at Salt Lake City, Utah, and will begin extensive improvements to its system in Utah, Colorado and Idaho.

Bids will be received till June 15th by the city clerk for the furnishing and placing of ornamental iron posts and installing lights and wires along the ocean-front walk between Pier and Hollister avenues, Santa Monica, Cal.

The Washington and Oregon Traction Company has secured rights-of-way for a power house, flume and water privileges on the south fork of the Walla Walla River, near Walla Walla, Wash., and will build a 5,000-horsepower plant.

The City Council of Santa Cruz, Cal., has taken preliminary steps for bonding the city for $100,000 for the expansion of the electric-lighting system and other purposes.

The Big Bend Light and Water Company has made application for a franchise to install an electric-lighting plant at Whitefish, Mont.

Work will begin shortly on altering and completing the municipal street-lighting system of Pasadena, Cal. Manager C. E. Koiner has charge of the work.

A deed of trust has been made of all the properties of the San Francisco, Oakland and San Jose Consolidated Railway Company to the Union Trust Company of San Francisco to secure a bond issue of $3,000,000. The money will be used to extend the system. The entire bond issue was for $7,500,000, of which $4,500,000 will cover the old Key Route bonds.

Advices from Long Beach, Cal., state that the Pacific Electric Company intends to extend its line from Long Beach to San Pedro over a private right-of-way along Long Beach harbor and Commercial Street.

Reports from Santa Ana, Cal., stated that the Southern Pacific Railroad Company will electrify its line between Santa Ana and Newport Beach and that the Southern Pacific and Pacific Electric companies will build a union depot at Newoprt. A.

President W. Jordan Massee of the Central Georgia Power Company was recently authorized to issue $30,000,000 stock and $16,000,000 bonds, and work on the big dam at Ocmulgee River is well under way.

PERSONAL.

Mr. [illegible] with the Common [illegible] in its inspection department, is now [illegible] of the electrical department of the Sanitary District of Chicago.

Vice-president C. E. Corrigan of the National Metal [illegible] Company of Pittsburg, Pa., was entertained at the Chicago South Shore Country Club last week by President Lemuel Cushing of the Illinois Electric Company.

Mr. N. C. Draper, general manager of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., has resigned to accept a position with the Ohio Electric Railway Company, with headquarters at Zanesville, Ohio.

Mr. Milton Hartman, well known in incandescent-lamp circles, has taken the sales management of the tungsten-lamp-fixture department of the Brilliant Electric Company. This is a new department being organized by the Brilliant company to push the new tungsten unit.

Mr. H. H. Kellogg, manager of the Antioch Electric Company, Antioch, Ill., was a visitor in Chicago last week. The Antioch company's plant, which is said to be the only gas-producer plant in Illinois, recently began supplying current for Antioch and vicinity and is meeting with success.

William H. Hubbard, formerly associated with Alexander Graham Bell in the early tests of the telephone, and said to have been one of the first men to hear the human voice over the telephone, died at his home in Lake Forest, near Chicago, on June 1st. He was a native of Chicago, born in 1858, and was well known among scientists.

Mr. O. A. Rochlitz, who has been connected with the chemical department of Armour Institute of Technology for seven years, about half of which time as associate professor of chemical engineering, has resigned this position to follow commercial pursuits. He has established an office in the Merchants' Loan and Trust Building as the representative for the Chicago district of the H. N. Strait Manufacturing Company, E. Keeler Company and Weinman Machine Works. These concerns manufacture various types of steam power-plant equipment.

The president of the British Board of Trade has appointed a committee consisting of Mr. G. R. Askwith, K. C., Sir John Gavey, Kt., C. B., Dr. R. T. Glazebrook, F. R. S., Major P. A. MacMahon, F. R. S., Major W. A. J. O'Meara, R. E., C. M. G., and Mr. A. P. Trotter to prepare a programme for the consideration of the delegates to the International Conference on Electrical Units and Standards, to be held in London next fall, and to make arrangements for the reception and assembly of the delegates attending the conference. Mr. M. J. Collins, of the Board of Trade, will act as secretary to the committee.

ELECTRIC LIGHTING.

The city of Carthage, Tenn., is considering the installation of an electric-light plant.

Amite City, La., will rebuild the electric-light plant recently destroyed by a tornado.

W. A. Erwin contemplates installing an electric-light and gas plant in Franklinton, La.

The Navasota (Tex.) Light and Power Company has been incorporated with a capital of $20,000.

The General Electric Inspection Company of St. Louis has been incorporated with a capital stock of $50,000.

The Glendora Light and Power Company has been incorporated in Glendora, Cal., with a capital stock of $20,000.

The Consumers' Company of Cœur d'Alene, Ida., has sold its electric-light and power plant to the Kootenai Electric Company.

City Electrician Bleidt of Little Rock, Ark., is preparing plans for a [illegible] electric-light plant. It will have a capacity of 750 arc lights, with a 450-horsepower steam turbine.

[illegible] Dayton, Fla., has [illegible] the system which may [illegible] with a new electric [illegible] planned recently.

ELECTRIC RAILWAYS.

At a special election in Sioux City, Iowa, an [illegible] to the Sioux City Traction Company was defeated by a [illegible]

[illegible]

light instantly. A number of interurban men have examined the model and say it is practicable.

Articles of incorporation have been filed at Helena, Mont., by the Stillwater Power and Railway Company. The capital stock is $3,000,000, and the incorporators include Willard Bennett of Helena, George H. Savage, E. E. Congdon and W. E. Dufresne of Butte. The company is organized to develop the waterpowers on the Stillwater River and also to build an electric railroad from Billings, Columbus and other points into Cooke City. Other stated purposes of the corporation are to furnish electrical power for all kinds of mechanical and manufacturing purposes, to produce, lease and sell waterpower and to supply water and electriicty to the public.

SOCIETIES AND SCHOOLS.

About 140 graduates of Armour Institute of Technology gathered for the semi-annual alumni banquet at the Grand Pacific Hotel on June 1st. The principal addresses were by Bion J. Arnold, Dr. William A. Colledge, W. J. Gordon, '99, W. S. Taussig, '03, and R. A. Calkins, '97. Prof. E. H. Freeman was elected president of the alumni association for the coming year.

The National Fire Protection Association recognizes that a practical means for the conservation of the natural resources of the country is to be found in the restriction of the destruction of property by fire. Therefore it recommends state legislation enabling communities to make proper provision for the supervision and control of building construction and installation of adequate fire protection and prevention measures. It also urges existing authorities to greater care in fire protection.

Armour Institute of Technology will open its regular six weeks' summer session on June 22d. Courses are offered in electrical engineering, chemistry, physics, practical shopwork, mathematics and drawing. In the electrical department seven regular and 11 special courses in electrical engineering are offered, as well as two courses in telephone engineering. The civil engineering camp for field practice in surveying will be located at Pemene Dam, Wis. This work will begin on June 10th. Further details in regard to any of this summer work can be had by addressing Dean H. M. Raymond, Armour Institute, Chicago.

PUBLICATIONS.

The Silvey electric locomotive headlight is described and illustrated in an attractive pamphlet issued by the Dayton Manufacturing Company, Dayton, Ohio.

The Electric Traction Weekly will move its publication offices from Cleveland, Ohio, to Chicago, with offices in the Manhattan Building, on June 12th. The first Chicago issue will be mailed from Chicago on June 18th.

The Triumph Electric Company of Cincinnati, Ohio, has prepared for distribution among those interested a convenient folder containing concise directions, symbols and formulæ for testing polyphase induction motors. The principal tests referred to are for motor characteristics, short-circuit test, no-load and service tests, heat and insulation tests.

The Fort Wayne Electric Works has just issued four interesting publications. One describes a convenient meter-reading book for maintaining permanent records in central stations. Another treats of Fort Wayne fan motors which are so largely used. Bulletin No. 1106 describes the company's interesting line of standard direct-current switchboard panels for small stations. The fourth is a valuable instruction book on Fort Wayne series alternating-current arc systems.

The Electric Storage Battery Company of Philadelphia has issued bulletin No. 109, bearing the title "Sale of Current for Electric Automobiles by Electric-light and Power Stations." The subject of charging automobile batteries has become one of much interest to central stations as presenting a field for new business, and the new bulletin contains exceedingly interesting data on this subject and includes matter of much value to those interested in automobiles or the sale of current.

A neatly printed testimonial booklet, "Vox Populi," issued by the Wagner Electric Manufacturing Company of St. Louis, contains 46 pages of praise for Wagner motors by satisfied users. The company has in the past made claim for certain points of superiority for its motors and feels that the testimonials prove such claims. Today the line of Wagner single-phase motors is complete as to size, speed, etc. Those interested can get a copy of the booklet by writing to the company.

A very interesting booklet entitled "Glimpses of Modern Belt Making" has been published by the Graton & Knight Manufacturing Company of Worcester, Mass. The different processes which convert a hide into leather and leather into belting are carefully described, and there are excellent illustrations of the different processes. Some valuable mechanical rules and data regarding belting and its use are given. This company's first tannery was built in 1867 and the plant has steadily grown to one of the largest and most complete in the world, with a capacity of over 200,000 hides a year.

MISCELLANEOUS.

More than seventeen million pounds (17,211,000) of metallic aluminum were consumed in this country during last year, according to Mr. W. C. Phalen of the United States Geological Survey, whose statistical report on the production of aluminum and bauxite has just been published. This is an increase of 2,301,000 pounds over the consumption in 1906.

The secretary of Public works of Mexico has let the contract for the equipment of the government wharves at the port of Tampico with electric cranes. The machinery has been purchased in Germany. The electrical energy will be supplied by the Compania de Fuerza Electrica de Tampico. It is reported that the government has in contemplation the providing of similar equipment for the other ports of the country.

It is stated that more than 12,000 horsepower of electrical machinery has been installed in the El Oro (Mexico) mining camp during the last two years. All of the principal mines of that camp are now equipped with electric power. The Veta Colorado Mining and Smelter Company, situated near Parral, state of Chihuahua, has installed more than 50 motors, with a capacity aggregating nearly 2,000 horsepower, to operate its cyanide plant and milling and mining machinery. It is said to be one of the most modern electrically operated mines in Mexico.

TRADE NEWS.

The Allis-Chalmers Company has opened an office at Birmingham, Ala., in charge of Mr. Seldon Jones, as district manager, rooms 319-320 First National Bank Building. Inquiries regarding the varied line of machinery manufactured by the company will be promptly attended to at this address.

The supervising architect, Washington, D. C., will receive sealed proposals until July 7th for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the post-office at Iola, Kan., in accordance with drawings and specification, copies of which may be had from the custodian of the site at Iola, or at the above office.

Just from the pen of the advertising artist of the American Carbon and Battery Company of Signal Hill, East St. Louis, come two neat little folders entitled, respectively, "Do You Know?" and "Brush History." Without going into details, these pamphlets are comprehensive in their character as advertisements of the carbon brushes of the American Carbon and Battery Company. It is plain to see, too, from its literature that this company is now making an aggressive campaign to secure its share of the carbon-brush business of the United States. A recent visit to the plant of this company revealed the fact that the American Carbon and Battery Company is in an excellent position to make satisfactory carbon specialties. The carbon brush which the company is now pushing most energetically is known as the "American Street Railway Brush."

BUSINESS.

The Chicago Fuse Wire and Manufacturing Company, Chicago, the well-known manufacturer of "Union" outlet and switch boxes and "Union" enclosed fuses and blocks, announces a constantly increasing business. It says that its fuses have been subjected to most rigid tests by the National Board of Fire Underwriters. "Union" enclosed fuses and blocks are approved by the Underwriters' Laboratories and the Mutual Laboratories of Boston and recommended by the National Board of Fire Underwriters. Each fuse is tested before leaving the factory, assuring accuracy as to reading. The fuses are carefully manufactured and all the parts are made from dies which cannot vary 0.001 inch. The Chicago Fuse Wire and Manufacturing Company has just issued a new catalogue, which it will be glad to send to those interested.

DATES AHEAD.

Canadian Electrical Association (annual convention), Toronto, Ont., June 10th, 11th, 12th.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

Michigan Electric Association (annual meeting), Grand Rapids, Mich., August 18th to 21st.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay Island, August 25th, 26th and 27th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) [illegible], 1908.

888,436. Dynamo-electric Machine. [illegible] Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed October [illegible].

[illegible]

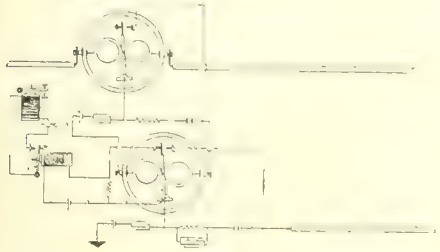
888,483. [illegible] Kirkland, [illegible] Clyde [illegible], Kirkland [illegible]. Application filed October 16, 1907.

[illegible] at its lower edge [illegible] upon the plate, [illegible]

888,497. Telephony. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed April [illegible], 1904.

Means for [illegible] consist [illegible] the line of [illegible] to the ground. One of the [illegible] the one part [illegible] effect at the second part.

888,500. Cable Telegraphic System. Isidor Kitsee, Philadelphia, Pa. Application filed December 17, 1906.



NO. 888,500.—CABLE TELEGRAPH.

In combination with a cable is a relay, a second relay controlled thereby and included in circuit with a condenser and a battery, and a shunt across the break of the first relay including a high resistance and a battery. (See cut.)

888,510. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed August 9, 1906.

This system operates by reversals. A localized commutating device is operatively related to the receiving device to make operative a translating device through one of the impulses received and make it inoperative through the second of the impulses received.

888,511. Duplexing Telegraph Lines. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed August 9, 1906.

Means to nullify the effect of the signaling current on the home instrument embrace an inductorium, a source of current for the primary, a movable auxiliary coil for the receiving device and means to connect this coil to the secondary of the inductorium.

888,514. Armature Winding for Electrical Machines. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed August 17, 1904.

A winding for polyphase electrical machines consists of coils that are divided into a number of groups for each phase of the current, the sides of the coils of each group alternating in position with the sides of the coils of other groups.

888,517. Rheostat. Seth A. Leonard, Cleveland, Ohio. Application filed June 17, 1907.

Separate sets of resistance units are electrically connected and have relatively greater conductive capacities increasing successively from one set to another. A rotating switch is connected in parallel with each unit of each set and arranged to switch in the units from the first to the last successively until all are in circuit in parallel.

888,521. Shade Attachment for Electric Incandescent Lamps. Albert F. W. Meyer, Chicago, Ill., assignor to James H. McGill, Valparaiso, Ind. Application filed June 6, 1906.

A combined sheet-metal base and socket shell is corrugated to provide an exterior and interior thread. Means for securing the lamp shade to the socket comprise two insulating rings, each screwed on to the outside thread of the socket and clamping the shade therebetween.

888,533. Igniter Rod for Gasoline Engines. Robert J. Rennie, Mooers Forks, N. Y. Application filed July 26, 1907.

An igniter rod carries an igniter finger and a contact bar in an extensible relation thereto. There are means for holding the bar rigidly to the rod at different extended positions.

888,540. Photographic Print Apparatus. William E. Sinclair, Chicago, Ill., assignor to the Haller Machine Company, Chicago, Ill. Application filed September 10, 1904.

The apparatus contains a traveling, counterweighted electric lamp retarded by a fan governor and appropriate switching mechanism.

888,557. System of Electrical Control. Hermon L. Van Valkenburg, Pittsburg, Pa., assignor to the

[illegible]

888,5[illegible]. [illegible]

[illegible]

888,5[illegible]. [illegible] W[illegible]

[illegible]

888,609. Pliers. [illegible], Illinois(?), [illegible] Atchison, Kan. Application filed February [illegible], 1908.

These pliers are provided with special recessed insulation cutters.

888,611. Spark Coil. John O. Heintze, Jr., Lowell, Mass. Application filed March [illegible], 1905.

[illegible] the units from the box necessitates the removal of its adjacent unit.

888,613. Electric-railway Signaling System. Edward B. Howell, Butte, Mont. Application filed August [illegible], 1907.

A pole has an upwardly extending bracket, a track wire supported on the upper end thereof, a hanger projecting from the pole above the bracket, and insulated sectional conductors supported on the hanger at points [illegible] the track [illegible].

888,615. Automatic Filling Machine. Jerome N. Humphreys, Dallas, Tex. Application filed June 20, 1907.

Two valved conduits are each provided with an automatic weighing device, means for moving receptacles onto and off of each device, electromagnets for controlling the valve and receptacle-moving mechanism and means connected with the weighing device for controlling the circuits through the electromagnets.

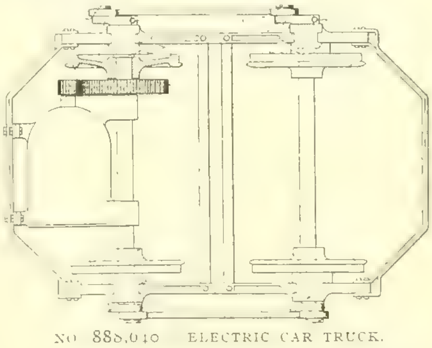
888,616. Insulator. Chauncey C. Johnson, Scranton, Pa., assignor of 45 one-hundredths to John A. Watson, Pittston, Pa. Application filed October 26, 1907.

The insulator has open wire-receiving spaces on top formed by a pair of complementary concaved jaws.

888,638. Apparatus for Electrical Separation of Particles from a Fluid Stream. Lawrence N. Morscher, Enterprise, Kan., assignor to William J. Ehrsam and Lawrence N. Morscher, co-trustees, Enterprise, Kan. Application filed March 24, 1906.

A pair of electrodes is electrically charged at different potentials and arranged one within the other to form an annular separating chamber having an induction passage leading thereinto, the chamber also having a fluid-eduction passage leading therefrom.

888,640. Car Truck. John Murphy, Pittsburg, Pa. Application filed August 9, 1907.



NO. 888,640.—ELECTRIC CAR TRUCK.

An electric car truck has a pair of axles having wheels inside the truck frame and cranks outside the truck frame, a rod connecting the cranks and a motor connected to one axle between the side frames. (See cut.)

888,646. Automatic Weighing Scale. Francis C. Osborn, Detroit, Mich. Application filed January 21, 1907.

An electric motor is arranged to slide the weight forward and backward on the beam. The direction of motion of the motor is controlled by the position of the beam.

888,648. Electrical Appliance for Controlling Air Brakes. James G. Pearce and William H. Pearce, Oakland, Cal., assignors of one-third to Truman J. Pearce, Berkeley, Cal. Application filed November 16, 1906. Renewed September 25, 1907.

The engineer's air valve has an electrically operated auxiliary controlled through special track circuits and contacts.

888,674. Connecting Conductor for Cables. Francis S. Viele, Pittsburg, Pa., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Application filed August 15, 1902. Renewed March 29, 1905.

[illegible]

888,7[illegible]. [illegible]

[illegible]

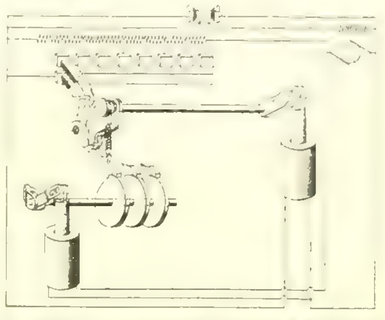
888,7[illegible]. [illegible]

[illegible]

888,741. Signal Apparatus [illegible] George [illegible]. Application filed May 7, 190[illegible].

[illegible]

888,759. Automatic Motor Starter. [illegible] Smythe, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed August 17, 1905.



NO. 888,759.—AUTOMATIC MOTOR STARTER.

A series of switch members is each adapted to cut out a portion of the motor resistance. A magnet adapted to be controlled by varying currents actuates a cam mechanism to regulate the successive operation of the switch members. (See cut.)

888,760. Circuit-breaker. Edwin H. Smythe, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed August 17, 1905.

In combination with circuit terminals having fixed contacts is a bridging member comprising two blades connected together by toggles and mounted to move forward freely between the contacts, and means for operating the toggles at the limit of the forward movement of the blades to spread the blades outwardly against the contacts to close the circuit.

888,763. Line-wire Fastener. Lafayette Stanton, Beaver River, N. Y., assignor of 95 one-hundredths to himself and five one-hundredths to the Forsyth Manufacturing Company, Buffalo, N. Y. Application filed August 1, 1907.

This fastener consists of two clamps, the ends of one extending through the ends of the other and receiving the wire and a lever for forcing the clamps apart and creating pressure upon the wire.

888,782. Spark Plug. Eligha Bruden, San Francisco, Cal. Application filed February 10, 1908.

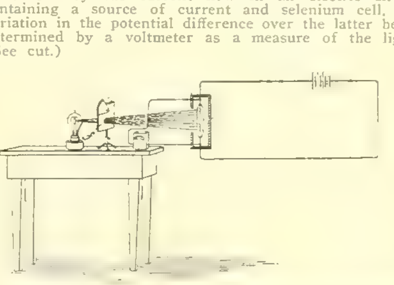
Two wires pass through a holder so that their ends are adjacent and exposed.

888,798. Speed Indicator. Edwin T. Greenfield, Kiamesha, N. Y. Application filed February 8, 1907.

A centrifugal governor driven by a rotary shaft moves a sliding contact, connecting varying members of sections of a coil in circuit with a source of supply. An indicator is connected to the core of the coil so as to show the speed of rotation on a scale.

888,801. Apparatus for Measuring Light. William J. Hammer, New York, N. Y. Application filed October 31, 1906.

Means are provided for causing the light to be measured to vary the current flow in an electric circuit containing a source of current and selenium cell, the variation in the potential difference over the latter being determined by a voltmeter as a measure of the light. (See cut.)



NO. 888,801.—APPARATUS FOR MEASURING LIGHT.

888,802. Method of Measuring Light. William J. [illegible] Application filed [illegible]

[illegible]

888,8[illegible]. [illegible] Benjamin [illegible] Hutchins, [illegible], assignor to the Auto[illegible] Company, New York, N. Y. Application filed June [illegible], 190[illegible].

[illegible] typewriter.

888,822. Telephone Cut-off or Muffler. George S. K[illegible], Buffalo, Mo., assignor of 40 one-hundredths to D. M. Rush, Buffalo, Mo. Application filed October [illegible], 1907.

This cut-off consists of a plate connected to a telephone [illegible] per prevented from striking the bell.

888,870 and 888,87[illegible]. Telephone System. Elmer R. Corwin, Clyde, Ill., assignor to the Monarch Telephone Manufacturing Company, Chicago, Ill. Applications filed May 11, 1906.

These patents relate to signaling devices for a common-battery multiple switchboard with its accessory jacks, cord circuits, relays, etc.

888,872, 888,873 and 888,874. Telephone-exchange System. Elmer R. Corwin, Chicago, Ill., assignor to the Monarch Telephone Manufacturing Company. Applications filed October 1, 1906.

In these three patents distinctive features of the line and cut-off relays and circuits and those of the supervisory signals are described.

888,877. Electric Furnace. Leon Dion, Wilkesbarre, Pa., assignor to the American Electro Hermetic Company, Wilkesbarre, Pa. Application filed April 30, 1906.

A chamber contains a bowl or crucible for receiving the material to be treated and provided with electrodes projecting into it and across the path of travel of the material.

888,885. Electric Signaling. William E. Hallett and Frank Kamerer, New York, N. Y. Application filed May 20, 1907.

This is a burglar-alarm system particularly adapted for application to sliding window sash.

888,901. Electrical Apparatus. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed September 3, 1907.

A line conductor is provided with an insulating sleeve therefor and a support intermediate the ends of the sleeve, and a flaring shield of conducting material that surrounds the insulator and extends outwardly therefrom.

888,903. Control System for Electric Motors. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 3, 1906.

A series of switches that are adapted to close in a predetermined sequence has a single operating coil for each switch, and a limiting device that may retard the sequential closure of the switches. Resistance sections connected in multiple circuit are short-circuited by the limiting device when the current traversing the motor circuit is less than a predetermined value.

888,904. System of Electric-motor Control. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 3, 1906.

The motor has means for automatically effecting its acceleration and a pair of switching devices which are adapted to act alternately in delaying the acceleration.

888,912. Method of Operating and System of Control for Electrical Generators. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed August 2, 1906.

A generator having series field and armature windings is operated by first connecting a secondary battery in shunt to the field and then connecting the generator in a braking circuit.

888,923. Electrical Heating Apparatus. Richard G. Pheysey, Ontario, Cal. Application filed August 22, 1907.

The apparatus consists of a sheet-metal shell, a heater plate secured thereto and having a recess formed therein for the reception of the heating coils, which are surrounded on the remaining sides by a heat non-conducting material.

888,924. Apparatus for Deflecting Frazil and Anchor Ice from Power Streams. Frank C. Pierce, Shoshone, Idaho. Application filed February 6, [illegible]

[illegible]

888,929. Automatic Electric-railway Switching Device. Francis M. Rice, Dows, and Arthur W. Hill, Belmond, Iowa. Application filed September [illegible]

[illegible]

[illegible] chetti, Woonsocket, R. I., assignor to the Un[illegible] Original application filed March 23, 1906. Di[illegible]

[illegible]

888,940. Dynamo-electric Machine. Egbert M. Tingley and Joseph L. Ray, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company. Application filed March 17, 1905.

In combination with a shaft having longitudinal grooves, and a sleeve having internal, longitudinal grooves and communicating, lateral apertures, are conducting rings mounted on the sleeve, and conductors enclosed within the grooves and apertures and connected to the rings.

888,951. Storage-battery Plate. Theodore A. Willard, Cleveland, Ohio, assignor to the Willard Storage Battery Company, Cleveland, Ohio. Application filed March 29, 1907.

The plate consists of a one-piece blank having rows of projecting ribs alternating with rows of flat spaces arranged on opposite faces of the plate and having oval openings arranged crosswise of the ribbed rows and out of [illegible]

888,956. Process for the Manufacture of Oxycarbide of Barium. Rodolfo Battistoni, Ancona, and Romolo Rotelli, Venice, Italy. Application filed January 14, 1905.

[illegible] per cent. of carbide of barium, [illegible] per cent. of cyanamide of barium and 80 to 85 per cent. of oxide of barium are mixed with barium carbonate and a determined amount of finely divided carbon, then molten in an electric furnace and finally submitted to electrolytic action.

888,957. Stopping Gear for Sewing Machines. James Beattie, Pendleton, near Manchester, England. Application filed July 10, 1905.

When a thread breaks or gives out an electric circuit is completed between the tension and the thread supply and a motor thereby started which throws the operating means out of gear.

888,959. Railway Signal. Edgar M. Cain, Wilmington, Del. Application filed January 17, 1908.

A train-operated circuit closer governs an electromagnetic valve between an air tank and the whistle.

888,980. Rail-bond. Axel H. Englund, Philadelphia, Pa., assignor to the Protected Rail Bond Company, Philadelphia, Pa. Application filed June 16, 1904.

The bond is provided with a recess having a wall which extends entirely around the same, so that when the bond is applied to the rail the recess is closed on all sides.

888,993. Trolley Wheel. Frank M. Gass, Philadelphia, Pa. Application filed January 27, 1906.

A wheel with an interior oil chamber has a bushing extending through this chamber and formed with a longitudinal row of apertures formed adjacent to the concave side of a deflector plate.

888,996. Vibrator. Max K. Golden, Chicago, Ill., assignor to the Horto Electrical Company, Chicago, Ill. Application filed March 4, 1907.

In a supporting frame is an electromagnet and an armature-operated striker vibrating an abutment.

889,015. Trolley. Albert S. Janin, New York, N. Y., assignor of one-third to Amelia Janin, Brooklyn, N. Y. Application filed November 16, 1906.

A pantagraph trolley has an adjustable frame and means for locking the contact roller so that it may act as a scraper.

889,031. Wireless Telephone. Francis J. McCarty, San Francisco, Cal.; Henry A. McCarty, administrator of said Francis J. McCarty, deceased, assignor to the McCarty Wireless Telephone Company, San Francisco, Cal. Application filed December 12, 1904.

The apparatus consists of a mouthpiece, a transmitting diaphragm with metallic contacts and an opposed microphone transmitter, two primary windings connected with the diaphragm and microphone coil respectively, a secondary coil energized thereby and a spark-gap device connected with the secondary coil, through which the surrounding aerial medium is effected to transmit articulate speech between sending and receiving stations.

889,040. Electric Heater. Edwin F. Porter, Boston, Mass., assignor to Benjamin F. Peach, trustee, Lynn, Mass. Application filed January 29, 1906.

An electric car heater is mounted on the heel board and has means for admitting air to the back of heater and for venting the heat from its front.

889,041. Car-heating and Ventilating Apparatus. Edwin F. Porter, Boston, Mass., assignor to the Car Ventilating and Heating Company, Boston, Mass. Application filed August 19, 1907.

This is an application of the previous patent to a ventilating system for electric cars.

889,067. Mercury-vapor Apparatus. Percy H. Thomas, East Orange, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed January 6, 1904.

In combination with a closed holder of silica, electrodes therein, and lead wires for connection with an external circuit is a screen surrounding the holder, the screen being of a material which is substantially impervious to ultra-violet rays.

889,086. Electrical Governor for Gas Engines. Joseph D. Anderson, St. Marys, Ohio. Application filed September 5, 1907.

A spring serves to normally press the governor weight [illegible] forms a part of an electric circuit.

889,098. Process of Winning Aluminum or Other Metals from Their Compounds. Henry S. Blackmore, Mount Vernon, N. Y. Application filed February [illegible], 1907.

[illegible] trolysis, while associated with halogen-containing com[illegible]

889,103. Holder for Electroplating. William Y. Buck, Muncie, Ind. Application filed September [illegible], 1907.

[illegible] and provided with conductive hooks.

889,126. Automatic Safety Device for Cranes. Nathan S. Haseltine, Swissvale, Pa. Application filed August 16, 1907.

Means are provided whereby, when a safety switch is closed, the electric crane may be operated in either direction, and when the switch is open the crane may be operated in but one direction. The operation of the crane beyond a predetermined point throws the switch.

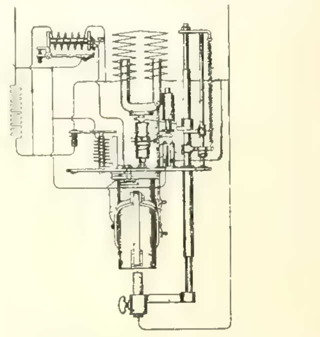
889,128. Apparatus for Treating Ores. Wilbur A. Hendryx, Denver, Colo. Application filed November 26, 1906.

A tank has means for continuously aerating its contents by lifting portions and moving them in a thin sheet or film in contact with the atmosphere. Electrodes are disposed in the path of the lifted portions.

889,145. Electric Sign. George C. Nientimp, Erie, Pa., assignor to the Jewel Electric Sign Company, Erie, Pa. Application filed March 16, 1907.

A sign character is formed with openings having a jewel holder for each opening. It is illuminated from within.

889,162. Arc Lamp. William S. Weedon, Schenectady, N. Y., assignor to the General Electric Company. Application filed May 20, 1904.



No. 889,162.—ARC LAMP

A pair of co-operating electrodes has a feeding mechanism for causing one or more relative approaching movements thereof, followed each by a relative separating movement, each approaching movement exceeding and each separating movement equaling the normal arc length, the feeding mechanism including means for causing the successive approaching and separating movements being continued until the electrodes engage. (See cut.)

889,163. Electric Arc Lamp. William S. Weedon, Woodbury, N. J., assignor to the General Electric Company. Original application filed May 20, 1904. Divided and this application filed September 21, 1904. Renewed October 22, 1906.

The construction of a special draft tube is described.

889,179. Pencil Sharpener. Roy V. Collins, New York, N. Y. Application filed January 17, 1907.

An electric motor drives the grinding wheel. The motor is started by inserting the pencil into the machine and stopped when it is withdrawn.

REISSUE.

12,795. Illuminating Device. Alfred W. Beuttell, New York, N. Y. Application filed March 25, 1908. Original No. 831,821, dated September 25, 1906.

A concave trough-shaped reflector has an integral bead extending along each side edge, electric lamps supported on the reflector and conducting wires housed within the beads of the reflector and connected to the lamps.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 2, 1908:

453,216. Electric Street-car Motor. J. F. Shawhan, Dayton, Ohio.
453,225. Electric Connector. F. Wheeler, Meriden, Conn.
453,2[illegible]. Magneto-electric Machine. W. Humans, Cambridge, Mass.
453,260. Electromagnetic Engine. C. J. Kells, Jr., New Orleans, La.
453,261. Telegraph Receiver. C. Langdon-Davies, London, England.
453,281. Safety Device for Dynamos. C. G. Young, New York, N. Y.
453,286. Pole for Electric Wires. C. A. Lief, New York, N. Y.
453,287. Automatic Switch for Electric Motors. R. Macrae, Baltimore, Md.
453,3[illegible]. Switch for Electric Motors. F. A. Wessel, Brooklyn, N. Y.
453,319. Automatic Starting Switch for Electric Motors. F. A. Wessel, Brooklyn, N. Y.
453,320. Automatic Starting Switch for Electric Motors. F. A. Wessel, Brooklyn, N. Y.
[illegible]. Electric Current Meter. W. H. [illegible], New York, N. Y.
[illegible]. Switchboard for Electric Arc-light Stations. R. [illegible] Sawyer, Chicago, Ill.
[illegible]. Starting Switch for Electric Motors. [illegible] kins, Chicago, Ill.
[illegible]
[illegible] bury, Conn.
[illegible]
[illegible] N. J.

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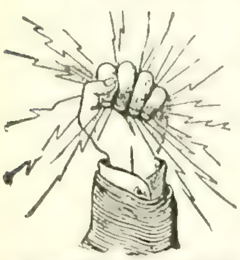

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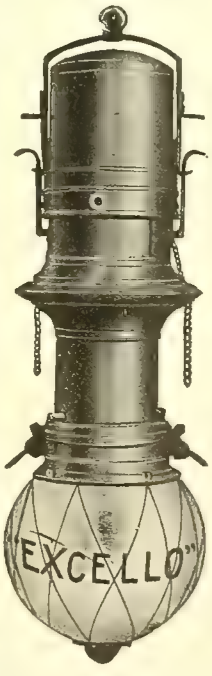

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SEALED PROPOSALS will be received at the office of the Electric Light Department, Bay City, Michigan, June 17th, 1908, until 12 M., and opened thereafter, for the purpose of supplying Transformers and their attachments in any quantities and capacities, for one year from signing contract. System, 60 cycles, 2,200 volts, primary. Prices to be F. O. B. Bay City.

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SEALED BIDS will be received by the City Council of the city of Valley City, North Dakota, up to 8 o'clock p. m., Monday, July 6, 1908, for the sale of the city's electric light plant. Said bids must be addressed to the City Auditor of said city and must be endorsed on the outside thereof, "Bids for Electric Light Plant."

No bid will be considered which is for a less sum than $40,000, and all bids must be accompanied by a certified check for 5 per cent of the amount of bid, and made payable to the City Treasurer of said city.

An exclusive 20-year franchise will be granted the successful bidder, the terms and conditions of which will be agreed upon on the acceptance of any bid.

An inventory and any information desired can be obtained from the City Auditor of said city upon application.

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By order of the City Council. Dated May 12, 1908.

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1	1	Wagner auto. 208 v., model A	2000
1	1	Gen. Elec., type I. S., form L, 110 volts, direct-connected to No. 2 Enterprise Meat Chopper	1875
2	1½	Holtzer-Cabot, 110 volts, self-starting	2500
1	2	Gen. Elec., 110 v., type I. S.	1875
2	2	Wagner, model A, 110 v., auto	2000
1	3	Gen. Elec., type I. S., form L, 110 volts	1875
1	3½	Wagner, model Z, 110 v., auto.	2000
1	3½	Wagner, Model Z, 220 v., auto	2000
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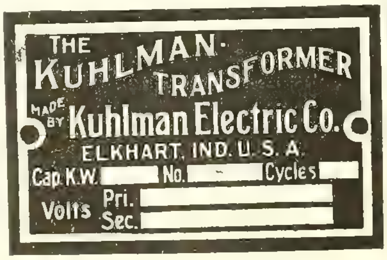

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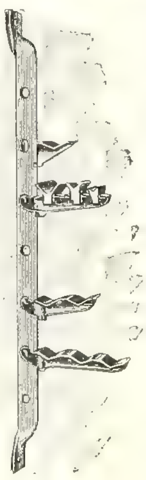

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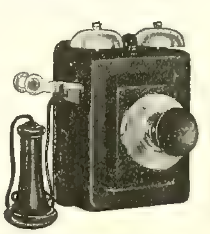

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EVERY SATURDAY

Vol. XLII.

Milking Cows by Electric Power.

In regions where the dairying interests are considerable, a comparatively new process of interesting application of electric power has arisen in the milking of cows. The cow-milking machine is operated by a partial vacuum which acts intermittently on the teats, similar to a calf when sucking. The vacuum is produced by an air pump, and this pump is most conveniently driven by an electric motor.

In the accompanying illustration (Fig. 1) is shown an electro-pneumatic milking outfit installed

FIG. 1. MILKING COWS BY ELECTRIC POWER AT A NEW BREMEN (OHIO) DAIRY FARM.

in May, 1906, on the dairy farm of Mr. Louis Huenke at New Bremen, Ohio, and which has been in continual operation ever since, serving from 30 to 50 head of milch cows in an entirely satisfactory manner. The electrical installation was made by Mr. F. H. Plaice, central-station manager, now at Hastings, Mich., whose modest account of what had been accomplished in the electrical line in a place of 1,500 inhabitants, written for the Western Electrician something over a year ago, at the request of the editor, made New Bremen famous among electrical men.

This outfit consists of a vacuum pump driven by a two-horsepower electric motor and piping running throughout the stable, with an attaching connection at each stall. Each milk pail is connected to the vacuum mains and also to two cows, as is more clearly shown in the picture of another installation on the next page (Fig. 2). The milk pails hold about five gallons each and are air-tight, the milk never being exposed to the air until it is strained.

In the New Bremen equipment four cows are

[illegible]

In practice the man in charge cleans off the cow's teats and after attaching the milk pail to the main the milking cups are slipped over the teats and the milking begins. Passing from cow to cow, he starts the apparatus at work, and then simply keeps watch to see when the milk stops flowing (there is a glass tube on the milk line), after which he removes the cups and goes to another cow. Sometimes, during the fly season, the cow will dislodge the cups, in which case the man in charge has to replace them. This is about all that he has to do in the matter, except to keep his charges in good condition.

Mr. Plaice says that the outfit shown in Fig. 1 cost the user, all installed, but without the motor, less than $275. The cost of operating it, with current at six cents a kilowatt-hour, will be about $6 a month, and the machine will take the place of two men on a dairy farm caring for 30 to 50 head of cows. Mr. Plaice is of opinion that any current-supply company that is in a position to furnish electricity to dairies will do well to interest

[illegible]

chines is about one-half atmosphere. The pump producing it is of the vertical type and occupies a space about three feet square. With the driving motor it is placed in any convenient location near the stable, 1¼ or 1½-inch piping being used. A vacuum-reservoir tank, a safety valve and two vacuum gauges are included in the system.

The milking machine proper consists of a strong, heavily tinned, steel pail, weighing about 12 pounds, and holding about 55 pounds of milk. The pail is smaller at the top than at the bottom, with a metal cover fitting loosely, but resting on a rubber gasket which makes an air-tight joint. A nipple projecting from the cover connects the pail, through a piece of hose, with the stanchion cock in the piping system. The cover contains the pulsating mechanism, to which are attached two lever handle cocks. Each cock is connected by a rubber tube 3½ feet long to a small metal connection, which has four outlets, from each of which a short rubber tube leads to a teat cup provided with a rubber mouthpiece to fit around the base of the teat. When

[illegible] over the teat they are held in [illegible] until removed by the operator. [illegible] with their rubber mouthpieces, are [illegible] different sizes to fit different sized teats; and the chief skill of the operator is in choosing the proper sizes. The pulsator, mounted on the cover, imitates the sucking of the calf, by first connecting the teat cups with the vacuum in the pail, thus drawing the milk from the teat, and [illegible] the vacuum and allowing [illegible] fresh

FIG. 2. COW MILKING MACHINES IN USE IN A NEW YORK STATE DAIRY.

supply of milk to enter the teat. The vacuum is again created in the cups, and this additional milk goes to the pail, and so on, until the milk is all drawn from the udder.

Activity in Wisconsin Hydro-electric Developments.

F. A. Pamperin of Oconto, Wis., who is interested in hydro-electric plants in that state, made some interesting observations during a recent interview in Milwaukee. He said:

"We are carrying electricity from our power plant on the Peshtigo River to Oconto, a distance of 12 miles, for lighting and power purposes. Quite a number of small manufacturers are using the power. We furnish current at 2½ cents a kilowatt for power, and lights at five cents a kilowatt. With electric current at that price it makes the cheapest power you can get when everything is taken into consideration. We have 1,200 horsepower on the river at our plant, sufficient for such lighting and power as will be needed. We shall this summer extend the wiring to Lena, five miles further along. There is no question but Wisconsin is certain to become a great manufacturing state, the power for which will be electricity.

"No state in the Union is better equipped for furnishing electric power than this. The Menominee River has over 150,000 horsepower scattered along at about a dozen different points. This is due to the rapid fall of the stream. At one point there is a fall of 70 feet, developing at least 30,000 horsepower. The Menominee has as much horsepower as the Wisconsin River, though the latter is better known. Then there is the Chippewa River and other streams throughout the state, so situated that there is hardly a portion of the state or a single town which cannot be reached with power generated at some one of the many places on these rivers. We are only at the beginning. Gradually as the different powers along the rivers are developed people will come more and more to the use of electricity in all sorts of purposes besides manufacturing."

For some time a project has been discussed of improving the Peshtigo River at High Falls and Johnson Falls in Marinette County, Wis., for the [illegible] for generating electricity. To do this work the Northern Hydro-electric Power Company of Green Bay, capitalized at $1,000,000, has now been organized with the following officers: President, F. H. Joslyn of Oshkosh; vice-president, A. M. Murphy; secretary, [illegible] Murphy, all of [illegible]

[illegible]

[illegible] over the company's private right-of-way, and will be [illegible]

also be furnished to the Green Bay Traction Company to operate its street and interurban cars, the steam plant of the latter being held in reserve in case of emergency. The advent of cheaper electric power for the manufacturing interests and for lighting purposes is expected to follow.

For 18 months the Green Bay and Mississippi Canal Company, of which John S. Van Nortwick of Appleton is president, has had a force of men at work in Kaukauna, Wis., constructing a power plant, which will be completed about August 1st. The plant is being equipped with two generators with a capacity of 1,000 kilowatts each. The electricity will be generated by waterpower, the plant having a head of 21½ feet on the Fox River.

Electrical interests in five different cities have been negotiating for a lease, but it is said that the plant will be leased to the Wisconsin Traction, Light, Heat and Power Company of Milwaukee, to be used to furnish power for the interurban system from Green Bay to Oshkosh, and possibly Fond du Lac.

The Kaukauna plant is one of three which the Green Bay and Mississippi Canal Company contemplates building. Permission has already been secured from the government for establishing a new level at Kaukauna just below the plant now being constructed, and work will begin this fall on the construction of a dam which will give the company a head of 27 feet for another and larger power plant.

It is generally believed that this second plant is to furnish power for another interurban system which will run from Milwaukee to Appleton, through Sheboygan, Fond du Lac, Manitowoc, Port Washington and Kaukauna.

The third power plant may be erected this fall on the present site of the Appleton Paper and Pulp Company's plant on the upper river in Appleton. The pulp mill will be razed within six weeks and the work of constructing the power plant will begin at once. The plant has already been leased to local manufacturers and will furnish the electrical power for several mills. This plant will have water for 750 horsepower.

A Long Multiple-unit Train.

The Metropolitan District Railway Company of London is now running a nine-coach train, which is said to be the longest multiple-unit train in use anywhere. It will accommodate 1,000 passengers and is 450 feet long. The financial fortunes of this railway would appear to be on the up grade, as, owing to the introduction of expresses at certain periods of the morning and evening, the receipts [illegible] a week.

A New Commission to Consider the Conservation of Natural Resources.

In accordance with the recommendation of the recent conference at Washington to discuss the conservation of the nation's natural resources, President Roosevelt on June 8th appointed a permanent commission to consider this subject and cooperate with similar bodies that may be appointed by the several states.

A few of the new commissioners are those whose names follow: On waters—Thomas E. Burton, Ohio, chairman; Gifford Pinchot, United States forester; Prof. George F. Swain, Massachusetts Institute of Technology. On forests—Senator Reed Smoot, Utah, chairman; Prof. H. S. Graves, Yale University. On lands—Senator Knute Nelson, Minnesota, chairman; Charles McDonald, American Society of Civil Engineers. On minerals—John Dalzell, Pennsylvania, chairman; Prof. Charles R. Van Hise, University of Wisconsin; John Mitchell, Illinois; John Hays Hammond, Massachusetts; Dr. Irving Fisher, Yale University.

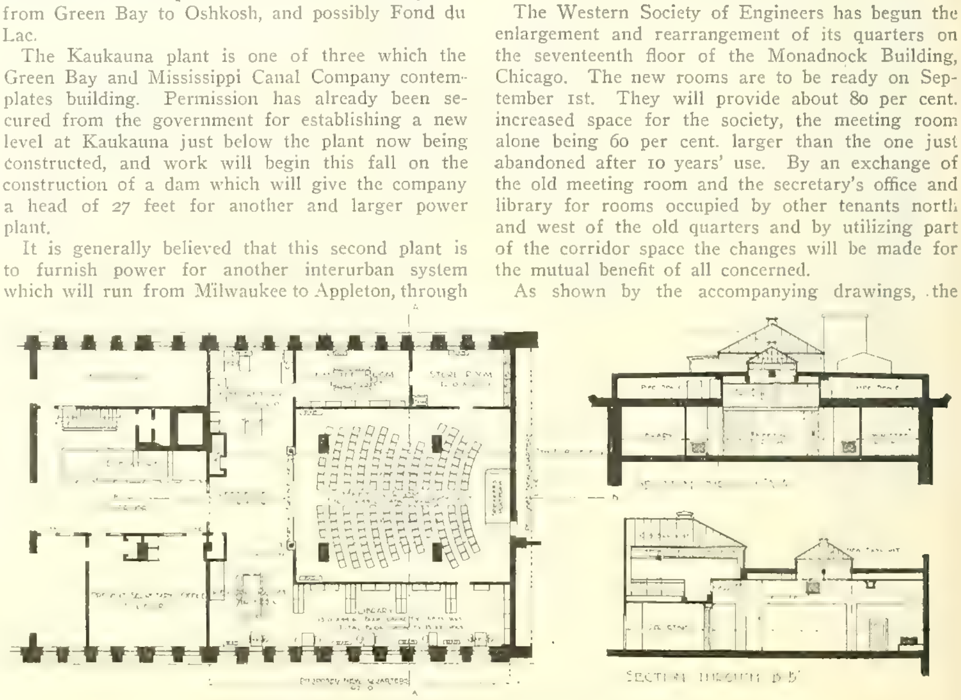
Winnipeg Hydro-electric Power Plant May Be Built.

It is now reported that the authorities at Winnipeg, Man., have decided to proceed with the erection of the civic power plant at Lac du Bonnet, which will cost approximately $3,000,000. Last fall the city expended $500,000 on preliminary work on this development and then work was stopped for want of funds. However, the Council has decided to sell bonds to the value of $600,000 to allow the work to proceed. By the end of June the tramway and steel bridge being built in connection with the work will be completed, and it is anticipated that financial arrangements will shortly be made for the completion of the plant. Cecil B. Smith of Toronto is still in charge of the work.

New Quarters for Western Society of Engineers.

The Western Society of Engineers has begun the enlargement and rearrangement of its quarters on the seventeenth floor of the Monadnock Building, Chicago. The new rooms are to be ready on September 1st. They will provide about 80 per cent. increased space for the society, the meeting room alone being 60 per cent. larger than the one just abandoned after 10 years' use. By an exchange of the old meeting room and the secretary's office and library for rooms occupied by other tenants north and west of the old quarters and by utilizing part of the corridor space the changes will be made for the mutual benefit of all concerned.

As shown by the accompanying drawings, the



NEW QUARTERS FOR WESTERN SOCIETY OF ENGINEERS.

new quarters will occupy a space 62 feet by 61 feet 6 inches, of which the present reading room is the only part now used by the society. Connected with the reading room on the Dearborn Street side will be the library with a total shelf room for about 15,000 volumes. On the west side of the building will be the office of Secretary J. H. Warder, a committee room and a storeroom to be used for additional shelf room for infrequently used books and records.

Occupying the center of the new suite of rooms will be the meeting room, 36 by 44 feet in area and 14 feet clear height in the main part. Permanent comfortable seats for 162 persons will be provided. The lighting and ventilation of the room will be excellent, two skylights being provided for and supplemented by a forced ventilation when necessary. It is believed that this room will be much more satisfactory for the society's meetings than the one hitherto used. The plans for the new quarters were prepared by Holabird & Roche.

The Oscillograph as an Aid to the Study of Alternating-current Phenomena.

At the meeting of [illegible] Technology Branch of the American Institute of Electrical Engineers, held [illegible] April [illegible] Prof. F. H. Freeman [illegible] oscillograph in [illegible] phenomena.

The oscillograph [illegible] galvanometer, the moving element [illegible] so that it can follow the variations of the current. Diagrams were given indicating [illegible] which records are obtained photographically or visually.

A number of oscillograms were shown which illustrated the use of the oscillograph and showed electromotive force and current wave forms under different conditions. [illegible] duced herewith.

When a sine wave of electromotive force is impressed upon a circuit containing resistance, inductance or capacity, the current wave is also that of a sine curve and is in phase, or lagging or leading, as was made clear by the oscillograms shown. If the electromotive-force wave is not a

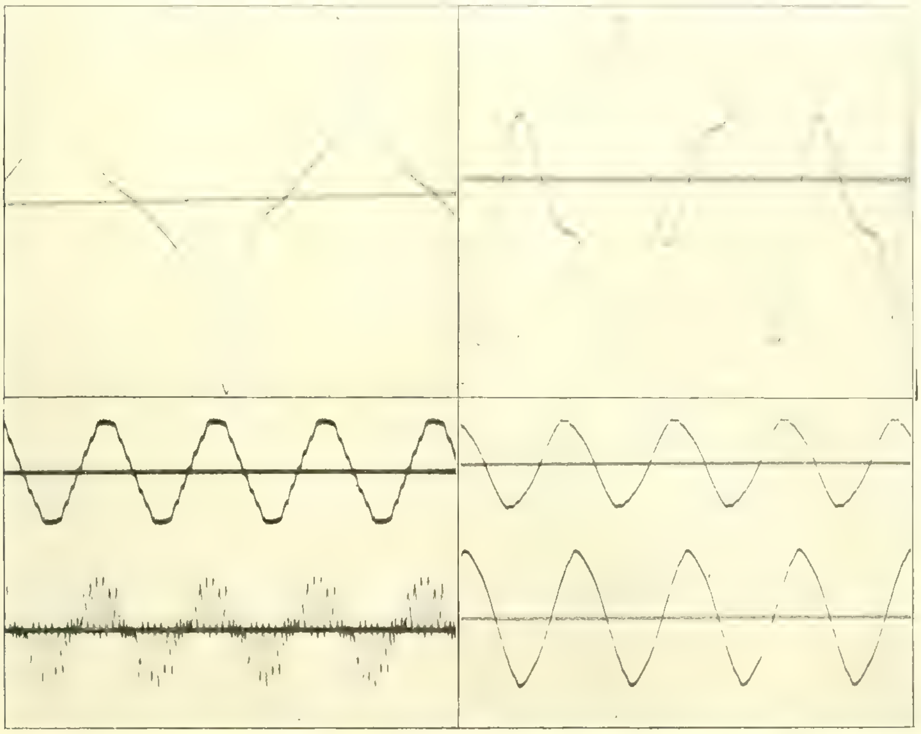


Fig. 1. Electromotive Force Wave of Magneto Generator for Local-battery Telephones.

Fig. 2. Current Wave in a Condenser Supplied by Magneto Generator.

Fig. 3. Electromotive Force Wave of a Small Rotary Converter.
Current Wave in a Condenser Supplied from Same Source.

Fig. 4. Current Wave in an Inductive Circuit Supplied from Rotary Converter.
Current Wave in Circuit having Inductance and Capacity in Series.

TYPICAL OSCILLOGRAMS OF ALTERNATING-CURRENT WAVES.

sine curve, the current wave is similar only when the circuit contains resistance alone. If there is inductance in the circuit, the current wave is less different from a sine curve than the electromotive-force wave; with capacity, the reverse is true. These effects were proved by oscillograms and explained by considering the electromotive-force wave as being composed of a fundamental sine wave and higher frequency harmonics. The choking effect of the inductance is relatively greater on the currents due to the harmonics than on the current due to the fundamental, so that the resultant current wave approaches more nearly to a sine curve than the electromotive-force wave; with capacity, the opposite result is obtained. The contrast between Figs. 1 and 2, as well as between the two oscillograms in Fig. 3, illustrates the latter point. The two upper curves in Figs. 3 and 4 show the smoothing effect of inductance. When inductance and capacity are connected in series, and resonance exists, it was shown that the form of the current wave is practically that of a sine curve, though the electromotive-force wave may not be of the same form. This is illustrated by the lower curve of Fig. 4, which also shows that inductance and capacity tend to neutralize each other and thus allow a larger current to flow.

Oscillograms showing no load current in transformers with different forms of impressed electromotive-force waves made it clear that the losses in the transformer will be affected by the shape [illegible] rotary converters and the effect of sparking at the brushes in producing variations in the electro[illegible]

The resistance of arcs depends upon the current, and where the electrodes are of different materials, may also vary with the direction of the current. These effects on the current wave were shown by oscillograms as well as variations of the current for a hissing arc.

In the operation of three-phase machines effects due to a triple-frequency current are very interesting. A triple-frequency current circulates in a delta connection and tends to alter the form of the fundamental electromotive-force wave, as was pictured in a number of oscillograms.

One of the most important uses of the oscillograph is to record phenomena which do not repeat themselves, such as the blowing of a fuse, the short-circuiting of a lightning arrester, or of a generator. Samples of such oscillograms were exhibited.

It is possible with the oscillograph to obtain simultaneously superposed electromotive-force and current waves, which clearly show their phase relations. Thus condenser currents can be shown to lead the potential wave and inductive currents to lag behind the same. This phase relation is not shown in any of the accompanying diagrams, however.

Another field in which the oscillograph is being used is in the recording of telephone currents, enabling comparisons to be made between different kinds of transmitting apparatus and systems. In Fig. 5 a few of these oscillograms are shown, giving the wave form of certain sounds as electrically produced by a telephone transmitter.

Peoria Electrolysis Case.

The taking of testimony in the famous electrolysis case of the Peoria Water Company against the Peoria Railway Company was concluded in Peoria last week by Frank L. Wean, special master in chancery, appointed by the Federal Court. Among those present were Henry W. Anderson, an attorney from Richmond, Va.; Albert T. Herrick, electrical engineer, of New York; E. L. Fischer, general manager of the Illinois Traction System, and S. L. Nelson, general manager of the Peoria Railway Company.

The case to date is said to have cost over $50,000. It was started more than 10 years ago and at different times highly paid experts have been engaged by both sides. Among the exhibits introduced in evidence was an alleged photograph of a water pipe into which nails had apparently been driven, it being asserted that the pipe had so deteriorated from the action of electrolysis that it could be easily penetrated by the nails. Mr. Leach, electrician for the Peoria Railway Company, testified that the nails

The Situation in Warren, Ohio.

[illegible] the street lighting for the city and light and power to the public.

[illegible] lighting the contract was renewed from time to time, but never for a longer period than five years, and sometimes for only two. In the year 1904 the two companies were incorporated under the name [illegible] continued to furnish water and electricity as before. Pleasant relations have existed between the management and the city and the service has been satisfactory. There has always been one drawback—the short-term contracts for street lighting, which have retarded some of the contemplated improvements.

On June 1, 1907, both the water and light contracts expired, and the company and the city could not get together. There was talk of municipal ownership. The council committee offered to recommend the purchase of the combined plants for $250,000, which was more than $100,000 less than cost. The water franchise stipulated a purchase clause by appraisement, but this right has not been exercised. During these pending negotiations a continuation of the contracts was granted, and the Water and Light Company is now furnishing light under this agreement.

The situation is complicated by the fact that a hydro-electric company has secured options on three dams on the Mahoning River, above Warren, and one at Parkman on the Grand River, with the idea of developing these powers and bringing electric current into the city. [illegible]

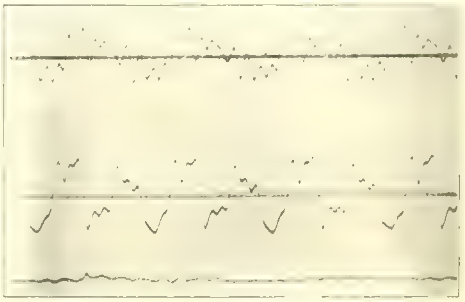


Fig. 5. Wave Forms [illegible]

tained the permission of the county commissioners to construct a high-tension pole line to Warren, and it now has an ordinance before the council for a franchise to furnish light and power in the city of Warren.

The Warren Water and Light Company has a well-maintained plant, and the cost of current generated is on a par with most any steam plant of its size, and yet the net income has never given only a small return on the money invested. The company has never divided its profits among the stockholders, but has kept them to effect contemplated improvements. The price charged for current is reasonable, 10 cents a kilowatt-hour being the highest price for domestic lighting, ranging as low as five cents to large consumers, while the power rate is from six cents per kilowatt-hour to 2¾ cents, based on a sliding schedule. What the outcome will be is not known, but the probability is that the older company will be required to meet the competition of the hydro-electric company, which in a town of 12,000 inhabitants or less will probably be unprofitable. The property owners object to more poles being placed in the streets, as there are two telegraph companies and two telephone companies besides the present lighting company which have pole lines at the present time.

The situation is of more than local interest, for in a number of other places the local central-station industry has been affected by hydro-electric developments not thought of when the local electric-light plant was established.

New Forms of Combined Starting and Speed-controlling Rheostats for Motors.

Starting rheostats for direct-current shunt motors are frequently provided with auxiliary resistances to be inserted in the shunt-field circuit for regulating the speed. This combination has a number of advantages, among which are its compactness and simplicity of operation, since it does away with the need for a separate field rheostat. These combination rheostats are always so arranged that the motor cannot be started on a weak field.

Two new forms of these combined rheostats have been recently invented independently by Albert J. Horton, of White Plains, N. Y., and Charles D. Knight of Schenectady, N. Y. Each of these inventors has lately received an American patent on his form of motor-starting rheostat. By the aid of the three accompanying drawings the construction of these rheostats will be made clear.

It will be noticed that in each case only one handle has to be moved, and this is so arranged that the armature resistance must be all cut out before resistance is inserted in the field. Each rheostat is also provided with a magnetic retaining and release coil which permits the contact arms to be thrown back to starting position by a spring when the main switch is opened or when the power fails.

In Mr. Horton's rheostat (Fig. 1) an insulating base (1) is mounted in front of the starting box (6). Arranged in an arc on the base is a set of contacts (2) which are connected to the field resistances (3) that are wound on a supporting plate (4) of porcelain or similar material. The first three of these contacts are dead, as shown in Fig. 2. Another row of contacts (5) is located a little below the first set and connected with the armature resistances (7); the first contact in this row is dead as usual in starting boxes. Below the armature contacts is a brass contact-sector (8) connected with the field circuit. This sector is of such length that when the contact brush is in the extreme position at the right end it does not contact with the sector, but with a dead button adjacent to the latter.

A contact brush (9) is mounted on the lever (10) so as to sweep over contacts (5) and sector (8) at the same time. This lever swings on the pivot (11), about which is coiled a spring that tends to hold the lever to the left in its "off" position against the stop (13). On the front of the lever is a pair of posts (14) through which [illegible] (15) that [illegible] the catch (16) at its outer end. The spring (17) tends to hold this rod at its innermost position.

[illegible] pivoted on post (11) [illegible] front of lever (10). Upon this second lever is carried the brush (20) so it can [illegible] (2). On the inner [illegible] mounted a dog (22) [illegible] engage the [illegible] (10) with it when the outer lever is moved to [illegible]

[illegible] gized, is adapted to attract the armature (27), which is pivoted at (28) to one of its pole-pieces. This armature has an extension (29) extending between levers (10) and (19) and engaging at its extreme end the lower end of the rod (15) so as to move the catch to its outermost position when the armature is attracted. When lever (10) is at the extreme left or "off" position, the spring (30) mounted on the armature is placed under tension by engagement with the shoulder (25), and raises the extension and moves the catch to its outermost position. Immediately above the retaining magnet a dog (31) is pivotally mounted upon a small post and held at the limit of its downward movement by means of a spring (33) coiled about this post. This dog is adapted to engage the catch when in its outer position and thus holds lever (10) at the limit of its movement to the right, or in the "on" position.

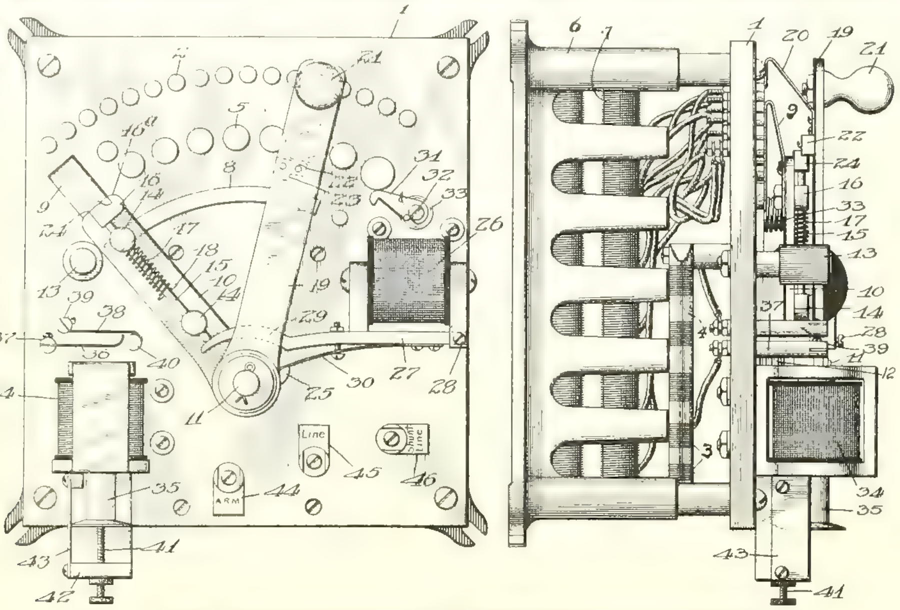


FIG. 1. FRONT AND SIDE ELEVATIONS OF HORTON MOTOR-STARTING RHEOSTAT.

At the lower left-hand corner of the base is mounted an overload coil (34), the core of which when attracted is adapted to engage and move a spring switch arm (36) mounted upon a stud (37) carried by the base. A second spring-switch arm (38) is mounted upon a stud (39) and arranged to be engaged by a projection on the arm (36) when it is raised by the core (35) and thus moved out of engagement with a contact (40). The extent of movement of the core is adjusted by the set-screw (41), as in many forms of circuit-breakers.

The electrical connections of the different parts not described are shown in Fig. 2. It should be noted that the retaining and release magnet (26) is in series with the field (60) and that the overload coil (34) is in series with the armature (56) of the motor. The two sides of line are indicated at (59) and (63).

To understand the operation of this rheostat, assume that the two contact levers are in position shown in Fig. 1. In order to start the motor lever (19) is moved to the left until it engages the stop. The catch being at its outermost position, its shoulder will be engaged by the dog on the front lever. By moving the latter to the right, the back lever will be moved over the armature contacts. The first one of these being dead, the field circuit will be first closed from the line (63), through arm (10), brush (9), sector (8), switch (38), contact (40), retaining magnet, field winding, and back to the opposite side (59) of the line. The closing of the circuit through the retaining magnet causes the same to attract its armature, which will hold the catch in its outermost position, although the shoulder (25), after the lever has been moved to the first of the contacts (5), will be disengaged from the spring (30).

As soon as the brush (9) makes contact with the second of the contacts (5) the armature circuit will be immediately closed, this circuit being as follows: From line (63) through arm (10), brush (9), resistance (7), overload magnet, through the armature (56), and back to the opposite side (59) of the line. The motor will immediately start and run up in speed as the arm is moved to the right to cut out the armature resistances. When the arm has been moved to the extreme "on" position, the dog (31) will engage the catch and [illegible] in this position as long as the armature (27) is attracted by the retaining magnet and maintains the catch in its outermost position.

When the arm has reached its full "on" position the brush (9) has been moved off the sector and a new field circuit established, which includes lever (19), brush (20), one of the contacts (2) and conductor (48), and then as before. Under these conditions, the front lever may be freely moved to the left, whereby the resistance (3) will be inserted in circuit with the field, thus weakening the latter and increasing the motor speed.

If, while moving the arms to the right, in removing the resistance from the armature circuit, the operator should move the arms so rapidly that the current becomes excessive, the overload magnet (34) will respond and attract its core, which will move the switch (36) upward, thus engaging the switch (38) and moving it off of the contact (40). This short-circuits the retaining magnet, causing the same to release its armature, which in turn will permit spring (17) to move the catch inward, disengaging the same from the dog (23) and permitting the arm (10) to fly back under the impulse of its spring to the "off" position. In order to bring the rear arm forward again, it will be necessary to return the front arm to the "off" position and the operation of starting the motor can then be repeated. In case of an overload on the motor at any time the same action occurs.

If the line current should fail or be cut off at any switch the retaining magnet would act as a "no-voltage release" and, being de-energized, permit the spring (17) to retract the catch so as to disengage it from the dog (31), and thus allow the arm to fly back to "off" position.

Mr. Knight's form of rheostat (Fig. 3) is somewhat simpler. It is specially designed so that the machine driven by the motor cannot be run at

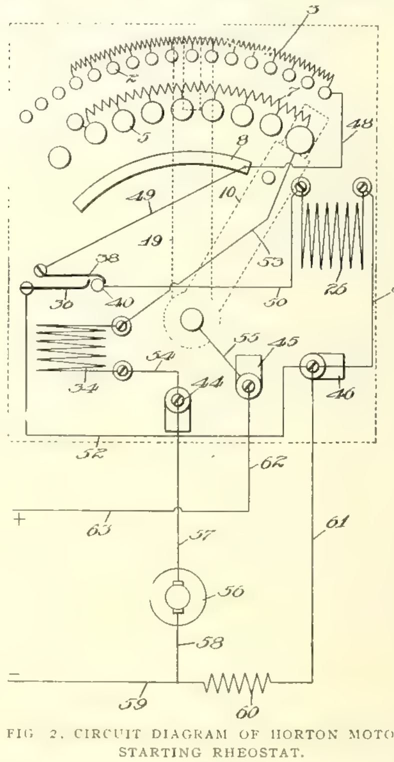


FIG. 2. CIRCUIT DIAGRAM OF HORTON MOTOR-STARTING RHEOSTAT.

excessive nor too slow speed by an unskilled or careless operator. In fact, a positive limit is placed upon the speed at which the motor is to be operated, while at the same time provision is made for the variation of this limit. Means are provided whereby the setting of the limit is beyond the control of the operator, the arrangement being such that the adjusting feature is locked by a key which is accessible only to the proper foreman or inspector.

As shown by Fig. 3, the armature resistances (12) are connected to the contacts (11) and the sector (19). In a converse manner, the sector (18) and contacts (13) connect with the field resistances (14). A retaining magnet (21) is connected in series with a resistance (R) directly across the line.

Carried by the contact arm (15) is an adjustable curved and slotted slide (22). It is held to the arm by the locking stud (24) which fits into the slot (23) and firmly locks the slide at any point desired. The slide has a flange coming close alongside the head of the stud, so that an ordinary wrench cannot be used for turning it. A special key is provided for tightening or loosening it. On the right-hand end of the adjustable slide is fast-

[illegible] the armature (20) [illegible] of the retaining magnet.

In operating the rheostat, [illegible] from the diagram the contact arm [illegible] the armature resistance, [illegible] point cuts out field resistance till the armature (20) [illegible] the poles of the retaining magnet. The amount of field resistance that is inserted, and therefore the speed, is determined by the position of the slide on the stub, and this is adjusted only as described above. No matter what the extreme running position may be, cutting off the line current de-energizes the magnet (21) and the arm, being thus released, is thrown back to starting position at the left by the spring (17).

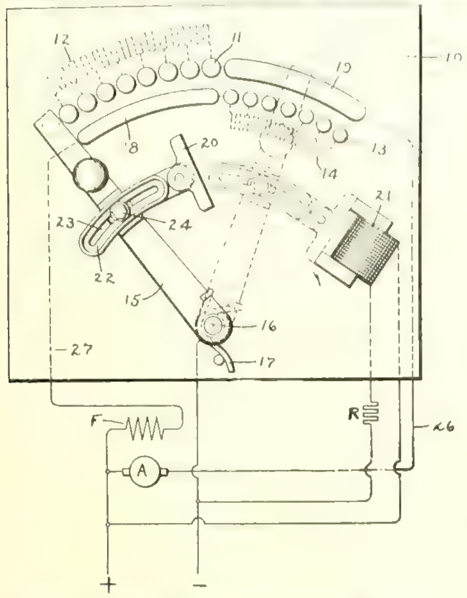


FIG. 3. KNIGHT MOTOR-STARTING RHEOSTAT.

Sanitary District Transmission Wires Cut by Miscreants.

The transmission wires of the Sanitary District of Chicago carrying current to the grounds of the Forest Park Fair Ground and Amusement Company were apparently maliciously cut on June 6th, the night the park was opened, throwing the large grounds and buildings into darkness. The transmission line, six or seven miles long, had just been completed at considerable expense by the Drainage Canal people. A sub-station is located on the grounds of the new park, which uses a large amount of current for lighting, decorative illumination and motors. It was nearly 11 o'clock when the wires were cut, but there were many people in the park. The damage was repaired in time for the Sunday evening illumination. The line is now patrolled the entire distance by watchmen. President McCormick of the drainage board has offered a reward of $1,000 for information sufficient to convict the persons responsible for the act.

Reduced Price for Current in Boston.

In pursuance of the recommendation of the Massachusetts Gas and Electric Light Commission, the Edison Electric Illuminating Company of Boston has made a reduction from 15 to 12 cents per kilowatt-hour to consumers.

President Charles L. Edgar's rejoinder to the commission's suggestion, however, is such as to indicate that the company defers to the public sentiment created by the action of the commission, but does not concede the justice of the demand made upon the company. Mr. Edgar says: "In deciding to put the reduced price into effect, we do not want to be understood as admitting the incorrectness of our theory of differential prices or the incompleteness of our proof that our prices are based upon cost."

Brilliancy of Tungsten Lamps.

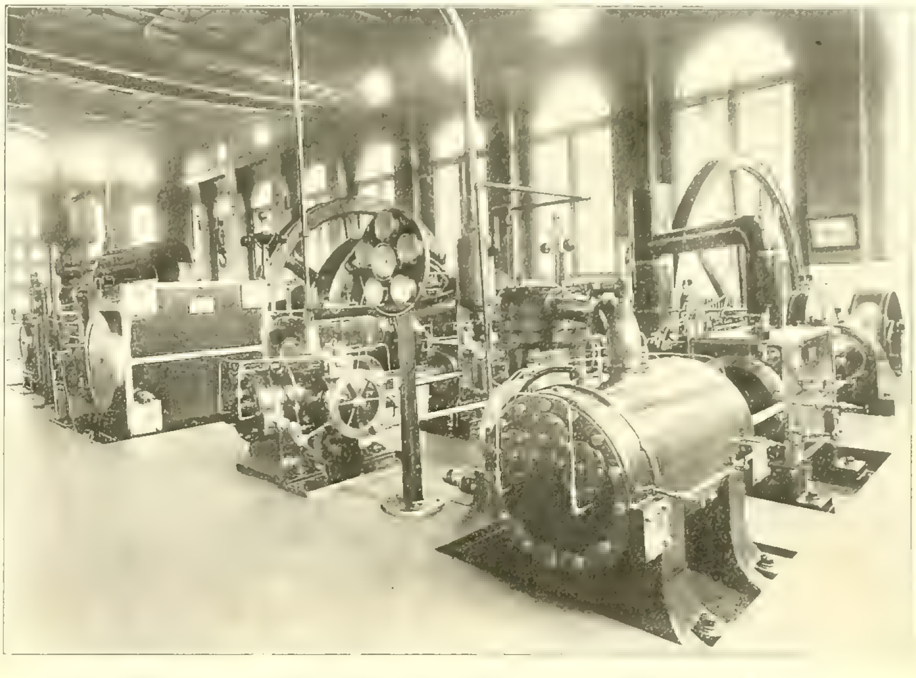
Dr. Louis Bell of Boston made a rather long speech at the Institution of Electrical Engineers in London on May 28th in the discussion on a paper by Hugo Hirst of the London General Electric Company, which dealt with the Osram lamp. He gave the history of the use of metallic-filament lamps in America, and mentioned that the question now uppermost was the most economical efficiency at which to run these lamps. At one watt per English candle he thought experiments rather showed that they were being overrun, and it would

[illegible]

Electric and Pneumatic Power in the Manufacture of Railway Supplies.

[illegible] Mulliken & Co., Chicago, use is made of the most modern machines and methods, and electric power plays an important part in the economical operation of the works. The company manufactures railway supplies, such as track switches, frogs, etc., and in the various stages of manufacture throughout the large works many different kinds of high-grade machines necessary in a plant where good workmanship and economical operation are important considerations are employed. These machines are all electrically driven, group drive with six to ten machines in a group being employed in many instances. For the operation of the numerous pneumatic tools air compressors were installed.

A complete description of the plant soon after the original installation of a generator and motors was given in the Western Electrician of June 18, 1904. The accompanying illustration gives a view in the present power plant. The wisdom of the provisions originally made for future growth is now apparent. At first there was one 600-kilowatt generator and 25 motors. Now the power plant consists of two engine-driven direct-current 600-kilowatt Crocker-Wheeler generators and one of 300 kilowatts of the same make. The use of electric drive has increased rapidly, and there are now in use about 80 Crocker-Wheeler direct-current motors of various sizes, the largest one being a 90-horsepower machine driving a rail saw.



POWER PLANT OF A CHICAGO FACTORY MAKING RAILWAY SUPPLIES.

In making the extensions the same thoroughness was carried out as in the original installation, and the plant is therefore modern and efficient in every way, serving well to illustrate the economy and advantages of electric drive. By going to some additional expense in the original installation to provide for probable future growth, economy and convenience were effected in the later additions.

Compressed air is used for the chipping and cleaning of castings by means of pneumatic tools and in other ways. The illustration shows one of the Allis-Chalmers heavy-duty two-stage air compressors installed. The steam cylinders of the newer compressor are 12 and 24 by 36 inches and the air cylinders 20 and 12 by 36 inches, this being practically a duplicate of the older machine installed some time previous. This compressor was designed to furnish 1,200 cubic feet of free air per minute at a discharge pressure of 105 pounds.

Two-stage compression is now recommended by experienced engineers for anything beyond very moderate pressures, the air being thoroughly cooled between stages by inter-coolers such as that furnished with the machine mentioned so as to take full advantage of the economy obtainable from this system.

Electric Club [illegible] Lecture.

[illegible]

language. He carried his hearers, by the aid of simple explanations, supplemented by illustration with "home-made" apparatus from his private laboratory, in a logical manner through vibratory phenomena ranging from the swing of a "slow" pendulum up to and above the highest and inaudible note of a Galton whistle. Then the listeners [illegible] through a small inductance, and thus brought within range of electrical high-frequency phenomena.

Although severely handicapped for room by the failure at the last moment of the Grand Pacific Hotel to have the luncheon in the large hotel dining room, Mr. Perry quickly built for his audience, from a mica condenser, a wireless-telegraph transmitting station, and constructed while the luncheon was in progress two receiving stations in different parts of the room. Messages were transmitted to these two stations [illegible] listen to the "clicks" brought about by the action of the transmitted electrical waves.

With the idea of simplifying the transmission, Mr. Perry used as a source of current a static machine, or an electrical "pump," as he designated it by popular term. After the transmission of the electric waves to the two stations, two sympathetic tuning forks were exhibited, and the transmission of energy by sound waves from fork to fork across a table effected. This was done with the object of conveying roughly to the audience some idea of sound and electrical resonance phenomena as relating to the transmission of a wireless-telegraph or telephone message.

This lecture was the first at the Electric Club, except one by Mr. H. W. Young of the Central Electric Company, in which apparatus was employed with the idea of making the talk practical and much more interesting to an everyday audience of business men. As only 25 minutes are allowed, such talks of necessity must be concise and to the point.

Engineers and experts employed to examine the Chicago elevated-railway conditions have completed their work, and their reports are now said to be available as a basis upon which to form terms for a consolidation of the properties. It is said that the preliminary negotiations looking to an amalgamation of the overhead properties will be commenced within the next week or 10 days, although the main issue of the plan may not be reached until next fall. It is asserted that Mr. Samuel Insull is taking a leading part in the effort to bring about a consolidation.

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States Army has been experimenting at Fort Williams and elsewhere with disappearing platforms of this character. The device is intended to meet the need for masking the lights, and also to prevent their location being discovered during the daylight hours. Encouraging results are reported, and it is expected that the work contemplated will be ready for test next fall.

IT IS DIFFICULT to realize that only the other day an effort was made in Paris to replace the old magneto signaling system, with its little crank at the right of the telephone which has not been seen in large cities in this country for many years, by the much more convenient automatic signaling system. But the Paris correspondent of the New York Times, in a dispatch dated June 6th, says that such was the case. And, more curious still, the effort to introduce this improvement met with disfavor! The correspondent explains: "Hitherto excitable Frenchmen whiled away the time while awaiting Central to answer by grinding furiously at the crank bell call. The new system denied them this form of relief. The result was that their pent-up feelings found outlet in imprecations and wild gesticulations. In many cases the telephones were damaged by poundings and shakings and had to be removed." It is said that the French minister of telephones was forced to admit that the imported system was a complete failure. "The new system may be good enough for the highly trained Americans," he is quoted as saying, "but I am convinced that my excitable countrymen need the safety valve of the old-fashioned bell."

Telephone service in Paris has been the subject of many jokes. One reason is that the operators are government functionaries and take their time. Still it is hard to believe that the service is so bad that the magneto call must be suffered to remain as a vent to the feelings of subscribers who are not only excitable but justly indignant.

THE RAILROAD COMMISSION of Indiana is making what is apparently an earnest and honest effort to reduce the number of railroad accidents in that state. In its "Accident Bulletin" for the first quarter of 1908, issued last month, it notes some gratifying improvement. Thus the total number of deaths from accidents on both steam and electric roads in Indiana during the third quarter of 1907 was 107; fourth quarter of 1907, 99; first quarter of 1908, 83. The corresponding figures for those injured were 401, 478 and 309. The number of passengers killed for the three quarters was respectively 8, 5 and 2.

Comparing steam and electric roads, it will be noted that the number of casualties on the electric lines is much less, as might be expected. Nevertheless, the electric railways do not show the same improvement as the steam roads. Thus the total deaths on the "electrics" during the three quarters mentioned were, respectively, 8, 14 and 9, and the total number injured was 34, 70 and 71. This may be due to fuller reports from the electric lines, but on its face it is a bad showing, which should be corrected.

The commission is especially vigorous in denouncing trespassers on rights-of-way. "For nearly 50 per cent of the entire fatalities on the steam railroads these trespassers were to blame. [illegible] The death roll of trespassers will continue to increase until the power of the law, backed by strong public pressure and sentiment, is directed against this fatal nuisance." Legislation is desired to prevent this trespassing to save life.

As to grade crossings, commendable precautions are now taken, but more are needed, and the final separation of grades is urged. It is recommended that the newspapers, at least once a week or when there is stormy weather approaching, warn the general public to approach railroad crossings with great care. Most of the persons killed during the quarter at crossings were killed during cold and stormy weather.

[illegible] constitute a large proportion of persons killed and injured on railroads. One of the greatest causes of danger is the American spirit [illegible]. It is truthfully declared that [illegible] his own life [illegible] a man who [illegible] little better than a criminal. A higher standard of efficiency should be insisted on.

The Railroad Commission of Indiana is doing work of great importance in endeavoring to lessen the number of railroad accidents, and the railroads and general public should uphold its hands in every possible way.

MILKING cows by pneumatic apparatus electrically driven offers an opening for electric power which is worthy of the attention of central-station companies in regions where dairying interests are considerable. Installations of this character are illustrated and described in this issue. Where dairies are fairly abundant and the electric service can be furnished at reasonable cost central-station managers and milk producers may well give this subject consideration to mutual advantage. Cream separators in large dairies may also be advantageously operated by electric motors in many cases.

In many directions the use of electricity about the farm is bound to be greatly extended. Pumps for raising water, feed cutters, winnowing machines and other types of farm machinery all require power, and the time is coming when much of this power will be electrically transmitted and applied. Some central stations in the country have used portable motors for farm work with good results, and the whole subject will well repay the careful study of the plant managers in rural districts. The great difficulty, of course, is the expense, not so much of the actual current supply as of the investment represented by lines and machinery to supply a limited and intermittent demand for power. But this objection becomes less formidable in many cases when a careful canvass is made of local conditions and an idea obtained of the possible load to be secured. Not all the opportunities for an active new-business campaign exist in the cities by any means.

CENTRAL-STATION companies generating current in steam plants, especially if these plants are of the older type, should keep a keen lookout on hydro-electric possibilities within a wide range of the localities they serve. Coal and labor are not decreasing in price, and with the development of the art the area of practicable power transmission by electricity is being steadily enlarged. It seems unfair that a central-station company that has been serving the community faithfully and at reasonable rates for a term of years should be underbid, with the sanction of city authorities, by some new hydro-electric concern with the advantage of cheap power. And yet hydro-electric development, like the tungsten lamp, is simply a manifestation of the inevitable law of progress, and should be met not merely with resignation, but should be welcomed, for what is for the good of the community at large is, in the long run if not immediately, good for the electrical industry.

It behooves the central-station men, then, to be alert, to look to the future. If they cannot develop the waterpowers themselves, and so realize on these natural advantages which appeal so strongly to President Roosevelt, they should at least be cognizant of the situation and arrange to act in harmony with the march of events. They have the great advantage of being first in the field, with their conductors in the streets, and among reasonable men it ought to be possible, even if there is no legal protection, to arrange, with the existing facilities for distribution, to take the cheap power themselves, even if developed by others.

There is no disguising the fact that the constant tendency is not only toward a greatly extended use of electric power, but toward cheaper electric power. The electric-light and power companies, while sturdily maintaining their right to a reasonable profit, should be eager to seize upon every development of the art which will enable them to supply current more cheaply to their customers. In this way they will take advantage of the trend of science and invention and the new, enlightened methods of doing business in this "electrical age," rather than make the fatal mistake of opposing or ignoring the great forward-march of the world's advancement. Electrical enterprises have succeeded by being distinctively progressive and an improvement on what has gone before. The policy—the recognition of this fact must be continued.

Central-station Business in Boston.

[illegible] about 7½ per cent. increase in net. In the previous fiscal year [illegible] and the increase in net was 4.8 per cent.

The new business which the company has secured in the first four months of this year has been comparatively small compared with corresponding period a year ago, due to the general business depression. The year's business, however, will be the best in the company's history, owing to the unusually large increase in the six months' period previous to the general setback in business.

The recent introduction of the high-economy lamp is estimated by the management as already showing the result of customers securing the same amount of candlepower from the company for about seven per cent. less money.

The incandescent lamps, arc lamps and horsepower in motors connected April 30, 1908, compare with connections on June 30th in the years 1907, 1906 and 1905 as follows:

	April [illegible]	[illegible]	[illegible]	[illegible]
Incandescent lamps	[illegible]	[illegible]	[illegible]	[illegible]
Arc lamps	[illegible]	[illegible]	[illegible]	[illegible]
Horsepower	[illegible]	[illegible]	[illegible]	[illegible]

The total connections on April 30th aggregated 1,635,160 16-candlepower equivalents, compared with 1,503,478 on June 30, 1907, an increase of nearly nine per cent.

Evanston Extension of the Northwestern Elevated.

The Northwestern Elevated Railway Company now has its service between the Loop in Chicago and Evanston in full operation. From the former terminal of the line at Wilson Avenue, which is the end of the elevated structure, the electric trains go to the surface and run over the Chicago, Milwaukee and St. Paul Railway Company's right-of-way to Evanston. Steam passenger trains on this branch of the steam road have been entirely abandoned.

After leaving the elevated structure the overhead trolley is used. A modern sub-station is located near the Chicago city limits, which supplies current from the Commonwealth Edison Company for operating the Evanston extension. The cars are of modern design, with many desirable features. They are especially well lighted as a result of the thorough study of car lighting made by President Starring of the company. During the busier forenoon and evening hours trains are run on a 10-minute schedule, and most of them stop only at the express stations between the Loop and Wilson Avenue.

Artistic Illumination for Milwaukee Business Streets.

The question of plans for the artistic illumination of the business sections of Grand Avenue and Wisconsin Street, Milwaukee, Wis., is being discussed by the Greater Milwaukee Association. At a recent meeting President Beggs of the Milwaukee Electric Railway and Light Company, offered his support and co-operation and agreed to erect specimen lamp clusters and maintain them for 60 days to permit the members of the association to decide upon the desirability of the lighting of downtown streets as proposed. Merchants are in favor of the project.

In the plan proposed by the association the lamps are 50-candlepower and may be attached to the trolley poles in clusters of five. It has been figured that the cost of installing, maintaining and lighting the new lamps, which will comprise about 168 clusters of five each, will be 45 cents per running foot per year for each side of the streets benefited

Canadian Convention Next Week.

The eighteenth annual convention of the Canadian Electrical Association will be held at the University of Toronto, Queen's Park, Toronto, on June 17th to 19th, inclusive. A good programme has been arranged, including, among others, these papers: "Power Rates," W. N. Ryerson; "How to Increase Station Load," George Williams; "Lost and Unaccounted-for Current," C. R. McKay; "Electrical Earnings per Capita," W. A. Bucke; "Modern Street Lighting," A. E. Fleming; "Distributing Systems," R. G. Black; "Grounding of Secondaries," W. L. MacFarlane, and "Regulation of Electric Currents," W. G. Chace. The entertainment features will include an outing on Lake Ontario, inspection of the university, tea at Royal Canadian Yacht Club, visit to Scarboro Beach Park, association luncheon, boat excursion to Hanlan's Point

[illegible] pected and desired

Niagara Plants to Be Shut Down for Inspection.

On Sunday, June 14th, from 1 a. m. to 3 p. m., the Niagara Falls Power Company will shut down its two mammoth stations on the American side at Niagara Falls, and factories operating by the electric current supplied from these power houses have been notified to cease operation between the hours mentioned. This shutdown will be the first since June 1, 1902, on which date an inspection was made of the wheel-pits and tunnel after the latter had been in use from July 26, 1897.

It is announced that the present shutdown is made to enable the International Railway Company to make a thorough inspection of the American abutment of the great Upper Steel Arch Bridge, which it owns. It has been admitted for some time that the outrush of the waters from the tunnel portal is harmful to the abutment foundation, for this abutment is forced to stand the brunt of the flow as it strikes the waters of the gorge. Months ago men worked about the abutment trying to protect it, and when they attempted to lower a sheet of armor plate, the current was so fierce that the steel was hurled out into the river. It is essential that the exact conditions be known, in order that repairs may be made if needed, and divers will be employed in ascertaining the exact condition of the abutment and its foundation.

Availing itself of the opportunity afforded when the waters are shut off, the engineering force of the Niagara Falls Power Company will inspect the wheel-pits and the mile-long tailrace in every part, searching carefully about the bottom, the sides and the roof of the great bore to determine how the brick-lined waterway is standing up under the tremendous flow of water that is hurled through it night and day, year in and year out. The inspection of 1902 showed that it was all right.

While the American plants of the Niagara Falls Power Company are shut down the power station of the Canadian Niagara Power Company will be called upon to supply electricity for the operation of the lines of the International Railway in Buffalo, Niagara Falls, Lockport and vicinity. No trouble whatever is anticipated in this service, but, so far as the public knows, it will be the first time the Canadian station has carried this great trolley load of Western New York. Cables cross the Niagara River over the Upper Steel Arch Bridge and also high over the flood of water at the entrance of the river at Black Rock and Fort Erie, so good cable connections are assured.

Progress of Radio-telegraphy.

In a letter to Mr. Marconi dated March 12th the postmaster-general of Great Britain said: "How soon and how far wireless telegraphy can be utilized for internal telegraphic purposes yet remains to be seen. But the working of the two postoffice installations we have in operation—one on the Marconi system—is evidence to us of the steady improvements that are being made in the development of wireless telegraphy, while the opening of the Marconi Atlantic station marks another step in advance in the case of long-distance communication."

Mr. Marconi says, in a communication to the London Electrical Review, dated March 16th, that the New York Times informs him that during five months it received from its correspondent in England and on the Continent "news dispatches totaling 68,404 words, promptly and efficiently transmitted by your system."

Steam Engine and Interurban Car Collide.

An electric car of the Joliet, Plainfield and Aurora interurban line was struck by a freight train on a country crossing of the Elgin, Joliet and Eastern steam road near Joliet, Ill., a few days ago, killing three persons and injuring others. According to the steam-road officials, two signals were set against the electric car, which was coming down grade. It is said that the interlocking switch at the crossing derailed the car, but instead of sending it to the side the car apparently was going so fast that it jumped and ran nearly straight ahead on the ties to the center of the crossing, where it was struck by the engine.

[illegible]

[illegible] than the amount contracted for or $50 per cent more.

For the construction of long-distance lines the [illegible] Stone & Green, O'Brien & Co., E. Gareau, Harple stokes, Ltd., C. Mareoux, W. G. Wyatt, R. D. [illegible] for the line between Winnipeg and Ste. Anne, 37 miles, was R. D. McLeod, the contract price being $50 a mile. The Virden and Sinclair branch, 29 miles, was let to W. G. Wyatt at $65 a mile. Stone & Green, Chicago, were awarded the contracts for the following lines: Gimli to Selkirk, 42 miles; Minnedosa to Binscarth, 103 miles; Baldur to Miami, 67 miles; Minto to Belmont, 27 miles; Brandon [illegible] tensions was at a flat rate of $87 a mile.

Contracts for the common-battery and magneto telephones were awarded to the Northern Electric Company and the Canadian Independent Telephone Company, Toronto. The latter will supply the telephones for the system to be constructed in the municipality of Wallace.

For the lead cable a number of English firms sent in figures, but these prices were all too high, and the contract was awarded to the Wire and Cable Company, Montreal; it approximates $40,000. The Whitecross Company, Ltd., and the British Insulated and Helsby Cables, Ltd., of England, were given contracts for the supply of 150 tons of BB galvanized iron wire at three cents a pound.

Additional contracts have been awarded as follows: Cross-arms, the F. Bissell Company, Toledo, Ohio; copper wire, Wire and Cable Company, Montreal, Que.; copper sleeves, F. B. Cook, Chicago; weatherproof iron wire, Canadian General Electric Company; steel strand wire, E. M. Skinner, Winnipeg. Orrin F. French is chief engineer of telephone department, Winnipeg, Man.

Construction on these government lines will be rushed, and within three days of the awarding of the contracts the work had started on several of the branches.

Railway Telegraphers Will Discuss Telephone Dispatching.

A meeting will be held in Montreal, Que., June 24th, 25th and 26th by the Association of Railway Telegraphers, including representatives of the large railroads in Canada and the United States. One of the principal questions to be taken up at the meeting will be the dispatching of trains by telephone instead of by telegraph. There are already a dozen railroads with telephone circuits in operation or being equipped. The Canadian Pacific Railroad is equipping one of these circuits, and it will be in operation between Montreal and Farnham during the convention, so that the company can give a practical demonstration of the system in operation. It is an independent metallic circuit, controlled entirely by the train dispatcher, and is not to be used for telegraphic work. The cost, according to W. J. Camp, electrical engineer for the Canadian Pacific Railroad, is fully seven times that of the installation of a telegraph line, but the increased cost is offset by the facility by which trains can be handled, and delays will be greatly reduced.

National Electrical Trades Association.

The National Electrical Trades Association is announced to meet at the Manufacturers' Club, 1409 Walnut Street, Philadelphia, on June 11th. This organization is composed of the electrical trades associations of Boston, New York, Philadelphia, Chicago and San Francisco, and has a total membership of 410, comprising the representative electrical manufacturers and jobbers. The present officers are: President, John H. Dale of New York; vice-president, Charles M. Wilkins of Philadelphia; secretary and treasurer, Frederic P. Vose of Chicago. In addition to these official members R. W. Van Valkenburgh is the representative of the San Francisco association, James Wolff of the Chicago association and Norman Marshall of the Boston association. The Chicago association will also be represented by H. E. Hackenberg of the National Carbon Company, Cleveland, and F. D. Van Winkle of the Post-Glover Electric Company of Cincinnati.

Protective Features of a Large High-tension Underground System.

[illegible] Section of the American Institute of [illegible] held its last meeting of [illegible] the programme of the evening being the reading and discussion of R. F. Schuchardt's paper on "Recent Developments in Protective Features of a Large High-tension Underground System." The system referred to was that of the Commonwealth Edison Company of Chicago, [illegible] Mr. Schuchardt is connected. The paper is briefly abstracted below.

In the development of suitable protection for such a system there is danger of providing so many devices that instead of protecting the system the latter is actually overburdened with danger points which may seriously impair the service. Simplicity must be sought for and no protective devices used that introduce complications or that are not positively necessary.

On the introduction of the 9,000-volt transmission in 1902 remote-control oil switches were installed and the simple solenoid and plunger type of overload relay with a fixed time-limiting device was adopted. After some experimenting with the time-limit adjustments the fallacy of a fixed time limit became apparent, and it was therefore abandoned, leaving only the plain relay with practically instantaneous action.

As the Fisk Street station was put into service there became evident the necessity for getting selective action of the relays, so that in the larger system the proper switches, and those only, would open in case of cable troubles and dangerous overloads. About this time the bellows attachment to the coil and plunger type of relay was produced and soon introduced in Chicago. The effect of the bellows was to make the time of action of the relay inverse to the amount of overload. Moreover, the bellows relay was found to be capable of proper time adjustment for selective action and was therefore believed to have solved the problem.

In the early bellows relays the plunger when drawn up returned to its original position very slowly, so a quick recovery valve was added. This was intended to prevent the plunger from being picked up and gradually brought to the contact position by an intermittent overload lower than its setting. In several cases of cable breakdown the line switch did not open as quickly as it should. Investigation showed that this was due to vibration and pumping, which greatly retarded the upward motion of the plunger. When tested with the same adjustment on 60 cycles no vibration was to be found. The vibration at 25 cycles was found to be caused by the fact that this was near the natural period of vibration of the suspended plunger. A slight change in frequency caused the vibration to become more pronounced. With strong throttling of the valve, as for a six-second adjustment, this action was worse than with a light throttling, as for a two-second adjustment. It was proved that this chattering was largely due to the quick-recovery valves and work was begun to improve them. The trouble caused by the vibration was so serious that when a short-circuit came on the line and the switches should have been opened instantly, they really did open more slowly than with an overload of only 150 to 200 per cent.

It was also found that the time adjustment of the relays was very important. Greater uniformity of action and better results were found with a two-second adjustment than with one for six seconds at minimum current setting. (This setting means that the relay does not operate at all until the current rises to this "minimum current" value and persists for at least six seconds.) With the standard relays the quickest action was obtained in 0.3 second.

The desideratum for an ideal relay is to operate instantly when the overload is in the nature of a "short," and to operate only after several seconds when the overload, though dangerous if prolonged, is not of the short-circuit kind. As continuity of service is always the first aim, the switches should not be opened by an overload until it is positively unsafe to hold on longer. On the other hand, when a cable breaks down the switch should be [illegible] for the breakdown, which usually [illegible] the neutral of the system is grounded, will otherwise spread to the other [illegible] to the system and open the switches of many sound lines. Where the [illegible] normal current [illegible] would be dangerous if con[illegible] two seconds or less. The switch should remain closed under these swings, and therefore the two-second adjustment [illegible] occasional burn[illegible] part of the [illegible] should open [illegible] of the main [illegible] point being [illegible]

[illegible]

The time settings referred to above relate to the time taken by the relay to close the tripping circuit. The various forms of oil switches used require from 0.2 to 0.6 second to open. The trip switch can operate in about 0.03 second. Therefore the time setting of the relays should not be too high. In specifying the setting of a time-limit relay at least two points of its characteristic curve should be stated, otherwise the description defines only the point stated, and this may fit any number of curves.

At the generating stations overload relays are used on transmission lines only. In conformity with American practice, no automatic devices are used on the generator switches. Three times the normal continuous load on any transmission line is considered as requiring instantaneous action of the relay and 225 per cent. of the normal load is supposed to operate it in two seconds. The minimum current on which the relay will operate is 160 per cent. load.

In sub-stations line relays are not used, but the lines feed into separate bus-bars which are not ordinarily connected in parallel. Dependence is placed on the relays of the sub-station units themselves for disconnecting the line from the load in case of trouble on that line. The relays on the 25-cycle side of rotary converters and frequency changers are set for minimum opening at twice full-load current, two seconds at three times full load and instantaneous action at four times full load.

The relays on the 60-cycle side of frequency changers and corresponding circuits do not have the instantaneous attachment and their overload settings are higher than those on 25-cycle relays. The chief reason for this is that the short-circuit characteristics of these generators are different from those of the 25-cycle turbo-generators, consequently the possible energy which can flow into a "short" is not sufficient to endanger the machines. At 60 cycles also the relays act quite promptly on excessive overloads. The bellows relays just referred to constitute the entire protective apparatus on the alternating-current part of the system. Since changing the adjustments and replacing the air valves the few cases of cable trouble which have occurred have produced no more than a slight jar on the system.

On the direct-current part of the system the rotary converters are equipped with a speed-limit device set to trip the direct-current circuit-breakers when the speed reaches 12 to 15 per cent. above normal. The rotaries in the basements of office buildings are further provided with reverse-current relays operating on the direct-current circuit-breakers only. This practice has been found desirable during a number of heavy system disturbances, when the alternating-current switch remained closed and the unit kept on running, thus requiring only the closing of the direct-current switches to put it into active service again.

The advantage of operating the high-tension system in sections has been shown on several occasions and the great importance of limiting the extent of a disturbance on the system made clear. There are now but two sections, but some time after the addition of the new Quarry Street station a redivision into three sections will be made. The independent operation of the transmission lines at the sub-station end permits the omission of protective devices at that point.

Of the central-station companies operating in the five largest cities of the United States the Commonwealth Edison Company is the only one that operates with a grounded neutral, though among large railway companies this practice is common. Originally every generator was grounded. When the four-pole, 8,000-kilowatt units were installed the neutral cross-current between them and the six-pole, 5,000-kilowatt units was found to be undesirably high, so a resistance was placed in the neutral of the new units. Experience with this has not been conclusive either way. With the growth of the system and the addition of large units it was found that the effect of cable breakdowns increased in severity, and therefore the grounding of each unit has been discontinued. At present only two units of each section of the system are grounded.

After the reading of Mr. Schuchardt's paper, which was illustrated by quite a number of lantern slides, communicated discussions were read from L. L. Elden of the Edison Electric Illuminating Company of Boston; W. G. Carlton of the New York Central and Hudson River Railroad, New York city; S. B. Way of the Union Electric Light and Power Company of St. Louis, and S. D. Sprong of the Union Electric Light and Power Company of New York city. In these communications the practice of the respective companies in regard to protective devices was explained and contrasted with that of the Chicago company.

The general discussion was then opened by W. L. Abbott of the Commonwealth Edison Company, who presided, and participated in by F. Woodmansee of Sargent & Lundy, Chicago; C. Wiler of the Western Electric Company, Chicago; F. A. Vaughn of the Milwaukee Electric Railway and Light Company, Milwaukee; W. O. [illegible] of the Chicago and Oak Park Elevated Railroad, Chicago, and D. W. Roper, P. Junkersfeld and Mr. Schuchardt of the Commonwealth Edison Company, Chicago. During the discussion much information of value was brought out.

QUESTIONS AND ANSWERS.

Abnormal "Gassing" of Storage Batteries.

F. S. S., Peoria: Why should storage cells "gas" when they have been charged for two days? No current had been flowing for two days, and they were fully charged by voltmeter test.

ANSWER.

A very slight bubbling of gas takes place from a storage battery at nearly all times, whether discharging or standing idle. Toward the end of charge heavy evolution of gas, or, as it is called, "gassing," normally takes place. If this occurs at other times it is caused by marked local action in the cell, due in all probability to impurities or foreign substances in the electrolyte. See whether anyone has dropped a nut, screw, nail or other foreign object into the cell.

Arc Lamps of 2,000 Candlepower.

M. C. S. Rayne, La: Does a 2½-ampere, 220-volt constant potential arc lamp give the equivalent light of a nominal 2,000-candlepower lamp?

ANSWER.

Till over a decade ago the old 9.6-ampere direct-current series open arc was usually regarded as a 2,000-candlepower lamp. The development of arc-lamp photometry showed this to be a decidedly excessive rating. As varous sizes and types of lamps were introduced, considerable controversy arose as to what should be regarded as the equivalent of the nominal 2,000-candlepower lamp. This led to the adoption of the following standard definition of this lamp by the National Electric Light Association at its convention of 1894:

"Resolved, that in the opinion of this convention what is ordinarily known as a 2,000-candlepower arc lamp is one requiring on the average 450 watts for its maintenance, the measurements being made at the lamp terminals where no sensible resistance is included in series with the arc. In case such resistance is used it must be excluded in the measurement of the voltage."

By a resolution at the convention of last year the same organization ratified this definition as a proper one "for the old open type of arc lamp and the standard carbon type of enclosed arc lamps," but not for flaming or luminous arcs or for mercury-vapor and vacuum tube lamps.

Now, in this particular case of the 220-volt, 2½-ampere, direct-current, enclosed lamp, it is evident that as measured at the lamp terminals the lamp takes 550 watts. However, in accordance with the above definitions, the voltage must be measured across the arc, which in this lamp is probably about 150 volts. The energy consumed in the arc would seem, therefore, to be but 375 watts, which is too low to place it in the nominal 2,000-candlepower class.

Meeting of the Oklahoma Association.

The annual convention of the Oklahoma Electric Light, Railway and Gas Association was held in Guthrie, Okla., May 26th, 27th and 28th. Washouts on some of the railroads delayed many of the delegates, and some of the members were busy with pending legislative matters, consequently the attendance was small. President F. H. Tidman delivered a good address, followed by a discussion of new and pending legislation of interest to the association.

Interesting addresses and papers were given as follows: "Construction of Street-railway Lines in Oklahoma," Charles Ford of Oklahoma City; "Operation of Street Railways," O. W. Weddle; "Light and Heat," R. O. Demming; "Distribution," H. C. Nelson; "Light and Illumination," Prof. C. M. Jansky; "The Installation, Testing and Care of Meters," Prof. R. P. Sauerherring of Oklahoma State University. Representative Stettmund addressed the association.

Several sessions were given up to a discussion of coal, oil and gas subjects. The Sons of Jove held a rejuvenation at the Elks' Club.

Action was taken to merge the office of secretary and treasurer, and on account of the small attendance it was decided that President Tidman of Oklahoma City and Secretary G. Crow of Guthrie hold over until some action is taken by the executive committee. The various committees will be selected by letter-ballot.

The Ashland (Wis.) Lighting Company has voted $450,000 in bonds to extend its street railway and build a new gas plant and buy new cars. Copper Falls waterpower, 18 miles from Ashland, will be developed and an interurban line will be extended to Washburn and Odanah. C. L. Wright of Chicago, F. T. Sullivan of Chippewa Falls, M. M. Reed and A. E. Appleyard of Boston are the new directors and the moving spirits in the extension.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By [illegible]

Special Equipment and Methods.

(Continued.)

[illegible] the Revolutions [illegible] Meter.

[illegible] by the use of the [illegible] sketches, Figs. 15 and 16.

[illegible] revolutions [illegible] meter disk during comparatively few revolutions of the disk. This device is used in conjunction with a contact-making device and telephone circuit (Fig. 16) applied to the disk of [illegible] meter. The [illegible] of the complete apparatus is as follows:

Fig. 15 shows a plan and elevation of the disk of the meter under [illegible] the underside of the [illegible]

[illegible] server at (E), noting on the telephone the revolutions of the disk (K) (master meter) and noting visually the [illegible] under test, will hear a click in the telephone and at the same instant observe the spot (F) passing the same given point [illegible] observer [illegible]

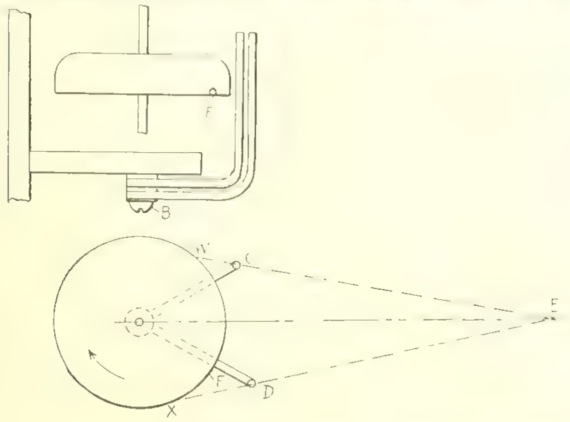


Fig. 15

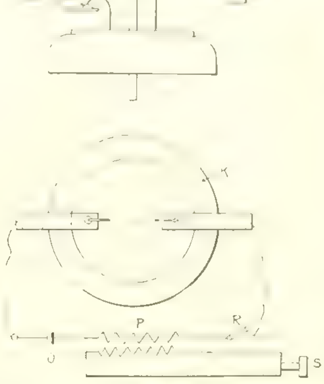


Fig. 16

APPARATUS FOR TESTING THE REVOLUTIONS OF A METER

shelf on which the meter stands and pivoted upon a stud (B) in line with the meter shaft are a pair of slender arms (C) and (D), bent up so that their free ends stand in front of the disk when the latter is viewed from the observer's position (E).

The arms may be swung independently of each other into any angular position, but the upper end of each will obviously always remain at the same distance from the edge of the disk. They serve as sights for observing the transit of the spot (F) painted on the edge of the disk as the disk revolves, and may be set so that any two points on the disk, including between them any desired fraction of the circumference of the disk, may be sighted on the two arms from (E).

Thus, in Fig. 15, as drawn, the disk will make about one-third of a revolution between the instant that the spot is sighted on (C) and the instant that it is sighted on (D), i. e., from the point (W) to the point (X). The sights may thus be said to be set one-third of a revolution apart.

Referring now to Fig. 16, the arrangement of the master meter disk shown is a means of counting the revolutions of this disk without having to observe the transits of a spot upon the disk, thereby leaving the eye of the observer free to note the revolutions of the meter under test in the manner just described.

Fixed to the disk (K) are a pair of contact fingers consisting of light wire uprights (L) (L), with their free upper ends bent over and amalgamated so as to make momentary frictionless contact as the disk revolves in two mercury globules (M) (M), which are held on the copper supports (N) (N). Note that one of the contact fingers is shorter than the other and that the mercury with which it makes contact is held on a correspondingly low support, so that as the shorter finger is carried around it does not make contact with the upper support, and vice versa.

The contact fingers and the supports are readily adjusted so that the two fingers sweep through their respective mercury globules at the same in-

Note.—This serial article, begun in the Western Electrician of April 4, 1908, is an advance publication of a portion of a forthcoming book by Mr. Baker on the general subject of "Electric Meters." It will be understood that the present serial refers to watt-hour meters used on customers' premises.

(C) for example to a permanent sight on that given point on the circumference of the disk at which the click and the transit simultaneously occur.

If, however, the meter under test is not accurate its disk will either lag behind or forge ahead of the master meter disk, and the amount of such difference in speed may be determined by the use of the two sighting arms (C) and (D).

Assume that the meter under test is known to be "fast." The observer sets the arms, say "one-eighth revolution apart," and then gets a sight past arm (C) on spot (F) in transit, simultaneously with the click in his telephone. Inasmuch as the meter under test is running faster than the master meter's disk, spot (F) will execute a revolution and a fraction instead of exactly one revolution between clicks, and will accordingly reach points successively further and further from the line of sight on arm (C) every time it comes around. The observer therefore counts the number of clicks that he hears between the transit of the spot past arm (C) and the transit past arm (D), this number indicating the fraction of one-eighth of a revolution gained by the disk of the meter under test for each revolution of the disk of the master meter.

For example, if between the transit on (C) and the transit on (D) 24 clicks are counted, with the adjustment of arms as stated (one-eighth of a revolution apart), the meter under test would be shown to be gaining one-eighth of one-twenty-fourth of a whole revolution over the master meter, and therefore to be one-one-hundred and ninety-second (0.52 per cent.) fast. If, on the other hand, the meter under test were known to be slow, a sight would be taken on arm (D), and the number of clicks which occurred while the spot "lagged back" from its transit on (D) to the transit on (C) would be counted—10 clicks in the one-eighth of a circumference between the sighting arms meaning that the meter was one-eightieth (1.25 per cent.) slow.

For accurate results the arms should be as close to each other as they can be arranged without touching, and their distance from the disk should be very small compared to the distance from the disk to the observer's position (E). A very rough arrangement, however, suffices to give results accurate enough to facilitate greatly the rapid calibration of a meter preliminary to the final adjustments required for accurate calibration.

[*To be continued.*]

COMMUNICATION.

[illegible]

sons:

[illegible]

remove the zinc from the latter. When hot gal[illegible]

[illegible] electro-zinced articles are similarly treated the copper adheres firmly to the zinc and no fresh surface is exposed, apparently due to the deposit of zinc applied by the electro-zincing, sherardizing and cowperizing processes having a fine matted surface.

It would appear [illegible] apparently great resistance to corrosion of sher[illegible] to the protection of the zinc by the deposited copper; therefore, experiments were made with a solution of ferric sulphate, which dissolves zinc without forming a precipitate on the zinc coating. To test this, known areas of sherardized and hot galvanized plate were exposed to the action of ferric-sulphate solution for an equal period, and the amount of ferrous salt formed by the reducing action of the zinc determined. The column headed "Weight of Zinc Dissolved" shows the relative corrosion.

No.	Sample	Zinc per Sq. Ft. [illegible]	[illegible]
1.	Sherardized	[illegible]	[illegible]
2.	Sherardized	26.908	[illegible]
[illegible]	Sherardized	[illegible]	[illegible]
[illegible]	Hot Galvanizing	[illegible]	[illegible]
[illegible]	Sherardized	[illegible]	[illegible]

Sample No. 2 was moistened with water and allowed to dry. The oxide formed appears to protect the zinc, and this protection is more marked if water is allowed to act for a longer period than was permissible in these experiments. It will be noticed that samples 1 and 2, which had a thicker coating than samples 3 and 4, dissolved to a greater extent than samples 3 and 4, which had practically the same weight of zinc coating dissolved. Sample 5 was sherardized copper, and, although the zinc coating was the heaviest, yet the corrosion was in this case the least, probably due to the conversion of the greater portion of the zinc into brass. On testing this sample with copper-sulphate solution, as in the other cases, instead of a brown precipitate of copper a bright metallic deposit was obtained, and no further action seemed to occur.

From the results of experiments, the copper-sulphate test has been found to be quite unsuitable for testing electro-zinced, sherardized or cowperized surfaces; therefore, it will in future be necessary to substitute some other test, such as the ferric-sulphate test or a modification of the copper-sulphate test.

Sherard Cowper-Coles.

London, May 18, 1908.

Induction Motors Cause Saving in a Wood-working Plant.

The wood-working plant of a large Chicago lumber company which manufactures pine, hemlock and hardwood lumber, sash, doors, wood finishings, etc., has recently been overhauled and the newer portions equipped with a full line of Allis-Chalmers induction motors. One feature which already gives particular satisfaction to the owners of the plant is the saving in power effected by means of electric drive. When machines are not in use they take no current from the wires, and the load is thus distributed only where it is absolutely needed at the time, thereby enabling the entire system to be operated on only a fraction of the power that would be required for shafting continuously run. While the power necessary with all machines running is 150 horsepower, the average pull from the generator does not exceed 70 horsepower, and occasional overloads are easily met. Among the electrically driven machines are tenoners, spindle shapers, rip saws, pony planer, emery grinder, large band saw and various accessory apparatus, operated by motors ranging in size from 2 to 25 horsepower.

The Status and Commercial Possibilities of High-efficiency Lamps.[1]

[illegible]

[illegible] that with the average [illegible] great hardships may be worked because of a minimum operating expense requiring also a minimum revenue. In a small central station [illegible] have to go very far to reach the minimum. In a large plant, the output being reduced, the operating expense decreases correspondingly; in a small one it cannot be decreased in the same ratio, because of the different relation which a minimum expense bears to the latter.

Still, present conditions demand something that will meet the encroachments of the vapor-gas lamps, and our judgment is that the wise policy is to "take the bull by the horns" and push the high-efficiency lamps for what they are worth. The change may be such that the average small plant will, while losing a part of its present revenue because of a decreased consumption, have its field broadened in a surprising manner and at the same time find its reserve with the new lamps sufficient for extensions of this nature. We believe that the lamp manufacturers have a keener appreciation of conditions than central stations and their various associations, and that a high-efficiency lamp, where it was only an improved device a year ago, is now an essential factor, accentuated by the gas-vapor people astride of hard times.

41. *From Illinois.*—Lamps cost too much to cut much figure in a community like this. Can't figure what will happen if the price should get down to what customer would be willing to pay.

42. *From Massachusetts.*—People will use more light than ever. Will have the same effect as a reduction in price.

43. *From Pennsylvania.*—The introduction of the tungsten lamp in many places will reduce consumption of current. It will be necessary for us to charge full price for the lamps and secure more customers to keep up our sale of current. The increase in light used with our trade will not compensate for the loss in consumption.

44. *From Iowa.*—Will tend to encourage the use of electric lighting; but believe the advantage of increased efficiency should be shared in just proportion by central station and customer.

45. *From New York*—We are pushing the sale of tungsten lamps, made up in clusters, to replace the standard enclosed-arc lamp. We believe that eventually the high-efficiency lamp will be beneficial to the supplying companies, but care must be taken to see that consumers are educated to the advantages of a higher standard of illumination. The better the illumination in the stores, theaters and other places of amusement, so much better will the illumination be in private houses, and the gain throughout will balance.

46. *From West Virginia.*—We are making our contracts with a flat charge based upon the candlepower of the lamps and a low price per kilowatt-hour for current consumed, the intention being to make the flat charge help out on these lamps, but we have not gone far enough to determine what the results will be.

47. *From Vermont.*—Will hurt the small plants unless they can find other use for their current at a remunerative rate.

48. *From Pennsylvania.*—Have only used them a short time. To some customers we furnish renewals, others we charge a rental of 15 cents each per month.

49. *From Virginia.*—I believe we should give our customers the benefit of everything in the way of improved methods and appliances. When these have passed the experimental stage I think the high-efficiency lamps will at no distant date be very generally used. The change will, of course, be gradual. If it is to the interest of the customer, he should be willing to bear at least the greater part of the cost.

50. *From Rhode Island.*—We believe these lamps in large units of great value to the lighting com- [illegible] and competing with gas and individual plants. We believe that in the end the loss of revenue to the central station will be made good by

[illegible]

(2) Consequent broadening of peak load;

[illegible] customers, on the general principle that the average customer will prefer more light for the same money rather than the same light for less money.

51. *From Canada.*—Have not used it yet. At the present price of the lamp we do not believe it will have much sale. The best way to meet the situa- [illegible] as well as first installation.

52. *From Pennsylvania.*—We have already re- [illegible] for them the manufacturer can see his way to lower the price.

53. *From Pennsylvania.*—Think some plan of charging by candlepower will have to be worked out. It may be advisable to use them in competition with gas arcs at maximum current rates and full charge for the lamps, original and renewals.

54. *From Wisconsin.*—Educate the public that future reductions in price are to come through higher-efficiency lamps. The Welsbach lamp helped the gas business, and the high-efficiency lamp will do the same for the electric business.

We think that free renewal of lamps should be stopped. The public demands a lower kilowatt rate, and the comparison with other places is made on this basis. A company giving free renewals, wiring and repair service gets no credit for it in a rate controversy.

55. *From Illinois.*—The substitution of the high-efficiency lamps for commercial arcs has saved to this company a number of customers, affording as it does much better distribution without increasing expense, being more pleasing in appearance and cheaper in maintenance, even though the central station should renew same free of charge.

56. *From Ohio.*—Where competition is severe with cheap natural gas at 25 cents and with gasoline competition, the tungsten lamp ought to be a great help. The character of the light is the best ever seen.

57. *From Massachusetts.*—I believe the tungsten lamp will be to the electric-lighting industry what the Welsbach mantle has been to the gas industry. It may in some instances cut down our revenue, but in my opinion it will enable us to get a lot of new business that we have heretofore been unable to secure. Experience has shown me that anything which would reduce the cost of electric lighting has led to a more general use of electric service and that it has increased rather than diminished our total revenue. I should meet the situation by pushing the tungsten lamp for all that it is worth and should urge its use to our present customers as well as to our prospective customers.

58. *From New York.*—We have about 30 entire tungsten installations at present. These installations have been made in place of electric or gas arcs or poor installations of the standard carbon-filament lamp. In every instance the customer has not expressed a desire to reduce his lighting bill so much as he has expressed a desire to get more light for his money. We are, therefore, convinced that this will ultimately prove to be the opinion of all users of high-efficiency lamps.

We are charging for these lamps an amount sufficient to cover breakage and cost of lamp. If the tungsten lamp is sufficiently developed to take the place of the carbon-filament lamp, it will be possible greatly to reduce the expense of free renewals on carbon lamps, as the customer will have become accustomed to paying for his lamps.

59. *From Missouri.*—Almost ruinous in some cases, particularly when the price of tungstens is reduced and the smaller candlepowers perfected. Inclined toward the belief that metering on a candlepower-hour basis will have to be finally resorted to by many companies.

60. *From New York.*—I think the best way to meet the situation is for the electric companies to sell tungsten lamps to customers who want them and to continue furnishing free renewals to customers desiring the carbon-filament lamps.

61. *From Pennsylvania.*—We believe the tungsten lamps should be furnished on some rental basis of so much per day or so much per month per lamp, and not change the meter rates. With this method, to the long-hour or desirable customer the rental rate per month would be a very small factor; the short-hour customer would not get the same advantage. This would encourage the use and manufacture of tungsten lamps and have the effect of dividing over a period of years a radical change from carbon or Gem filaments to tungsten filaments.

62. *From Pennsylvania.*—The tungsten and tantalum lamps will improve the lighting situation. We propose to continue the use of tantalum lamps. With tungsten we have under consideration a monthly maintenance charge per lamp: Forty-watt lamp, 18 cents; 60-watt lamp, 21 cents; 100-watt lamp, 25 cents. This, as a whole, we think, will net us a trifle more than covers the cost. Or sell lamps outright; customers to suit themselves which they accept.

63. *From Iowa.*—Think the tungsten and other units of this class will prove the greatest boost the electric-lighting industry has known. Cuts down the gross revenue from the individual consumer, but this is more than compensated for by the broadening of the field. Prompts the customer to use the service more freely. Will be the greatest and most effective competitive agent against gas. There is only one way to face the situation—from behind, i. e., boost it.

64. *From Illinois.*—We believe it is good policy to supply them. We have used them thus far mostly for fighting gasoline. We sell these lamps at $1.50 each and believe that if the present high prices are maintained the change will be made from [illegible] we shall not feel it seriously.

65. *From New York.*—We think the tungsten lamp will almost revolutionize the lighting business. Our customers are highly pleased with the light and well satisfied with their bills, although they do not seem to be much less in amount; but they feel that they have had something for their money. Our customers do not care anything about quantities of electrical current; they gauge everything by the amount of light they get. We have felt obliged to charge from 15 to 20 cents per kilowatt-hour, and our customers all feel that with old type of lamps their light costs them too much for what they get in return.

A large town could afford tantalums better than ours, for they would have more room to grow. Our town has only 2,000 people, and we are getting now $5.50 per person out of light alone, and we sell some power besides. So we can hardly look for very much additional growth on account of tungsten lamps alone. Still, we shall make a very energetic campaign as soon as we can get 1,000-hour tungstens.

66. *From New York.*—Should presume it would lower the income of plants as small as our own below an operating basis, as we find customers will not increase their light materially even at a low price for consumption. We see no way of meeting it, however, and think these conditions will prevail, as customers are already installing tungsten lamps.

67. *From Nevada.*—A godsend to companies whose rates are necessarily high on account of local conditions. Our basic rate is 20 cents. There are a large number of saloons, gambling houses and all-night resorts that burn their lights to full capacity all night and every night. We cannot secure their business on account of the excessive cost of electricity under these conditions. Most of them use gasoline lamps which have been brought to a remarkably satisfactory condition of operation. These same people are imploring us to give them a rate or illuminant whereby they can use electricity. They do not like the foul air, dirt and bother of gasoline. We have explained the tungsten lamp to many of them, and they all say that if the lamp is what is claimed for it they will use electric light. You can see what the introduction of this lamp will mean to us.

68. *From Colorado.*—Give no free renewals except of carbon-filament lamps.

69. *From Indiana.*—The tungsten lamp situation is a difficult one if you consider that all of your customers are going to adopt this kind of a lamp right away, but as they cannot get these lamps in any considerable quantities as yet, there is no danger of their general adoption very soon. There is no doubt but this lamp has come to stay and its use will increase. My advice to local managers is to control the lamp themselves, and do it quickly, and not to attempt to place before the customers any low-wattage lamps, but to persuade the adoption of the 100-watt lamp and make the price at cost to keep the contractors from handling them. However, if you are forced to handle the lower wattage lamp, you should control it also, so that you can induce your customers to take 100-watt lamps, if possible, and you can have a talking-point to hold them off as long as possible and discourage their use at present. I look for disastrous results from a revenue standpoint if low-wattage lamps are used.

70. *From Washington.*—We do not see why electric companies should be called upon or feel obliged to furnish free renewals on incandescent lamps, and should like to see all electric companies a unit on charging for renewals. It is a drain on the company to a large extent, which can be turned the other way if a charge is made. The gas men are aware of this, and we do not know of a gas company that furnishes free mantles or burners.

71. *From Michigan.*—We are advertising the lamp and preparing to meet the proposition with open arms. Tungsten may prove a fox at our vitals, but we are going to try to smile just the same. We recognize the inevitable, and "Tungsten, the Wonderful New Light," is on our roof sign in six-foot letters. We have a window exhibit similar to the one employed by the gas people to show the relative economy of the open and mantle burners, having two meters, one running on a 16-candlepower, the other on a 60-watt tungsten. Several colors of silk shown under each light serve to show the color values of each, and the exhibit has attracted considerable attention.

72. *From Maryland.*—Will boost electric lighting in that we can successfully compete with any illuminant on the market. The smallest store may be brightly lighted, and thus we believe the increased business will more than offset the reduced output.

By all means give your customers the best to be had, and they will be a walking advertisement for the company. With the high-efficiency lamps our lighting business will take care of itself, and our solicitors can turn their whole attention to power business, which, after all, is the real profit end.

73. *From California.*—We think it will have a beneficial effect on our own plants. We always endeavor to give consumers part or all the benefit of advances in the art, believing them better satisfied when they know they are receiving the best there is, and that saving in current consumption will result in a larger number of lamps being used, making the net result to us more, or at least no less. The results have proved our idea the correct one, as there are no plants in existence earning more per capita of population than ours in the cities served.

74. *From Canada.*—Change must be slow and

[illegible]

[illegible]

75. [illegible] general use, and will popularize and increase the demand for electric lighting. The introduction of the new lamps [illegible] have to buy them [illegible] nue, but in the end will be beneficial, as it will increase the number of individual consumers with- [illegible]

76. [illegible] running with a good rate [illegible] boon, for the efficiency over the carbon lamp is so great that there is [illegible] time you can compel your customers to turn this high-efficiency lamp out [illegible] losing this class of lamp. For the meter station it will stop a great deal of complaint of high meter bills, consequently better satisfied customers and longer life for the manager. We do not think there will be any great rush of meter trade to this lamp if the central station will furnish free renewals of a reasonable [illegible] carbon lamp. [illegible] give the loaded man [illegible] heavy peak load on tungstens and save the [illegible] he would have to spend for new machinery. After all, the interests of our customers are our own, for we are all one.

There is danger for one only, and that is the man who does not get next, and waits for his customers to find that there is a good thing [illegible] market that he is keeping from them.

77. *From Illinois.*—We believe that the tungsten lamp should be first used in store lighting in meeting gas competition. Here the larger units will not be at a disadvantage as they would be in residence lighting. Furthermore, by putting them out in comparatively small numbers, control can be kept and a fair charge can be made for renewals. At present prices of the lamp and the general conditions surrounding its manufacture, it will of course be necessary to make a charge for the renewal of lamps.

78. *From California.*—Would state that I consider that the advent of any form of lamp that will give the consumer more light with less consumption will be a great benefit to the lighting companies. This is best illustrated by the history of the Welsbach mantle and its effect on the gas-lighting industry. In the light of the above, the situation takes care of itself in so far as companies not supplying free renewals are concerned.

79. *From Pennsylvania.*—We believe the advent of the tungsten and other high-efficiency lamps will help the electric-lighting industry by more liberal consumption on the part of the present consumers and will materially assist in securing new consumers.

80. *From Vermont.*—The writer will personally advocate the free renewal of the standard carbon lamp and a charge for the difference in cost if the customer wishes the higher-efficiency lamps.

81. *From Ohio.*—Believe the increased use of these lamps will depend on the energy with which the central stations push them. On the basis of present prices for the lamps, we think the most feasible policy for the station interests lies in furnishing the lamps only upon a rate composed of a high fixed charge (insuring profit irrespective of the metered consumption) plus a meter rate for actual energy used.

82. *From Canada.*—A high-efficiency lamp will be to the electric-light industry what the mantle was to the gas industry. On the introduction of the high-efficiency lamp, earnings may show a decrease, but eventually a larger current consumption will be the result, as the reduced cost to the consumer will make electric light more popular.

We believe that the general use of the high-efficiency lamp will materially increase the earning capacity of electric-light companies.

83. *From Maine.*—I don't believe any general rule could be adopted that would apply to plants in general. Each individual plant will have to formulate a rule to meet circumstances as they occur. Some may need to increase their rates, while others would be benefited by a much-needed gain in surplus of capacity and cutting down their coal consumption.

84. *From Massachusetts.*—A temporary hardship, especially to small companies with a limited market; but believe that it will so raise the standard of illumination that in a few years our income per customer will not be materially lessened. We shall advocate their use as much as possible.

85. *From Colorado.*—The central stations should supply customers for the present with the high-candlepower tungsten units, and not attempt to [illegible] watt.

[illegible] distributed among our customers and installed about [illegible] shipment of the tungsten lamps we have experienced no trouble with breakage, having lost but [illegible] so far received have lasted only a few hours. We find, however, that most of this trouble is apparently due to poor assembling, the filament becoming detached from the spider terminals.

I do not believe the introduction of the tungsten lamp will have the effect of greatly decreasing the gross income of electric-lighting companies, al- [illegible] me on this point. There is a steady and growing demand for more light, and the customer is getting educated to the point where only the nearest approach to sunlight is satisfactory.

A number of customers with whom I have talked this matter over have stated that they do not complain of the size of their present monthly lighting bills, but in order to keep these bills at the present figure they have to economize on their lighting. They want more light, and want to be able to use it freely, both of which they can do with a lamp like the tungsten.

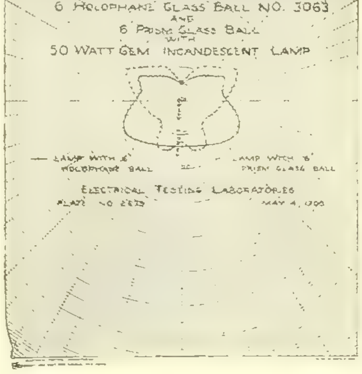
It is my intention, so far as possible, to replace our commercial arc lamps with tungsten lamps. We can give the customer far better and more light and better distribution for the same money. Taking the arc-lamp cost of installation, repairs and maintenance, with unavoidable troubles characteristic to them, I believe the tungsten lamp is a welcome substitute.

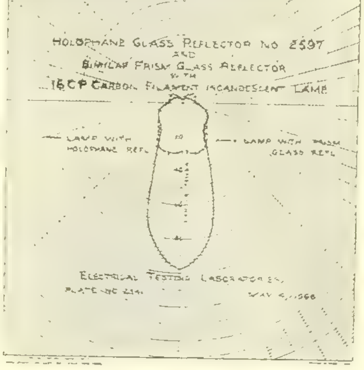
According to claims made by makers of tungsten lamps, the deterioration in their candlepower at the end of their allotted life is very small, so much so that the claim is made that they can hardly be distinguished from new lamps. This feature of the tungsten lamp, with its high cost and economical operation, should, to a great extent, if not wholly, do away with free renewals, which are practically universal throughout the country in all cities. This renewal of lamps is a large item with a good many stations, and if discontinued will go a long way toward offsetting losses that may be due to the introduction of the tungsten lamp.

[The end.]

Comparative Curves of Electrical Glassware.

The accompanying curves of illuminating efficiency are plotted from the results of tests by the Electrical Testing Laboratories of New York and are made public by the Holophane Company. They show, on the left, results obtained by testing a six-inch Holophane glass ball and another ball of the same size, both enclosing a 50-watt Gem lamp. On the right the comparison is between Holophane reflector No. 2597 and a similar glass reflector of the same size, with an ordinary 16-candlepower lamp. The differences are certainly striking and greatly in favor of the Holophane ball and reflector. The Holophane company contends—and the results of these tests seem to bear it out—that it is practically impossible to judge as to the efficiency of such reflectors by merely comparing their outward appearance. A photometric comparison is needed.

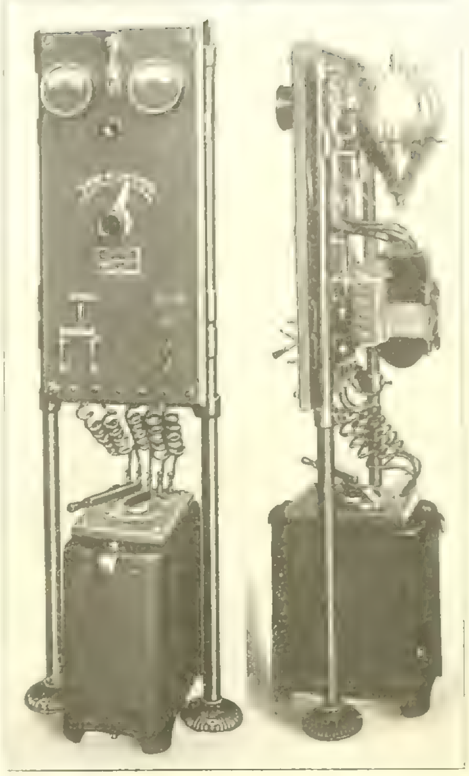




COMPARATIVE CURVES OF ELECTRICAL GLASSWARE.

Westinghouse Mercury-rectifier Battery-charging Outfit.

[illegible]



Front View. Rear View.

WESTINGHOUSE MERCURY-RECTIFIER BATTERY-CHARGING OUTFIT.

panel. The essential apparatus consists of an auto-transformer, a two-pole alternating-current knife switch, a starting switch, a shunt and starting resistance mounted in one case, a regulating resistance, rectifier bulb, ammeter, voltmeter and direct current circuit-breaker. The outfit is compact and is well suited to the limited spaces available in small private garages. The panel is 36 by 16 inches, its top reaching 66 inches above the floor. The face of the panel need not extend more than 24 inches from the wall against which it stands. It is made of slate and is supported on a standard pipe frame. The auto-transformer is mounted on the floor directly under the panel, and all the other apparatus is mounted upon the panel. The rectifier bulb is mounted on the back of the panel and is supported in a metal ring having a stem which projects through the panel, to which a hand-wheel is connected for tilting the bulb.

These rectifiers are designed to operate on 60-

[illegible] they can also be designed to [illegible] commercial frequency between 25 [illegible] 133 cycles. The average power factor [illegible] rectifier outfits when operated under proper [illegible] approximately 90 per cent., and this high power factor holds good at whatever voltage [illegible] battery is charged.

A certain constant voltage, amounting to about 15 volts, is absorbed in the rectifier bulb, which is practically independent of the amount of current flowing. The energy represented by this lost voltage appears as heat and a small amount of light. The efficiency, therefore, varies with the voltage at the load. At the maximum voltage of the rec-

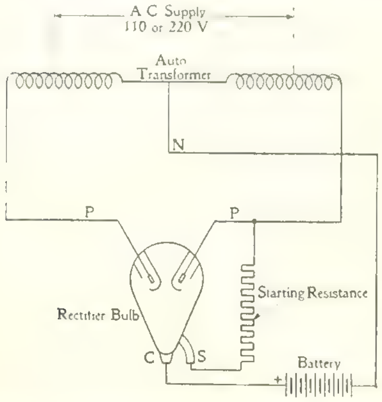


DIAGRAM OF CONNECTIONS FOR BATTERY CHARGING

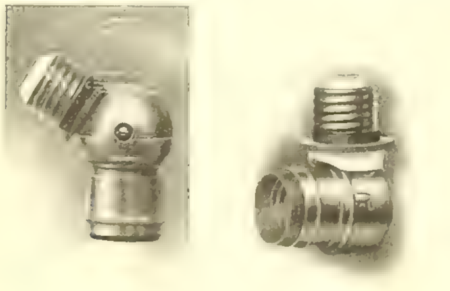
tifier the efficiency is over 80 per cent., while at lower voltages this figure is not greatly decreased.

The complete circuit of the mercury rectifier is shown in the accompanying diagram of connections for battery charging. The alternating-current supply circuit of either 110 or 220 volts is connected to suitable taps of an auto-transformer whose terminals are connected to the two positive electrodes of the rectifier bulb. From the negative electrode (C) the current passes through the battery to be charged and the circuit is completed through a connection to the middle point of the transformer. The auxiliary starting electrode (S) is connected through a starting resistance to one of the outside leads from the auto-transformer, and when the bulb is tilted a mercury contact is formed between the electrodes (C) and (S), and the current is established through the starting resistance. When the bulb is returned to the vertical position a spark breaks down the resistance of the negative electrode and the bulb starts into operation.

Numerous advantages for these battery-charging outfits are maintained, including economy of first cost, simplicity of operation, high efficiency of conversion, small space occupied, and the fact that any desired direct-current voltage can be obtained from 110 or 220-volt alternating-current supply, without the use of two-to-one ratio transformers.

New Adapter for Tungsten Lamps.

The Benjamin Electric Manufacturing Company of Chicago is placing upon the market a new device in the form of an adjustable plug socket, the principal use of which is that of an adapter for tungsten



[illegible]

[illegible]

Aluminum Cell Lightning Arrester.

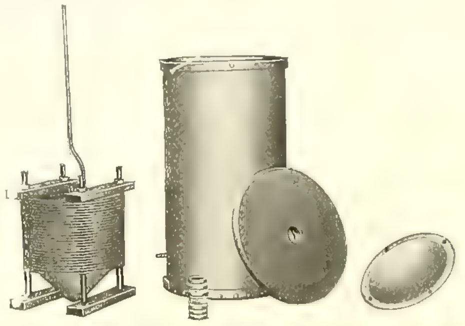
Considerable attention has been attracted by the new electrolytic lightning arrester known as the aluminum-cell arrester for operation on alternating-current circuits. This arrester, as shown in the cut, consists essentially of a series of concentric inverted cones placed one above the other with a vertical spacing of about three-sixteenths inch. The cones are insulated from one another except for the electrolyte, which partially fills them. Each cell then consists of two aluminum cones and the intervening electrolyte.

A sufficient number of cells placed in series forms a complete arrester, the electrical characteristics of which are the same as a single cell. The cones, complete with the electrolyte, are immersed in a tank of oil, which affords the necessary insulation and great heat-absorbing capacity. These tanks are made of welded steel and are equipped with wooden covers and suitable porcelain bushings.

The efficacy of the cones as a lightning arrester depends upon a thin film which is formed upon the surface of the aluminum by a special process of manufacture. This film may be compared with the safety valve of a steam boiler which opens at a definite pressure and allows the steam to escape.

Each cell, two adjacent cones with intervening electrolyte, is designed to operate normally at 300 volts. If the potential rises to any value greater than 300 volts and less than 420 volts, the film allows the discharge to take place, but a thicker film is immediately formed and the current is again decreased to a small value. When the line potential becomes normal this extra thickness of film gradually dissolves, leaving the film in its normal condition.

At 420 volts (about 40 per cent. above normal voltage) the film opens and allows a free and heavy discharge to take place. This voltage represents the maximum critical film value per cell.



PARTS OF ONE LEG OF 12,500-VOLT ALUMINUM-CELL LIGHTNING ARRESTER

The plate area of the cells is sufficient to allow a discharge of more than 1,000 amperes at double normal potential, or 600 volts per cell. This represents a quantity of electricity many times greater than that usually liberated by an ordinary induced lightning stroke. Consequently it is not possible to get an excessive potential across the terminals of the arrester by such discharges.

The aluminum-cell arrester is designed to be connected to the line through adjustable horn gaps. These gaps may be set so that the voltage will break across at any desired rise above the normal operating voltage. When the conditions warrant the gaps can be set so as to allow the arrester to discharge when the line voltage rises only about 25 per cent.

The horn gaps perform three important functions: First, they act as spark gaps, as explained; second, they may be used as disconnecting switches, and third, for subjecting the arrester to normal voltage. It is recommended that current be sent through the arrester every day or two, so as to assure proper formation of the film on the aluminum cones. The horn gaps are so constructed that they can be easily short-circuited momentarily for accomplishing their purpose.

An important feature in the mechanical construction of these arresters is that the aluminum cones are supported by their rim at four points, thus making a sturdy construction and eliminating any liability of the adjacent cones short-circuiting against each other.

The cone shape or pointed construction of the aluminum has a decided advantage in preventing explosive or corrosive action of the arrester, and prevents local heating and short life.

Some of the advantages of this type of arrester from a protective point of view, are stated as follows by the General Electric Company, which [illegible]:

First—They are designed to discharge at a comparatively small rise of voltage or electromotive force.

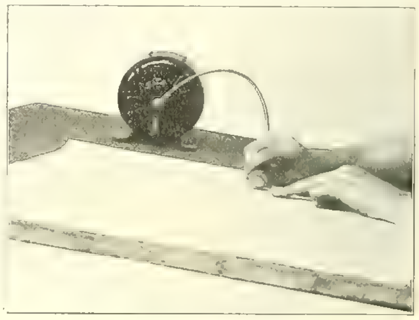
Second—The arrester will discharge the heaviest induced stroke without allowing an abnormal rise of voltage in the system.

Third—The large amount of oil used for heat absorbing and radiating capacity enables the arrester to discharge continuously for one-half hour. This is particularly desirable in case of a grounded phase, since the cause of the ground can often be located in a half-hour's time, or necessary switching done, so as to transfer to another set of buses.

Fourth—An inherent feature of aluminum cell arresters, with a properly formed film, is the fact that no dynamic current will flow as a result of the discharge.

A Motor-driven Eraser.

In even the most careful work in engineering offices and drafting rooms mistakes will occasionally be made, and changes are frequently necessary, requiring alterations in tracings. It is well known by draftsmen that erasing with a very light, fast motion will remove the lines without a scar. But most draftsmen do not have the patience to do



A MOTOR-DRIVEN ERASER.

the work without putting too great a pressure on the rubber, and the result is a marred tracing. The use of a scratcher leaves the poorest job of all. For these reasons an eraser driven by a small electric motor finds favor among draftsmen.

The eraser shown in the illustration is connected to the small Westinghouse motor by a Coates flexible shaft, allowing the motor to remain in one position near the edge of the table, from which any spot in the drawing may be reached. If desired the motor may be carried from table to table, as its weight is but little. In some cases a separate bench is used for erasing, and all tracings and other drawings requiring correction are brought there.

The motor is supplied for either direct or alternating current, one-twelfth or one-eighth horsepower. The high speed of the motor gives the circular eraser the required high speed, so that but a light pressure is required to remove any line desired. The tendency of men unfamiliar with the use of these erasers is to put too heavy a pressure on the eraser. This results in overheating the paper, and in some cases may injure it enough to spoil the drawing. But with a little practice anyone may readily learn to use the eraser very rapidly and accurately. The outfit is supplied by the Coates Clipper Manufacturing Company of Worcester, Mass.

Motor-vehicle Delivery versus Horse Delivery.

Hayden Eames, general manager of the Studebaker Automobile Company, says that the only way to arrive at a fair comparison between motor-vehicle delivery and horse delivery is to make a complete ledger statement of what it costs to do the work with horses, including rent of stable space, insurance, interest on investment and every part of a financial accounting. Then draw up specifications for a corresponding power wagon installation or organization and prepare an accurate ledger statement of the expected performance of this second installation and compare the two. When the power wagons are properly selected and applied it is an extremely rare case when the advantage of the power wagon ledger sheet is not overwhelming.

Some of the officials of the Illinois Traction System held a meeting and dinner at the Country Club, Springfield, Ill., a few days ago, the object being to discuss questions of business policy. Those present at the meeting were: L. E. Fischer, general manager; B. R. Stephens, traffic manager; C. F. Handshy, manager of transportation; H. C. Hoagland, mechanical and electrical engineer; R. McCullum, chief engineer; J. H. Rosenbury, superintendent of equipment; A. C. Murray, supervisor of expenditures, and Mr. Murphy, secretary to the general manager.

Ozone in Water Purification.

At the meeting of the [illegible] Society [illegible] on May 12th Mr. [illegible] Mellor [illegible] entitled "The Industrial [illegible] particularly in Connection with W[illegible] Pur[illegible]" [illegible] method used by Siemens & Halske [illegible] detail. The apparatus [illegible] electrodes, the inner [illegible] the outside one of glass. The aluminum one in order to keep it cool is hollow and has water circulating through it. The external one is also kept cool by water contact, and as the water is in an iron container which is [illegible] negative pole, and of course water is a conductor at the high tensions which are employed. Dried air is passed up the annular space between the two electrodes, and by means of the silent electric discharge which is there taking place is ozonized. From the ozonizer the air passes up towers which are filled with pebbles, and over which the water trickles. By this means the water is divided up into a number of small streams, and consequently a very large surface is exposed to the action of the ozone. After the water has been thus treated it is allowed to flow into the reservoir in a [illegible]. By this means it comes in contact with the air, and any excess of ozone which may be in it is removed.

It is found that the water purified in this way becomes almost absolutely sterile, and any bacteria which may happen to remain are not of a pathogenic nature, consequently the water is safe for potable purposes.

Messrs. Siemens & Halske have a large installation for dealing with water at Wiesbaden and another for purifying the water supply at Paderborn. The process can be cheaply carried out, as it does not cost more than 0.4 cent for every cubic meter of water which is treated.

Dr. T. M. Lowry thought that a simpler method of sterilizing on a large scale was to soften the water and bring down the bacteria in the precipitated chalk.

Dr. H. Borns pointed out that water from rapidly flowing rivers needed little further purification.

Dr. G. Senter referred to the difficulties of removing the last traces of ozone from the sterilized water.

Dr. V. H. Veley remarked that germs that could not easily be destroyed were, as a rule, harmless.

The chairman (Mr. Leon Gaster) described an ozonizing plant he had lately visited in Philadelphia, where the water purified was practically diluted sewage. This plant was capable of treating water for a population of 30,000, but occupied only 30 by 50 feet of ground, as against acres required for sand filters. He also gave some particulars of the Lahmeyer process.

Synchronous Motor-generator Set in a Colorado Chlorine Plant.

The chlorine plant of the United States Reduction and Refining Company at Colorado Springs, Colo., has installed in its power house a 150-kilowatt synchronous motor-generator set to supply current for the electrolytic production of chlorine gas, used in the chlorination treatment of gold ores. It is used in conjunction with the MacDonald cell, in which carbon electrodes form the anode and a cast-iron tank the cathode, with an electrolyte of sodium chloride solution. The machine has current capacity for the manufacture of 2,000 pounds of chlorine solution per 24 hours.

In a plant of this kind, where the transmission voltage is liable to fluctuate to any great extent, the machine must be protected by an automatic circuit-breaker trip to release the machine from the cells in the event of the voltage being reduced below the counter electromotive force generated by the cells themselves, in which event the polarity of the generator is reversed and the current flows through the cells in the opposite direction, thereby forming hydrogen in the cells, which necessitates their draining and the putting in of new electrolyte. A synchronous motor-generator set was selected as best adapted to this class of work from the fact that in case of any serious drop in voltage the machine will be unable to regain its speed when the voltage becomes normal and thus fall out of step and release itself from the circuit by blowing the fuses on the alternating-current side.

This set consists of a 225-horsepower synchronous motor coupled to a 150-kilowatt generator. The motor is supplied with three-phase current at 440 volts, 60 cycles, and by driving the direct-current generator furnishes direct current at 150 volts, the normal current output of the generator being 1,000 amperes. The set was supplied by the Allis-Chalmers Company and is arranged for starting from the direct-current end, being brought up to speed by running the direct-current generator up to speed as a motor until synchronism is attained on the alternating-current end.

Henry E. Huntington, the street and interurban railway magnate of California, has returned from the East and says that money for safe investment is plentiful and cheap. He believes that good times are at hand. His street and interurban railways did nearly 11 per cent. more business in January, February and March than they did for the corresponding period last year.

CORRESPONDENCE.

Continental Europe.

[illegible] now taken up the matter and proposes to try experiments in this direction on a practical scale, [illegible]

The Municipal Council of Rome is taking measures relating to a 7,000-horsepower electric-light and power station lying in or near the city, which it is proposed to erect soon.

Among the propositions for erecting electric plants in Switzerland, I may mention a new hydraulic plant which will no doubt be built, using the power of the Aar River, with a dam and turbine house located at Brugg. The total capacity of the new station will be about 15,000 horsepower at the start. Current is to be used in the surrounding region, mainly for operating electric tramways and on some portions of the railroads. The Federal government is occupied with the matter at present.

Another Swiss project relates to an electric rack-rail system of short length which will mount from the central part of Zurich to one of the neighboring heights. From Brigue, at the end of the Simplon Tunnel, to the town of Belap, there is to be built an electric road which will be also operated on the rack-rail system, at least for the greater part of the distance, the latter being about seven miles. The line will be narrow-gauge.

The new tramway lines which are to be constructed at Blois, France, have been approved by ministerial decree. The plans call for several lines of tramway. At Cambrai, the Municipal Council has granted to a contracting company the rights for the extension of several lines of tramway.

Owing to the recent increase of its plant, the electric-light and power station of Essen, which is owned by the Rheno-Westphalian company, now ranks among the largest on the Continent. An elaborate system of water-cooling apparatus is one of the features of the plant. A supply of cold water is wanting in this case, which made it necessary to adopt a special apparatus. This consists of a number of cooling chambers which are erected outside of the station and connected with the latter by piping. The water is cooled by means of a spray, combined with an air draft, which is given by a high chimney which lies above the cooling basin. For the five steam turbines of the plant it is required to have an apparatus for handling 7,200 cubic meters of water, and there are three separate cooling apparatus installed of the type mentioned.

As to affairs in Spain, I note the formation of a new company at Saragossa which is to operate a large flour mill by electric motors. It will erect a power plant for this purpose, and the remainder of the current will be used in the neighboring district. At Madrid, the traction company expects to install a new line of tramway for the city. It is proposed to erect a 5,000-horsepower electric plant near Barcelona, in the town of Manresa, and the current will be used for traction purposes in both these localities. A. de C.

Great Britain.

London, May 30.—The inquiry into the electric power bills for London drags along slowly before Lord Cromer's committee of the House of Lords, and inasmuch as the committee has decided to hear all three bills before coming to a decision, some time must elapse before any definite conclusion is arrived at. Nevertheless, an interesting stage has been reached, viz., the discussion of the terms of the proposed clause in the bill of the new company which will enable some authority at the end of 42 years to purchase the undertaking. The question of the ultimate purchase of such an undertaking is an important one, both for the promoters and for the public, and it is quite certain that the House of Commons will not allow any bill to go forward without such a clause.

The dispute between the postmaster-general and the National Telephone Company as to whether the latter should pay royalties upon all private telephone lines came before the Appeal Court this week, and a decision in favor of the company was given. The point is whether a private line, say, between a man's house and his office, or between several independent offices or businesses, came within the postmaster-general's monopoly and as such was liable to royalty.

A short time ago a bill was before Parliament by which it was proposed to expropriate a large tract of bogland in Ireland and to burn this as fuel in gas plants for the purpose of electrical generation. The bill included a large area over which electrical supply was to be given, including the city of Dublin and a number of other more or less important places. On the opposition of these authorities, the bill was rejected, but an arrangement has been come to now to exclude these areas from the scheme, and in this altered form the scheme has been allowed to proceed.

I have on more than one occasion referred to the somewhat extortionate demands of local au-

[illegible]

Eastern Canada.

[illegible] Ont., has decided to sign a contract with the gov[illegible]

The Kingston Milling Company of Kingston, Ont., purposes developing electric power at Kingston Mills, using the power in mills there and also bringing it into the city, a distance of six miles, for use in its city plant.

Application has been made by the Town Council of North Bay, Ont., to the hydro-electric commission of the province, to develop Smoky Falls, on the Sturgeon River, and supply North Bay with electric power. This is a magnificent waterpower, capable of developing 10,000 horsepower. The distance from North Bay is about 18 miles.

The stock of the Bell Telephone Company of Canada has shown a disposition to advance of late. It is generally felt that the company made a favorable move in selling its Manitoba and Alberta systems, as the Northwest provinces are, as yet, sparsely settled, and it would probably be some time before they would become valuable portions of its system. Moreover, the company now has at its disposal ove $4,000,000, which is available for extensions. Of the present outstanding capital of $12,500,000, no less than $8,500,000 has been issued to the shareholders since 1898, and an interesting feature is that eight per cent. dividends have been paid on the stock for over twenty years. W.

New York.

New York City, June 6.—The city lighting plant used to light Brooklyn Bridge has been closed down and Water Commissioner O'Brien has asked for an appropriation for a contract with the Edison Company to light the bridge. The plant has been operated by steam supplied by the Brooklyn Rapid Transit Company in return for certain terminal privileges. The changed terminal conditions abrogates the agreement and the city is now obliged to pay for its steam. The railway company has offered to supply steam for $36,500 a year. The bridge commissioner says the bridge can therefore be lighted much cheaper by contract with the Edison company, and he has shut down the city plant. The municipal plant on the Williamsburg Bridge was shut down some time ago because it did not pay.

The Public Service Commission of the second district has heard an application by the New York Central and Hudson River Railroad Company to transfer from the Mohawk Valley Company, a corporation which now owns various street-railway stocks and which is controlled by the New York Central, the interests of the New York Central and the Central Railway Syndicate in the street-railway companies of Rochester, Syracuse, Utica and Schenectady into a street-railroad corporation, the purpose of which is to unite the operation of the various companies, thus bringing them under the supervision of the Public Service Commission. Plans were under way to finance the interests of the New York Central through the means of the Mohawk Valley Company, a holding company, but on the passage of the public service commission law these plans were found to be inadvisable and the company at once proceeded to devise a plan of procedure which would place the interests which it controls under the jurisdiction of the Public Service Commission.

The department of water supply, gas and electricity has been endeavoring to compel the New York Central to put the electric cables of the Hudson and Harlem divisions underground, asserting that they are unsightly on the poles and that with the 11,000 volts are a menace. The company's engineers estimated it would cost $2,000,000 to do this work over the distance of about 10 miles. The city department's consulting electrical engineer estimates that the cost would be $1,453,000. A hearing has been conducted before Commissioner Eustis, which may be concluded today.

At a hearing before Commissioner Maltbie of the Public Service Commission on Tuesday an order was proposed that the city traction companies should supply the commission with plans of all new cars, brakes, fenders and other appurtenances of rolling stock to be purchased before such accessories are bought. Without exception the representatives of the companies not only declared the proposed order highly improper, but criticised the commission for considering it.

The building of the Fourth Avenue subway, in Brooklyn, is now assured. The appropriation of $2,800,000, the amount necessary for the beginning of the construction work, will be passed by the

Board of Estimate next week, and all that will then remain to be done will be for the Public Service Commission and the Board of Estimate to sign the contracts. Once the Board of Estimate has appropriated the money, the long fight for and against the building of the line will draw to a close, and work may be begun within two months. The line will be completed in approximately two years, according to the reckoning of the Public Service Commission. The plans contemplate a four-track line for the entire distance, and some of the opponents of the project have urged that four tracks are not necessary and are, in fact, an ex- [illegible]
W.

Southeastern States.

Charlotte, N. C., June 6.—Salisbury, N. C., has finally granted to the Southern Power Company a 10-year franchise to operate in the city and a five-year franchise to furnish city lights. Also the Salisbury and Spencer Electric Railway is empowered to use power from the power company for a period of 10 years. It only remains now for the two companies to accept the terms of the franchise.

H. H. Carr has been appointed in Federal Court as receiver for the Fayetteville (N. C.) Gas and Electric Company. The petitioners for the receivership were the stockholders, and principally the American Security and Trust Company. The Fayetteville concern is bonded at $50,000 and is said to have been operated at a loss for several years past.

An important action instituted some time ago by the Yadkin Power Company, chartered by the state legislature to operate power plants on the Yadkin River to secure the right to condemn the lines of the Whitney company, one of the largest in the South, has been disposed of in the state courts in favor of the Whitney Company.
H. D. L.

Ohio.

Toledo, June 6.—At a recent hearing in the United States court at Toledo, Judge R. W. Taylor decided that the Toledo, Port Clinton and Lakeside Electric Railroad has not infringed on the patent of the Westinghouse Electric and Manufacturing Company by using motors of the series-multiple type. The case has been contested for the last three years.

The Fremont Power and Light Company, backed by Chicago, Detroit and Fremont capital, has made application for a franchise from the city of Fremont, Ohio, permitting it to erect poles, string wires and furnish power for lighting and other purposes to that city and for private use. It is the purpose to "harness" the Sandusky River above Fremont, erect a power plant, and supply electricity in large quantities. An electric railway between Fremont and Tiffin, Ohio, is also contemplated.

A complete electric-lighting system is being installed at the Barracks at Columbus. There will be 2,000 incandescent lights of 16 candlepower each and 15 arc lights for the streets in the post. It is expected that the work will be completed by July 1st.

J. C. Fesmire of Indianapolis, superintendent of construction for the Bell Telephone Company, is now in Toledo, assisting City Electrician J. Tyler Greene in eliminating poles and wires from the downtown section of the city, and installing the conduits underground. The work is progressing rapidly and is supposed to be completed by June 15th.

The Fixler Trolley Stand Company of Delta has been incorporated with $25,000 capital stock. D. H. Lavenberg is general manager. The company will begin the manufacture of a new patent trolley stand for holding trolley poles on electric cars.

An increase of $250 a mile was added to the valuation of the main track of the Lake Shore Electric Railway at a recent meeting of county auditors at Cleveland. The valuation per mile of the main track was fixed at $5,000; of the second track at $2,000; of the rolling stock at $600, and of the sidings at $800.

The Union County Farmers' Telephone Company of Marysville, Ohio, which was incorporated with a capital stock of $24,000, divided into $20 shares, proposes to build exchanges at York, Byhalia and Raymond; also at West Mansfield and East Liberty.
H. L. S.

Michigan.

Detroit, June 6.—The Bellevue Lighting Company has submitted to the Village Council proposals to [illegible] a year each [illegible] a year [illegible] midnight for a pe- [illegible] accepted, the price of commercial lighting will be reduced from [illegible]

[illegible] into a con- [illegible] by the terms of which a lighting system will be ready for [illegible]

The plant furnishing current for Bellevue has [illegible]

[illegible]

and water pumping. It is expected that a lighting company giving service in Charlotte will be shut down at the termination of the present contract, as foreclosure proceedings have been instituted.

The title to the old Mansfield and Coldwater Railway, which was built about thirty years ago, has passed into the hands of the Coldwater and Battle Creek Electric Lighting Company, which, it is said, has been financed.

Construction work on the dam of the Menominee River, two miles west of Ingles, will be started very soon by the Marinette Light and Traction Company. The amount of power available will be 4,500 horsepower, with a reservoir to increase the peak capacity to 6,500 horsepower.

The Eastern Michigan Edison Company has taken steps toward the reforestation of the Huron Valley by planting 100,000 red-oak and white-pine trees. This work will be very much extended.

Foreclosure proceedings have been instituted against the Owosso and Corunna Electric Company of Owosso by the Fidelity Trust Company of Philadelphia because of default in payment of interest on bonds. The company operates an electric railway between Owosso and Corunna and sells power for commercial purposes. E. Mandeville of Philadelphia has been appointed receiver and will have the management of the property.

The Village Council of Belleville has granted a franchise to the Detroit and Adrian Traction Company.

Options have been secured on a 25-foot dam at Rollin by the promoters of the Toledo and Michigan Electric Railway. Options have also been secured on the Ames property, three miles south of Rollin, for another dam, with head of 30 feet. These two dams, in connection with those at Hudson and Kefus, which have been developed, will produce 3,000 horsepower, sufficient to operate the entire 56 miles of road.

A franchise has been asked for a street railway in Petoskey, with the proposal to operate both the electric lighting and railway from the same plant.
B. J. D.

Indiana.

Indianapolis, June 6.—Two new traction companies filed articles of incorporation with the secretary of state during the last week. The Terre Haute and Northern Traction Company, capitalized at $100,000, proposes to operate lines in the city of Terre Haute and in towns and villages near by. The company's headquarters will be in Terre Haute. S. C. McKeen, A. J. Stein and others are directors. The Vincennes and Washington Transit Company, capitalized at $60,000, may construct and operate an electric railway from Monroe City, in Knox County, to Washington, in Davies County, and thence to Bloomington, in Monroe County. J. J. Burns, Clyde F. Burns and others are directors.

The committee appointed some time ago by the traction companies of Indiana to work in conjunction with the Railroad Commission, in the drafting of rules, to be used by employes of the interurban companies, has completed its work and adopted a complete new code. Among other things, the rules prohibit traction employes from the use of intoxicating liquor, and also the use of tobacco when on duty. The rules cite the public statutes relative to what acts of an employe may render them criminally liable in case of the loss of life. Experienced railroad men say the new set of rules are the most complete and practical that ever came to their knowledge. The members of the committee were: C. D. Emmons, chairman; H. A. Nichol, C. C. Reynolds, Fletcher Durbin, Charles Lohman and Alexander Shane.

The People's Light and Heat Company of Indianapolis has increased its capital stock from $50,000 to $1,000,000. This is an additional step in the plans of Mr. Fauvre and Mr. White, who have secured a controlling interest in the property. A new company is being organized for the purpose of manufacturing electricity in an immense plant in the coal fields of Vigo County. Mr. Fauvre, who is to be president of the new company, says that within 15 months the company will be transmitting and distributing electricity in Indianapolis, a distance of 50 miles, for light, heat and power purposes. The stock of the new company has all been subscribed for.

The Carroll Electric Light Company of Delphi has filed articles of incorporation with the secretary of state. John H. Burr, Nathaniel Moore and others are interested.
S. S.

Illinois.

Peoria, June 6.—The city electrician of this city has decided that the old electric-light towers that were formerly used to light the city must come down. They were used to carry six to eight arc lights, but they were found to be too lofty, on account of the shade trees making it dark underneath. They are 125 feet high and have been up ever since the city was first lighted by electric light. When the city was first lighted by electricity there were eight of them, but they have been gradually taken down, until now only two remain, and these will [illegible] come down, and the arcs on them will be distributed in the same locality.

[illegible] awarded the contract for the completion of the electric-light plant at that city to the Fort Wayne Electric Works of Fort Wayne, Ind., on its bid of $2,900. The plant was started, but not completed, some time ago. Now the contract calls for the furnishing and hanging of 17 arcs and the furnishing of the generator and several commercial transformers. The bonds for the erection of the plant were sold to the Mason County Bank at Havana, and they brought a slight premium.

The state board of warehouse and railroad commissioners has granted the petition of the Illinois and Indiana electric road for a crossing of the Southern Railway in two places in East St. Louis and a crossing for the Illinois Transfer Company in East St. Louis. The electric road must protect the crossings which are at grade with interlocking devices.

The Illinois Traction Company has decided to stop the travel of the Mackinaw-Lincoln line until the construction force can get the line ballasted. They have been trying for two or three weeks to keep the line open, and with 100 men to ballast the track, but the travel has been too heavy and interfered too much with the work of the construction department. The company will route the freight via Decatur for this city till the work is completed.

The Leyden Light and Power Company has been incorporated with a capital of $50,000. The principal office is to be in Franklin Park.
V. N.

Northwestern States.

Minneapolis, June 6.—A meeting of the business men of Fort Dodge, Iowa, has been held with a view to electrifying the Crooked Creek Road, so as to form an interurban between Webster City and Fort Dodge.

The promoters of the Newton and Northwestern propose to electrify the road between Newton and Colfax, Iowa, provided the citizens of Newton will subscribe for $40,000 of the bonds.

Sleepy Eye, Minn., now has a 24-hour schedule for electric power and current.

The Hardin Waterpower Company of Hardin, Mont., has been incorporated for the purpose of manufacturing, purchasing and developing electric and steam power. Capital stock, $30,000.

The contractors for the electric-light plant of Joliet, Mont., ask for an extension of time at which to commence the work.

Norman S. Poole has bought the electric-light plant of Townsend, Mont., for $6,000.

The Madison River Power Company has bought the Billings electric-power plant at Billings, Mont., for $200,000. It has also secured options on the plants at Columbus, Forsyth, Big Timber and Livingston, and is negotiating for options on plants west of Butte.

The plant of the Appleton Paper and Pulp Company, at Appleton, Wis., will be razed and an electric power plant erected on the site.

E. Soerens has the contract for lighting Cedar Grove, Wis. As soon as the Milwaukee Northern Street Railway is in operation, electric arc lights will be substituted for the kerosene lights now in use.

The Chippewa Valley Railway, Light and Power Company, Eau Claire, Wis., is now using its own power to operate its cars, its lease with the Chippewa Lighting Company having expired.

A dam is being built across the Wisconsin River at Kilbourne, Wis., and a large electrical power house will be built and operated there.

The Mellen Water and Light Company of Mellen, Wis., lost its dam during the recent heavy flood
R.

Western Canada.

Winnipeg, June 6.—At a meeting of the City Council of Port Arthur, Ont., it was decided to carry out the power improvements along the Current River as recommended by Cecil B. Smith of Toronto. The city will repair the damage done by the breaking of the dam some ten days ago. J. J. Carrick is mayor.

The Carnduff Telephone and Electric Light Company has been organized at Carnduff, Saskatchewan, with a capital of $20,000 to install a telephone system in that town. J. H. Elliott and others are provisional directors.

In a report presented to the City Council of Lethbridge, Alb., Cecil B. Smith recommends that the city continue in control of the power plant and the continuance of the present source of supply.

The Canadian Westinghouse Company has been granted a license to carry on business in the province of British Columbia. John R. Reid of Vancouver has been appointed agent for that province.

When the fire at the power plant at Nelson, B. C., put the electric street railway out of business it was feared the city would be without electric cars for the rest of the year. However, the city has now made arrangements to give the company free power.

The British Columbia Electric Street Railroad Company is making every effort for the early completion of its line between New Westminster and Chilliwac. Last week the 12-mile section between New Westminster and Cloverdale was put under contract, the work being awarded to Boyd & Craig, a Vancouver firm.

The rights of the British Columbia Electric Street

[illegible] versy in the Pacific Coast capital. At present it is [illegible] solicitor that it would not be advisable to allow the [illegible]

Pacific Slope.

San Francisco, June [illegible] Great Western Power Company, which is making efforts to complete its 40,000-kilowatt plant at the Big Bend of the Feather River in California next winter, is trying to secure a contract to supply the United Railroads of San Francisco with all of the current needed to operate its cars. From 20,000 to 30,000 kilowatts will probably be required in the near future. There are prospects also that the Great Western Power Company may be able to secure a contract to supply the Oakland Traction Consolidated and the San Francisco, Oakland and San Jose Consolidated with current. A steam reserve plant is to be installed in Oakland.

The management of the Kohl Building, located on the northeast corner of California and Montgomery streets, San Francisco, has been granted permission from the supervisors to lay underground pipes and electric conduits to the Clunie Building, situated on the southwest corner of the same streets. It is understood that, besides furnishing electric light and power and steam heat to this building, the California Market, which is in course of construction in the rear of the Clunie Building, will be given a similar service.

William Ellery of Redding, Cal., has filed on 134,000 inches of water in the McCloud River near Baird, Shasta County, for the purpose of generating electric power. The water is to be diverted from the river and carried to two power houses.

The Washington Power Company of Spokane, Wash., has begun work on a power plant at Little Falls on the Spokane River near the town of Reardan. A head of 68 feet has been secured, and it is intended ultimately to generate 30,000 horsepower. The initial installation is estimated to cost upward of $500,000. When the new plant is completed the company will have three waterpower plants, with a combined capacity of 61,000 horsepower and a reserve steam plant with a capacity of 20,000.

The Kern River plant of the Edison Electric Company of Los Angeles is still supplying all of the power needed for that company, but the water in Kern River is getting low, and it is expected that one or more of the company's plants in Southern California will be started in a short time. The Kern River plant is now generating 40,000 horsepower.

The Grande Ronde Electric Company of Baker City, Ore., announces its intention of erecting 33 miles of transmission line this summer between Union, Ore., and its Rock Creek line, in Baker County. The extension will cost about $50,000. The new line will connect with the lines of the Fremont Power Company at the Red Boy mine, south of Sumpter.

The Globe Electric Light and Gas Company of Globe, Ariz., is reported to have passed into the hands of Russell Palmer of New York, who is planning improvements and extensions to cost in the neighborhood of $150,000.

The Utah Light and Railway Company of Salt Lake, Utah, has begun work on the new car barn and plant at Fifth South and Sixth East streets in that city. The complete plans involve the expenditure of about $600,000, but probably not more than half that amount will be spent this year.

A.

PERSONAL.

Mr. J. H. McKnight of Litchfield, Minn., manager for the Northwestern Telephone Exchange Company, has gone to Fargo, N. D., where he will take charge of that office for the same company.

Mr. E. M. Greene, formerly of Clifton Forge, Va., has accepted the position of superintendent of the Blue Ridge Light and Power Company, which operates the electric-light and street-railway system of Staunton, Va.

Mr. James E. Cole, heretofore chief engineer of the Department of Wires, city of Boston, has been appointed wire commissioner to succeed Patrick T. Kennedy, who resigned in January. Mr. Cole has been acting commissioner since Mr. Kennedy resigned.

Mr. W. W. Cole, vice-president and general manager of the Elmira Water, Light and Railroad Company, Elmira, N. Y., has resigned and on August 1st will become general manager of the public-utilities department for Dodge & Day, engineers, of Philadelphia.

Mr. Edward B. Pillsbury, who was transferred on January 1st from the superintendency of the Postal Telegraph-cable Company at Boston to the division superintendency in New York, has been promoted to be general superintendent, taking the place of E. G. Cochrane, who has retired on account of ill health. Mr. Pillsbury has had a long and varied experience as a telegrapher, and [illegible]

Mr. [illegible] the British Institution of Electrical Engineers, died [illegible] ganization, then the Society of Telegraph Engineer [illegible]

Mr. J. G. Blake, assistant general superintendent at San Francisco of the Postal Telegraph-cable Company, has been promoted to the general super- [illegible] pointed Pacific Coast representative. Mr. Blake was born in Vermont and is 48 years old. He began [illegible]

Mr. Angus S. Hibbard, vice-president of the Chicago Telephone Company, whose musical ability is well known, was chorus master at the recent "fellowship rally" of the Chicago Association of Commerce. He presented several songs to popular tunes, and one hymn, "Hail Chicago," for which he wrote both words and music.

William A. Pearson, chief architect of the General Electric Company, died at his home in Schenectady recently. He had been with the company for 16 years. Formerly he had served in various capacities, including that of civil engineer, for railroads, railroad shops and other industrial establishments. He was 53 years of age.

Mr. Charles J. Russell, district manager at Frankfort for the Philadelphia Electric Company, will attend the International Congress of Electricity, to be held at Marseilles, France, in September, and will read a paper. Mr. Russell was present at the last International Electrical Congress held at St. Louis and attended the International Congress of Applied Electricity held in Rome in April, 1906.

Mr. Herbert Parker, former attorney-general of Massachusetts, succeeds Mr. William E. McClintock as chairman of the highway commission, which has supervision over the telegraph and telephone companies operating in that state. Mr. McClintock becomes chairman of the commission appointed to govern the city of Chelsea for five years. He is succeeded in membership on the highway commission by Col. William D. Sohier.

Mr. P. L. Utley, secretary and treasurer of the Escanaba (Mich.) Electric Pulp and Power Company, has been chosen as superintendent and general manager of the Escanaba Electric Street Railway Company, to succeed Mr. A. W. Paine. Mr. Utley has had several years' experience in the operation of street railways and in general electrical work. Mr. Paine resigned in order that he might accept a position at Kansas City.

Mr. Frank W. Boyer, president of the Chicago Mica Company of Philadelphia and Valparaiso, Ind., visited Chicago last week, making his headquarters at the Auditorium Annex and also part of the time at the South Shore Country Club. During his visit to Chicago Mr. Boyer entertained in his usual lavish and hospitable manner a party of business men and capitalists from Valparaiso, Ind., and also several of his Chicago business friends. On Thursday Mr. Boyer gave a luncheon at the Auditorium Annex. President W. H. Gardner of the Valparaiso (Ind.) Farmers' National Bank, Vice-president P. W. Clifford of the same institution and Secretary and Manager E. H. Heilstedt of the Chicago Mica Company's Valparaiso factory were among the guests on this occasion. After luncheon Mr. Boyer took the entire party, including the Chicago manager of his company, Mr. F. F. Finney, for a pleasure trip to Milwaukee. The party returned to Chicago later in the week. Afterward a number of the party left for Valparaiso in an automobile as the guests of Mr. Gardner.

ELECTRIC LIGHTING.

Seward, Neb., will spend $7,000 in improving its electric-light plant.

H. V. Williams is about to install an electric-light plant in Lehigh, Iowa.

Kewaunee, Wis., has voted bonds to the amount of $20,000 for an electric-light plant.

The annual report of the Montreal Light, Heat and Power Company for the year ended April 30, 1908, shows gross earnings of $3,792,218 and net $2,140,562. After fixed charges there remained for dividends $1,647,467, and the surplus after dividends was $627,467, being an increase of $136,885 over the previous year.

It is said that the plan of financing the Toledo Railways and Light Company of Toledo, Ohio, and possibly of bringing about a complete reorganization of the company, is progressing satisfactorily. The plan is in charge of a committee of bondholders, of which Norman B. Ream is chairman, and it is understood that the company's officials approve of the committee's plan. A total of $10,166,000 bonds of the company itself or of its subsidiaries come [illegible]

[illegible] of University Place.

[illegible] ordinance which will reduce the rate of compensation paid the city by independent electric-light [illegible] duce their rates to patrons to the same basis as the Commonwealth Edison Company.

ELECTRIC RAILWAYS.

The Public Service Railway Company has resumed the reconstruction of its tracks in Newark, N. J., and vicinity, and with the recently authorized $50,000,000 bond issue, will continue the work until the entire system is equipped with the standard rail now in use in Chicago.

Messrs. C. A. Ross, C. B. Judd and H. S. Rattenborg of Chicago have secured a contract for a 60-mile extension of the 17-mile railway which they built from Atlantic to Kimballton, Iowa, last year. The extension runs 40 miles south from Atlantic and 20 miles north from Kimballton.

A consolidated mortgage or deed of trust of the Calumet and South Chicago Railway Company to the First Trust and Savings Bank for $5,000,000 has been filed. It is in the shape of a bond issue, the bonds being subject to redemption upon any interest payment date at par with a premium of five per cent. The purpose of the issue is rehabilitation, extension, funding and discharging outstanding debts. All property of the company of every nature is given as security.

The June folder of the Illinois Traction System (electric) is an attractive piece of railroad literature, comparing favorably with steam-railroad folders. There are time tables and a map and all needed data, including information about the Springfield-St. Louis sleeper and the package-express service. L. E. Fischer of Danville is vice-president and general manager and B. R. Stephens of Springfield general traffic manager of the Illinois Traction System.

The trains of the Inland Empire electric system carried to Spokane during April 11,755 passengers who bought their tickets at the stations on the Spokane and Inland and the Cœur d'Alene and Spokane divisions. The number of passengers does not include those traveling on mileage books, commuters and those who paid their fares on the trains. From figures compiled during past seasons it is believed that the travel this year is heavier by 40 per cent. than in any like period in previous years.

The Chicago City Railway Company and the Chicago Railways Company are doing rapid work on the reconstruction of tracks. Construction engineers and large gangs of men are at work at a score of points throughout the city. Several of the main lines have been rebuilt for long distances, and other streets will be taken up in order. The work is of such character as to make what is probably the best roadbed in the world. In many instances one track is rebuilt at a time, a temporary track close to the curb serving to carry on traffic.

On behalf of three banks in Philadelphia application was made in the Superior Court at Bridgeport, Conn., on June 2d for a temporary receiver for the Danbury and Harlem Traction Company, which is building a line from Danbury, Conn., to Golden Bridge, N. Y., where it will connect with the Harlem Railroad. The allegation is that the company has defaulted payment of interest on its bonds. The company has built a power plant and has two-thirds of its line built. It is capitalized at $500,000 and has issued bonds to the amount of $300,000. Dietrich E. Loewe of Danbury is the president of the company.

POWER TRANSMISSION.

The Mexican Light and Power Company of Mexico City has extended its transmission line to supply the Hacienda de Esperanza with power. This line is 175 miles long and runs from the hydro-electric plant of the company at Necaxa.

The Cuyahoga Light, Heat and Power Company, which was incorporated at Cleveland, Ohio, a few days ago, proposes, it is said, to develop a power plant at Cuyahoga Falls on the Cuyahoga River, where there is a fall of 100 feet. It is said that notices have been served on land owners along the river announcing the beginning of condemnation proceedings to get possession of the river bed for miles under a special statute passed two years ago

[illegible] Power Company, Grand Building, Macon, Ga., has awarded the contract to Lane Bros. of Richmond, Va., for construction of [illegible] hydro-electric plant [illegible] engineering will be in charge of J. G. White & Co. The development will cost $2,500,000.

On June 8th the City Council of Chicago adopted the report of its finance committee permitting the use of city poles and conduits for the distribution lines of the Sanitary District's system supplying electric power from the waterpower plant at Lockport, Ill. The District may use any available poles or conduits by consent of the city electrician and install its wires in accordance with his recommendation on payment of a reasonable compensation to the city. Placing of new poles shall not be done without a city permit and notification of the aldermen in whose wards the poles are to be set. The legal question whether the District shall be required to secure frontage consents was left to the city law department. In a test case on the frontage question a master in chancery has just decided that such consents are not needed. The city electrician submitted a report declaring dangerous the 12,000-volt lines, of which about 33 miles have been already placed in the city.

TELEPHONE.

It is said that the Delaware, Lackawanna and Western Railroad is preparing to establish a telephone system which may, it is understood, displace the telegraph for train dispatching.

The Gaston (Ind.) Home Telephone Company has completed its new organization, purchased property in Gaston, and is now erecting a modern exchange building thereon, to be installed with modern equipment. It is also constructing a number of new lines throughout the country.

The Home Telephone Company of Los Angeles, Cal., has refused to pay the May license fee of $50 for each telephone exchange and has begun suit to test the city's right to collect the fee. The telephone company argues that it purchased a franchise to do business in the city of Los Angeles for a certain sum of money, and that the ordinance providing for a license fee might result in the confiscation of this property right.

Among recently incorporated telephone companies are the following-named: Walker Telephone Company, Texola, Okla.; Shelbina (Mo.) Telephone Company; Big Bend Rural Telephone Company, Ralston, Okla.; La Crosse (Okla.) Telephone Company; Chuka Telephone Company, Coalgate, Okla.; Choteau (Okla.) Telephone Company; Barney (Okla.) Telephone Company; Adair (Okla.) Telephone Company; Pleasant Valley Telephone Company, Joy, Neb.; Roseau (Minn.) Telephone Company.

The Home Telephone Company of Crawfordsville, Ind., has decided to put in a complete new central-energy system with metallic lines. The estimated cost of the improvements is $50,000. John K. Johnston of New Philadelphia, Ohio, an experienced telephone man, has bought an interest in the plant and will become general manager. The company has 1,700 subscribers. The change of management of this company is regarded as a distinct advantage to the Independent telephone interests in the state, since the company has heretofore worked to some extent in conjunction with the Bell Telephone Company.

PUBLICATIONS.

A variety of Mathias Klein & Sons' linemen's tools are listed and illustrated in a circular from the F. Bissell Company, Toledo, Ohio.

Bulletin No. 30 from the Bristol Company, 45 Vesey Street, New York, illustrates an interesting [illegible]

Watson direct-connected ventilating fans are the subject of a recent illustrated bulletin issued by the [illegible] Chicago. Fans ranging in diameter from 18 to 42 inches are [illegible] schools, public halls, chemical works, boiler rooms [illegible]

The Cutler-Hammer Manufacturing Company of [illegible] generators, alternating-current generators, plating [illegible] brush, to insure satisfactory operation, the brush [illegible] descriptive matter and price list, the pamphlet contains useful information on the care of commutators and brushes, the importance of correct lap, etc.

The Goldschmidt Thermit Company, with main offices at 90 West Street, New York city, has published the second quarterly number for 1908 of its 20-page magazine, "Reactions." It contains many articles of value bearing on the welding of steel under a variety of conditions, such as rail welding, marine repairs and pipe welding. A copy of the magazine will be sent to anyone interested on application to the home office.

The Moline Incandescent Lamp Company of Moline, Ill., has issued an attractive booklet in which its various types of incandescent lamps are illustrated, brief data about the lamps being given. Ten types, including the Moline tungsten, are shown. It is just four years since the Moline lamp was placed on the market, and the company thinks that its many satisfied customers is excellent proof of the good quality and low cost of its product.

A general idea of the scope of manufactures carried on by the Allis-Chalmers Company may be gained from a handsome booklet published by the company and entitled "Works and Products." The manufacturing facilities of the company are divided between several large plants. The area of the West Allis Works alone covers nearly 250 acres. The scope of the company's operations is indicated by the following departments: Electrical, steam turbine, steam engine, gas engine, pumping engine, hydraulic turbine, mining machinery, crushing and cement machinery, saw mill, flour mill and air brake.

The Chicago Fuse Wire and Manufacturing Company, 170 South Clinton Street, Chicago, has issued catalogue No. 22, covering a complete line of Union switch boxes; also outlet boxes and covers. The catalogue is well illustrated and shows the many different uses to which the Union boxes and covers are applicable. Union stamped steel switch boxes, outlet boxes and covers for rigid conduit, metallic armored cable and flexible conduit meet every requirement of the electrical contractor. The sectional gang feature of Union switch boxes is one that appeals to all users. The two-gang box can be built up into any desired number of gangs by the aid of spacers. This work can be done on the job, thereby considerably reducing cost of installation. The new catalogue will be sent to those interested.

SOCIETIES AND SCHOOLS.

The annual convention of the International Association of Municipal Electricians will be held at Detroit, Mich., on August 19th, 20th and 21st. Frank P. Foster of Corning, N. Y., is secretary of the association.

The present week was set apart as commencement week at the Thos. S. Clarkson Memorial School of Technology. On Friday the ninth annual commencement exercises were concluded by addresses delivered by Henry Taylor Bovey, dean of the faculty of applied science, McGill University, and William R. Hill, special deputy engineer of the state of New York. This year there were 11 candidates for degrees.

At the recent meeting of the Glasgow Section of the British Institution of Electrical Engineers a membership of 294 was reported, consisting of members, associates and student members. Mr. W. W. Lackie is now chairman of the section and Mr. James E. Sayers is secretary and treasurer. A paper entitled "Electric Supply Prospects and Charges as Affected by Metallic-filament Lamps and Electric Heating" was presented by H. W. Handcock and A. H. Dykes.

As previously announced, the spring meeting of the American Society of Mechanical Engineers will be held at the Hotel Cadillac, Detroit, on June 23d to 26th. Among the papers to be read are these: "Identification of Power-house Piping by Colors," William H. Bryan; "Power-plant Operation on Producer Gas," G. M. S. Tait; "Horsepower Friction Losses and Efficiencies of Gas and Oil Engines," Prof. Louis S. Marks; "Economy Tests of High-speed Engines," F. W. Dean and A. C. Wood. Simultaneously, conventions will be held by the American Society for the Promotion of Engineering Education, the Society of Automobile Engineers and the Society of Gas-engine Manufacturers.

The Highland Park College of Engineeing, Des Moines, Iowa, has enjoyed an unusually posperous year. Nearly 400 different students have been enrolled in the various departments. The college maintains regular courses in civil, electrical, mechanical, steam, telephone, traction and gas engineering. It also has a regular machinist's course which may be completed in one school year of 48 weeks. Students have been in attendance from 34 different states. This is one of the newer engineering schools of the country, but it is well equipped, and, since the school is in session 48 weeks in the year, a regular standard four-year course may be completed in three years. President O. H. Longwell will send a catalogue of the Col- [illegible]

TRADE NEWS.

The Charles G. Sawyer Company, Boston, Mass., dealer in electrical and lighting supplies, has been incorporated by Elisha B. Sawyer and others.

It is said that the Canadian Northern Railroad will shortly call for bids for 200,000 telegraph poles. M. H. McLeod, Winnipeg, Man., is general manager.

The city of University Place, Neb., is in the market for three electrically driven pumps. F. Harbican is water commissioner and may be addressed.

The F. L. O'Bryan Company, South Framingham, Mass., with authorized capital of $50,000, has been incorporated to deal in electrical devices, by Francis L. O'Bryan and others.

The Municipal Electric Light and Water Commission of Howell, Mich., is in the market for a 100-horsepower boiler. Glenn H. Brown is superintendent of the commission.

The Willis Electric Meter Company of Chicago has been incorporated with a capital of $100,000 to manufacture electric meters. The incorporators are Charles J. Schmidt, Albert C. Bell and Leonard W. Novander.

In the Chicago Inter Ocean of June 5th an official of the Western Electric Company is thus quoted: "I am not so optimistic that I feel like throwing my hat in the air, but I do believe that there is a general turn for the better in business. In my negotiations with dealers throughout the country there is not only much less apprehension expressed by them, but there is a positive note of encouragement."

Domestic commerce movements for the month of April, as reported to the Bureau of Statistics of the Department of Commerce and Labor, indicate an improvement in the lumber and anthracite-coal trades, though activity in the live-stock, meat, grain, soft-coal and iron trades shows but few signs of a return to normal conditions. The American Railway Association notes an increase in the number of idle cars since the 1st of April from 307,507 to 413,605 on April 29th. Like figures for May 13th, referring to a larger number of roads, show, however, a decrease in the number to 404,534 cars.

The Acheson Oildag Company has been incorporated and has established offices and works in Niagara Falls. To this company Edward G. Acheson has turned over his patents and trademarks covering "oildag" and "aquadag," the new lubricants. These new Niagara products have been patented in 22 countries. Oildag is a paste made of deflocculated unctuous Acheson graphite and oil, and is intended to be mixed with mineral oil for use in gas-engine cylinders, electric-light plants, and where high-priced oils are now used. The oil serves as the carrier for getting the graphite lubricant to the place of service.

One of the American consuls in Latin America reports that the company which furnishes the electric light in the city in which he is located is engaged in an entire reconstruction of its plant. When this is completed it is expected that meters will be installed for the use of consumers. The consul states that the company has not yet made its purchase of meters and that there is an opportunity for American manufacturers of such goods who take prompt action in regard to the matter. An opportunity will also arise for the sale of motors for power installations in the future. The Bureau of Manufactures, Washington, D. C., can give information by referring to File No. 2292.

The F. Bissell Company, Toledo, Ohio, recently installed a department of illumination, in charge of R. W. Hiett, illuminating engineer. It will be the object of this department to give information as to proper distribution of lighting units so as to secure the best illumination both as to quality and cost. Anyone using light or selling electricity or doing wiring can economize for himself or for his client, usually, at no cost to himself, by taking advantage of this department, as the F. Bissell Company will be glad to inspect plans for lighting layout or to receive requests for information. Advice will be given free of charge unless in some special investigation requiring considerable time.

The interesting announcement is made that the Duncan Electric Manufacturing Company of Lafayette, Ind., has purchased the machinery, tools and business of the Lafayette (Ind.) Electrical Manufacturing Company, manufacturer of transformers. The transformer plant has been thoroughly rejuvenated, and the most modern transformer-manufacturing apparatus installed, and every effort will be made to keep the quality of the new transformers up to the highest possible standard. The Duncan company has secured the services of one of the most competent transformer engineers in the United States, and every transformer will be sold under guarantee. Workmen are now busily engaged in the installing of an impregnating outfit, and in a short time the company will be able to offer to transformer users a complete line of this type. A new departure in the testing of transformers is that of subjecting them to a higher

[illegible] manganese steel than is possible in other brands [illegible] in a high standard of dependability.

The [illegible] W. [illegible] Manufacturing Company, New York, announces [illegible] the removal [illegible] of the [illegible] headquarters [illegible] located at 30 Scott [illegible] under the management of Charles [illegible] W[illegible] for several years [illegible] represented [illegible] and [illegible] them.

BUSINESS.

The city of Seattle, Wash., has placed with the Central Electric Company of Chicago an order for 180,000 Columbia lamps, to be delivered at the rate of 15,000 a month. The Central Electric Company is now represented on the coast by Burton R. State, Seattle, and [illegible] A. Savage, traveling representative. The Seattle order is one of the several large orders which have been recently secured, indicating a better feeling in business conditions.

The R. D. Nuttall Company of Pittsburg announces that it has added to its already comprehensive list of gears and pinions the well-known Titan brand of manganese steel gears and pinions, having arranged with the Atha Steel Casting Company for their exclusive sale. This places the Nut-

[illegible]

[illegible] fective, f. o. b. Pittsburg: For each glower end, [illegible]

Recently in one week shipment was made from [illegible] or over, go into various industrial plants in the [illegible] of the country. In addition to these, two contracts for turbo-generator units, each 500 kilowatts in capacity, were received, one from Texas and one for Washington. The first unit was purchased by the city of Austin, Tex., and the second unit will be installed by the [illegible] Lumber Company of [illegible], Wash.

The Massachusetts Chemical Company of Walpole, Mass., operating the Walpole rubber works and varnish works, is calling attention to a change in name of one of its products, formerly known as field-coil cushions. From now on these appliances will be known as field-coil pads. These pads are

[illegible] them.

DATES AHEAD.

[illegible]

American [illegible] annual meeting, Detroit, [illegible].

[illegible] annual meeting, Detroit, June [illegible].

American Institute of [illegible] convention, Hotel [illegible], [illegible] to July 2d.

National Electrical Contractors' Association [illegible], Chicago, July 15th, 16th and 17th.

Michigan Electric Association [illegible] meeting, [illegible] Rapids, Mich., August [illegible].

International [illegible] convention [illegible].

Ohio Electric Light Association (annual convention), Hotel Victory, Put in Bay Island, August 25th, 26th and 27th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 2, 1908.

889,200. Electrical Fuse. Albert G. Charters and John G. Jones, Watford, England. Application filed June 21, 1907.

An automatically replaceable fuse consists of a spring-controlled rotating insulator with recessed arms at both ends, springs in the recesses tending to withdraw the contact pieces, and fuse wires connecting the contact pieces and drawing them out against the force of the springs. (See cut.)

889,205. Railway Signal System. Emory P. Cook, Oberlin, Pa. Application filed August 30, 1907.

In an electric block-signal system there is a main circuit established within each block, including elements of the main circuit of the adjacent blocks, and an engine circuit including signals adapted to be actuated upon the failure of the main circuit to close.

889,212. Advertising Device. Arthur J. De Barry, New York, N. Y., assignor to Victor C. Bell, New York, N. Y. Application filed February 7, 1907.

Two display chambers are provided with an electric lamp for each and a two-way flasher for lighting the lamps alternately.

889,219. Device Operated by Controller Reverse Lever for Automatically Operating Safety Appliances. Alfred J. Gairing, Cleveland, Ohio. Application filed August 13, 1906.

The fender of an electric car is dropped to the track when the reverse lever on the controller is used.

889,220. Trolley Pole. John C. Gay, Jordanville, N. Y. Application filed October 21, 1907.

Spaced parallel poles are pivotally connected to a plate with a stud for engaging a pole socket. Springs hold the spaced poles in erect position. A trolley harp and wheel are mounted on the upper ends of the poles.

889,264. Trolley Catcher and Retriever. Robert Shields, South Boston, Mass., assignor to the Frank Ridlon Company, Boston, Mass. Application filed April 22, 1907.

A casing contains a reel that can be rotated by a spring when a latch is released.

889,266. Third-rail Attachment for Electric Cars. George H. Sohn, Lincoln, Cal. Application filed October 30, 1907.

Two Z-bars are set facing each other so as to leave an opening between their upper flanges. Between the bars are bolted spool-shaped insulators that carry the working conductor.

889,277. Electric Railway. Casimir Von Gizinsky and William McClure, Schenectady, N. Y. Application filed December 19, 1906.

In a sectional third-rail system the rail sections are mounted on springs over contact posts set into the continuous conductor. The car depresses the sections to bring them into contact with the contact posts.

889,288. Insulated Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed January 19, 1907.

In combination with the rails and ties are angle bars, each carrying a metallic base arranged for the support of one rail end only, located between the ties and insulated from the rails.

889,305. Reversing Timer and Distributer. John O. Heinze, Jr., Lowell, Mass. Application filed November 30, 1906.

Reversing segments are mounted on the engine shaft so as to break and reverse the primary circuit of the induction coil.

889,311. Machine for Braiding Tubular Fabric. Louis A. Jones, Cambridge, Mass., assignor to the American Circular Loom Company, Chelsea, Mass. Application filed June 27, 1906.

This is a machine for braiding "circular loom" onto a mandrel.

889,317. Magnet for Telegraphones. John A. Lieb, New York, N. Y., assignor to the American Telegraphone Company. Application filed March 25, 1907.

In combination with the recording and reproducing medium of a telegraphone is an electromagnet having a pole-piece with a reduced polar extension provided with a wear-resistive device.

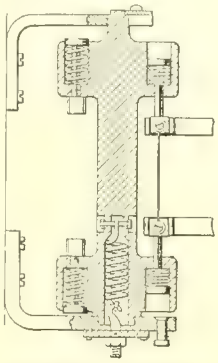
889,322. Lamp Receptacle. Andrew A. Moffitt, Providence, R. I. Application filed May 3, 1907.

A device for preventing short-circuiting of electric lamps consists of a cup portion of non-conducting material, raised feet on which the cup may stand, a center contact, a lamp-receiving collar and means within the walls of the cup for retaining the collar in position therein.

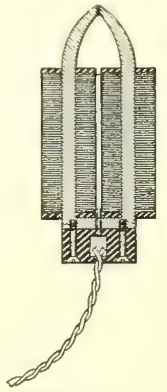
889,338. Igniter. George J. Schultz, New York, N. Y., assignor to Benjamin Briscoe, Tarrytown, N. Y. Application filed February 26, 1907.

Sparking points are carried by a shell so as to cooperate with a set of sparking points mounted on an insulated body in the shell.

889,346. Eye Magnet. Harold Thomassen, Dayton, Ohio. Application filed May 1, 1907.



NO. 889,200.—AUTOMATIC REPLACEABLE FUSE.



NO. 889,346. EYE MAGNET.

A bipolar eye magnet has two solenoids, cores extending beyond the ends and converging to a point at their poles. To the yoke of the magnet is fastened a handle for the implement. (See cut.)

889,354. Process of Feeding Molten Glass for Making Glass Insulators or Similar Articles. Henry M. Brookfield, New York, N. Y., assignor to the Brookfield Glass Company. Application filed June 13, 1906.

A furnace is provided with means for causing the molten glass to flow in a large stream to heat the outlet passages and then in an unclogged smaller stream as needed for making the insulators.

889,355. Thermostat. Peabody A. Brown, Denver, Colo. Application filed September 4, 1906.

The thermostat comprises an element composed of two substances possessing the properties of expansion and contraction in unequal degrees and a circuit containing contacts carried by two movable devices arranged to be simultaneously acted on by one of the substances to cause the devices to move whereby the contacts are made to approach each other for closing the circuit.

889,358. Cut-out Mechanism for Electrically Operated Machines. George S. Conger and Charles Pearce, New York, N. Y., assignors to the Eltypic Manufacturing Company, New York, N. Y. Application filed December 27, 1906.

This mechanism for maintaining the current during short intervals in the use of the machine and for stopping it during long intervals consists of a movable contact piece for making and breaking circuit, operated by a [illegible] actuated rotary [illegible] the wheel and [illegible] with its rotating means.

889,431. Furnace for Metallurgical and Smelting Purposes. Kristian Birkeland, Lysaker, near Christiania, and Samuel Eyde, Christiania, Norway. Application filed January 6, 1906.

In this electric furnace there are [illegible] electrodes, a hearth adapted to prevent material fed thereon from coming into contact with the arc ends of the electrodes, and magnets of different intensity adapted to spread the arc over the hearth.

889,432. Spark-plug. George J. Blum, Chicago, Ill., assignor to the Armstrong-Blum Manufacturing Company, Chicago, Ill. Application filed February 7, 1906.

This spark-plug consists of an electromagnet, a fixed contact, a movable contact, a finger for carrying the latter, a sectional shaft between the sections of which the finger is clamped, and an armature clamped to the shaft.

889,442. Cable Terminal. Frank B. Cook, Chicago, Ill. Application filed November 2, 1907.

A cable terminal comprises two concentric drum-shaped portions with an annular space between, fixed plates closing the ends of the space, protective devices carried within the same and means for suitably mounting the whole in place.

889,443. Photographic Printing Apparatus. Adrien Cottillon, Asnières, France. Application filed January 29, 1907.

A box has a cover normally held raised therefrom, an air cushion fixed to the cover and adapted when drawn down to press the paper upon a negative, electromagnets for operating the cover, electric lamps within the box, and a distributer of electric current adapted to operate the lamps and the electromagnets.

889,448. Third-rail Electric-railway System. John F. Feeley, Bigtimber, Mont. Application filed July 16, 1907.

The third rail is mounted inverted against the concave roof of an overhanging wooden housing and protection.

889,450. Timing Device for Jump-spark Ignition Systems. William D. Foreman, Chicago, Ill. Application filed July 5, 1907.

In combination with a rotary member and an adjustable stationary member provided with electrical contact pieces is a brush carried by the rotary member, and a contact cleaner slidably supported on the same to be movable relatively thereto.

889,463. Trolleywheel. Robert F. Henne, Mamaroneck, N. Y. Application filed August 30, 1907.

The harp has a wide-spreading forked part carrying a shaft on which the trolleywheel is laterally slidable between two coiled springs.

889,469. Signaling System for Railways. Charles H. Lay, Jersey City, N. J., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed February 27, 1908.

A series of closed-track circuits has each a relay with a single front contact and an armature. The signaling circuit for the signal in each block comprises an independent source of current and the single contact points of two or more relays of the closed-track circuits.

889,482. Electric Signaling System. Francis L. O'Oryan, South Framington, Mass., assignor of one-half to Hiram Stanley Marsh, Cambridge, Mass. Application filed January 8, 1908.

In a railway-signaling system there is a signal operated by a motor, a track relay for closing the motor circuit and an electromagnet in this circuit having an armature adapted to break the circuit at the track relay after the signal has been actuated.

889,522. Electric Induction Furnace. Karl A. F. Hiorth, Christiania, Norway. Application filed January 2, 1908.

There is provided a spiral-like smelting channel, the ends of the windings of which are conductively connected to each other.

[illegible]. [illegible] Electric Clock and Call System. George B. Maas, Cleveland, Ohio. Application filed December [illegible], 1907.

A[illegible] clock adapted to report hours [illegible] thereof is combined with a timeboard hav[illegible] lamps corresponding to the hours [illegible] clock [illegible] sending device with the board and connections between the clock and lamps and [illegible] separate plug for each series of lamps.

889,542. Electromedical Battery. Edmund T. Otto, Jersey City, N. J., assignor to the Otto Manufacturing Company, Jersey City, N. J. Application filed August 15, 1907.

The battery set comprises a cabinet having upper and lower sections, a coil and operating cell, and an electrode or accessory compartment formed in part by the walls of the cabinet and by one of the electrodes.

889,559. Protector for Third Rails of Railway Systems. Joseph N. Tomlinson, Vineland, N. J. Application filed December 19, 1906.

A series of insulating shoes is provided with grooves in which the rail is seated and a protective roofing extending freely over the rail from one side.

889,561. Signal System for Railways. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 3, 1906.

A relay at the end of each block section has an armature operated in one direction by the maintained difference of potential and in the reverse direction when this is destroyed.

889,566. Electric Switch. Alfred A. Wohlauer, New York, N. Y. Application filed June 25, 1907.

In combination with opposing contacts is a vacuum tube swiveled between the same, the tube being partly filled with mercury and provided with sealed-in electrodes, and metallic end-caps to coact with the contacts.

889,567. System of Electrical Distribution. Joseph L. Woodbridge, Philadelphia, Pa. Application filed October 2, 1907.

An alternating-current circuit and a direct-current source are provided, transforming apparatus connected between them, and means for controlling the transfer of current between this apparatus and the former circuit, the means being responsive to only such component of the current in the alternating-current circuit as bears a predetermined phase relation to its voltage.

889,582. Telephone System. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed November 15, 1902.

This is a common-battery system having special ringing and supervisory and line-signaling circuits.

889,589. Tin-transferring Machine. Adisch C. Donell, Canonsburg, Pa. Application filed December 30, 1907.

The machine has a number of manipulating wheels journaled between frames, horseshoe magnets carried by the wheels, adjustable guide strips and means for adjusting the manipulating wheels.

889,592. Telegraph System. Stephen D. Field, Stockbridge, Mass. Application filed January 24, 1907.

A local inductive shunt at each station is bridged directly across the key thereat, but does not include the local relay. There is a short-circuiting shunt for bridging the key and the inductive shunt when desired.

889,608. Lamp Hanger. William R. Holcombe, U. S. Army, assignor of one-half to John S. Jones, Jefferson Barracks, Mo. Application filed January 15, 1907. Renewed April 8, 1908.

The hanger has a shaft mounted so that it can be rotated by a spring in the frame and thus wind up the wires leading to the suspended lamp.

889,639. Blasting Cartridge. Peter Selbach, Cologne, Germany. Application filed March 13, 1907.

A cartridge for blasting operations under water contains a detonator connected with conducting wires placed in a bore and surrounded with packing material.

889,659. Electrically Operated Photographic Apparatus. William A. Chamberlain, Sunbury, Pa. Application filed January 25, 1906.

The device contains an electromagnet and its armature, [illegible] shutter, a valve and a sparking device as well as means for simultaneously operating the shutter, [illegible] sparking device.

889,712. Pressure Governor. William McClave, Scranton, Pa., assignor to the McClave-Brooks Company, Scranton, Pa. Application filed March [illegible].

A [illegible] has a balanced valve for gov[illegible] electromagnet connected [illegible] adapted to actuate the valve.

[illegible],7[illegible]. Trolley. [illegible] D. [illegible]stone, Chicago, Ill. Application filed December 7, 1907.

[illegible] frame on the pole and [illegible] of the wheels and [illegible] being normally [illegible]

[illegible] H. Slinack, Philadel[illegible] Pennsylvania Gas [illegible] Philadelphia, Pa. Ap[illegible]

[illegible] collector [illegible] the carriage [illegible]

[illegible] G. Backu[illegible] Zeiner & Leavitt [illegible] Application filed [illegible]

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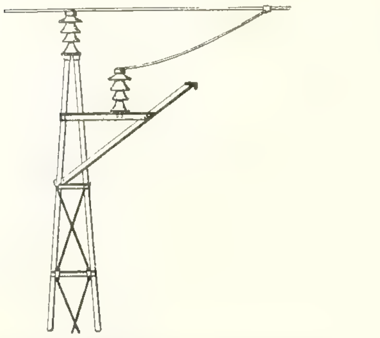


No. 889,803.—SUPPORT FOR HIGH-TENSION CONDUCTORS.

tension of this member, and receptacles to be connected with the endless member and partially submerged within the bath.

889,760. Switch Button. Charles A. Clark, Hartford, Conn. Application filed October 24, 1907.

A switch button has means for attachment to a switch spindle and a series of resilient leaves forming a cushion intermediate the button and its attaching means.

889,765. Thermal Electric Alarm. Lloyd Currier, Underwood, N. D. Application filed May 11, 1907.

A supporting member having one end bent back upon itself has a heat-responsive element secured thereto and provided with a socket, a lever having a ball at one end engaging in the socket and adjustably mounted on the bent-back portion of the supported member, and a circuit-closing device controlled by the lever.

889,775. Water-heating Apparatus. Frank Dupuis, Pawtucket, Frederick E. Page, Providence, and George H. Page, Pawtucket, R. I. Application filed June 24, 1907.

An electromagnetic coil is supported beneath the cylinder and has its two poles extending into the latter.

889,776. Trolleywire Splicer. Harry G. Dyer, Gloucester City, N. J., assignor of one-half to William J. Van Meter, Gloucester City, N. J. Application filed September 12, 1907.

A body with shoulders thereon has tubes suitably connected with it and abutting on the shoulders, each of the tubes having a suitable bore to receive an end of a conductor and jaws situated within the tubes adapted to grasp the conductor and retaining guides for the jaws.

889,784. Telegraph System. Charles K. Jones, Quincy, Ill., assignor of 30 one-hundredths to the Railway Telegraph Automatic Signal Company. Application filed August 17, 1903. Renewed September 12, 1907.

The armature of a relay is arranged to close the circuit of an electromagnet. The armature is supported on a rotatable disk.

889,786. Connector for Electric Wires. Charles J. G. Keiner, Baltimore, Md., assignor to the Universal Railway Supply Company. Application filed October 18, 1906.

A socket member and a plug member are each provided with fingers for interlocking the members together.

889,787. Means for Producing Telegraphic Transmitting Tapes. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed January 5, 1905.

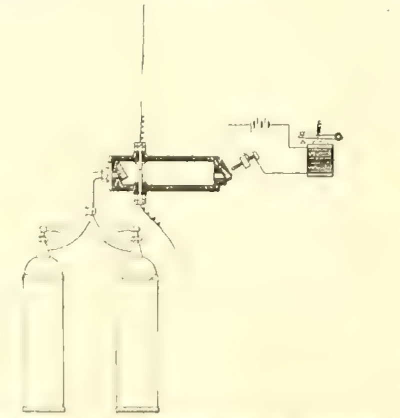
Three keys are provided in this device, two for punching holes in the tape and for moving it definite distances and the third key for determining which of the other keys shall operate.

889,788. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed October 28, 1905.

A telegraph line has the two line wires twisted together so as to be conductively independent but inductively related to each other.

889,789 and 889,790. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Applications filed November 9 and 17, 1906.

Means to receive and translate wireless telegraphic impulses comprise the creation of a high temperature through the incoming impulses, an explosive medium in the region of the high temperature, a conductor adapted to be actuated through the explosion of the medium and a local circuit containing a translating device adapted to be made and broken through the movement of the conductor. The second patent covers details of the receiving device. (See cut.)



No. 889,789.—WIRELESS TELEGRAPH RECEIVER.

889,791. Wireless Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed December 21, 1906.

This is a modification of the preceding patent.

889,792. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed December 21, 1906.

Another detector for electromagnetic waves is described in which there are two series of metallic plates, one being covered with an oxide.

889,803. Support for Electrical Conductors. Francis B. H. Paine, Buffalo, N. Y., assignor to the Niagara, Lockport and Ontario Power Company. Application filed June 20, 1906.

In a high-tension transmission line there is an insulating support for the line wire, an auxiliary insulating support, a connecting conductor attached thereto and to the line wire, and a grounded contact in the line of movement of the line wire or connecting conductor when one of the supports for the line wire fails. (See cut.)

889,807. Packing. Charles H. Reynolds, Rochester, N. Y. Application filed February 14, 1908.

The packing consists of a compressed mixture of fibrous asbestos with suitable vulcanizing material and provided with a protective coating of a suitable electrolytically deposited metal.

889,812. Multiple Socket for Electric Lamps. Frank J. Russell, New York, N. Y. Application filed December 18, 1907.

The socket has a canopy with a number of sockets supported therein and two conducting pieces electrically connected, one to one set of socket-lamp contacts and the other to the other set of lamp contacts, the two pieces being supported independently of each other by the insulating portions of the sockets, and at the same time serving to hold the sockets in place in the canopy.

889,841. Dynamo-electric Machine. Vincent G. Apple, Dayton, Ohio, assignor to the Dayton Electrical Manufacturing Company. Application filed May 11, 1907.

In this machine there is a continuous connecting tube of paramagnetic material exteriorly flattened between the pole cores and at such flattened points attenuated to prevent short-circuiting of the pole core.

889,852. Means for Automatically Indicating Certain Relative Positions of Guns or the Like to Each Other. Willie D. Kilroy, Hatch End, England, assignor to himself, and Evershed & Vignoles, Ltd., Chiswick, England. Application filed March 23, 1907.

These means consist of electric switches controlling electric-signaling devices, means operated by the training movement of the guns for working the switches when the gun or guns are within danger angles of mutual interference, signaling devices situated at each gun position and circuits connecting them.

889,857. Electric Furnace. Albert J. Petersson, Alby, Sweden. Application filed April 13, 1906.

A furnace for treating gases by means of voltaic arcs has a concentric furnace chamber, inner and outer electrodes, means around the furnace for creating a magnetic field in the space within the outer electrode, and means for moving gases through the furnace chamber.

889,871. Switch Button. Charles A. Clark, Hartford, Conn. Original application filed October 24, 1907. Divided and this application filed February 15, 1908.

The button has a recess, a spring plug located therein, curved spring leaves arranged in pairs and with their curvatures opposed and means for retaining the spring leaves within the recess.

889,883. Wind-operated Dynamo. Emil J. Johnson, Madrid, Iowa. Application filed August 31, 1907.

A shaft has a hub mounted on it, a disk-shaped web connected with the hub and having brackets on one side, windwheel blades fixed to the brackets and a dynamo field on the other side of the web. A second hub is mounted on the shaft with a disk-shaped web thereon, a dynamo armature on the latter overlapping the field, and a flange on the armature web overlapping the periphery of the disk-shaped web on the field to form a rain-tight joint between them.

889,884. Insulator. M. Harrison Strong, Ozark, Mo., assignor of one-half to Solomon E. Bronson, Ozark, Mo. Application filed June 9, 1906.

Two adjacent insulating rollers are rotatably mounted on pintles in a sheet metal frame.

REISSUE.

12,805. Ruhmkorff Coil. John McIntyre, Jersey City, N. J. Application filed February 21, 1908. Original No. 796,851, dated August 8, 1905.

This coil has a specially constructed make-and-break device.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 9, 1908:

153,633. Electric Switch. L. F. Furlong and F. O. Tucker, Hartford, Conn.
153,693. Electric Arc Lamp. J. W. Ellis, Pittsburg, Pa.
153,695. Secondary Battery. W. W. Griscom, Haverford College, Pa.
153,710. Electric Railway. J. Jones, New York, N. Y.
153,712. Manufacture of Incandescent Electric Lamps. R. A. Fessenden, Roseville, N. J.
153,858. Commutator for Dynamo-electric Generators and Motors. H. Davis and A. H. Stokes, Derby, England.
153,862. Distributing Frame for Electric Conductors. A. B. Hibbard, Morristown, N. J.
153,888. Electric Switch. W. Mitchell, Malden, Mass.
153,898. Electric Battery. J. O. Brinkerhoff, Hackensack, and M. E. Smith, Rutherford, N. J.
153,950. Secondary Battery Element. C. H. Walter, Washington, D. C.
153,682. Fire-alarm Telegraph. G. F. Milliken, Boston, Mass.
153,995. Secondary Battery. S. C. C. Currie, Philadelphia, Pa.
154,0[illegible]. Supporting and Connecting the Driving Motors of Electric Cars. S. H. Short, Cleveland, Ohio.
154,016. Metallic Circuit Test and Time Signal for Telephone Exchanges. J. J. O'Connell, Chicago, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLII. [illegible]

Electric-lighting Device for Showing the Time at a Distance.

By [illegible]

[illegible]

Some time ago I made a number of experiments upon apparatus which could be used to show the time from an elevated point by means of incandescent lamps after the manner of an electric sign. I was able to devise an apparatus for the purpose which worked very successfully at St. Petersburg, and I then conceived the idea of bringing the device to Paris and placing it upon the Eiffel Tower, so as to show the time at a great distance over the city. Acting in accordance with the company that controls the tower, I mounted the lamps at a sufficient height and installed a clockwork device for controlling them in one of the cabins of the tower. Since then it has worked very successfully and is quite a novelty.

The accompanying illustrations show the device, with diagrams of the working parts. The illuminated figures on the tower are also shown. There are four figures needed for showing the hour and minute throughout the entire 24 hours, such as 12—45, for instance. In other cases but three figures are employed, as 8—50. The apparatus, at least as far as the lamps are concerned, is used only at night, as might be expected.

The lamps are mounted at the second platform of the tower. To avoid wind resistance they are not placed as usual in a solid board frame, but are mounted on a series of horizontal and parallel slats, these being spaced at the proper distance and hung down by ropes along the side of the tower. There is one set of slats for each figure, that is, four separate sets. Upon the slats are placed the incandescent lamps, and these are connected together electrically in a certain number of elements, so that by joining a series of such elements together the desired number is obtained. Thus, the figure 3 is made up of four elements. In order to form the 10 numbers a total of 14 elements is required for each of the sets of supports. The lamps which form the elements are all mounted together upon the frame, and there are 14 different circuits which pass down to the apparatus. This applies to each one of the frames.

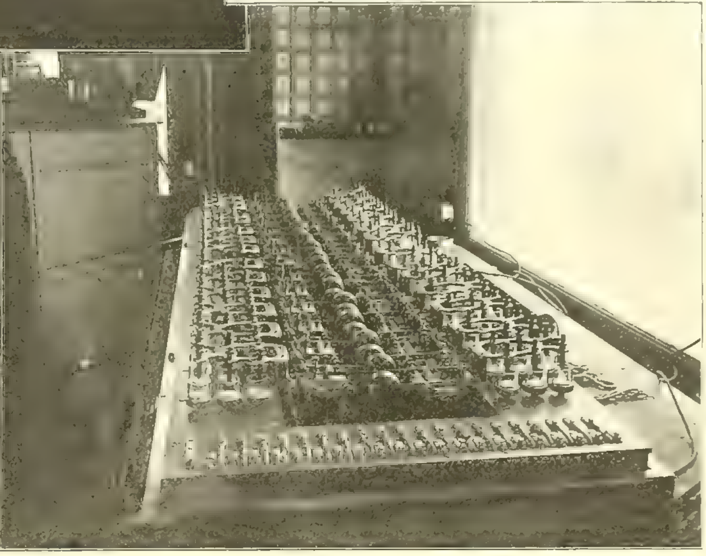
The hour is shown, as stated, by the figures 7—15, 8—36, and so on, with a dash between the hour and minute figures, which consists of a row of lamps kept permanently lighted. As to the middle figure (1 or 3 in the present case), there are only six figures, from 0 to 5, which need to be used, since after the figure 7—59, for instance, the next change gives 8—00. In the other cases the whole 10 figures are used. For the middle figure there are only the circuits which correspond to the

[illegible]

clock, and on the [illegible] not capable mechanically [illegible] closing of the lamp circuits. It [illegible]

Figures in Incandescent Lamps on the Tower

Clockwork for Making Mercury Contacts



Relay Set of Substantial Design.

ELECTRIC TIME-INDICATING DEVICE ON THE EIFFEL TOWER.

this was to have the clockwork make a series of mercury contacts which would not interfere with its action, and such contacts are used to operate a set of relays. These latter in turn are made to close the circuits of the lamps in the proper manner. The action of the device is illustrated herewith, the clockwork, mercury contacts and relays being shown. It will be seen that the lamp contacts are made by a set of carbons which plunge into mercury cups and thus complete the circuits, one after the other, according to the current impulses which come from the clockwork apparatus.

Of the diagrams on the next page Fig. 1 shows the method employed for making contacts by the clockwork. The following contact changes must be carried out in this case: For the figure showing the hours there must be 12 different contacts. For the minutes there are two sets of figures, these ranging from 01 to 59. The first set represents the tens and the second the units, but as in the former case the tens do not run above 50 there are but six changes (including the zero) to be carried out for the middle figure. In the case of the unit figure there are needed 10 changes.

In order to make the contact for the low current which operates the relays (this being given by a few Leclanché cells), I found it best to adopt the system of projecting pins which work in mer-

[illegible] apart. Under each of the pins is placed a mercury [illegible] into the mercury at a time.

[illegible] tion with the relays there is added a mercury cup [illegible] contact made by pin No. 1 closes the battery circuit [illegible] of the apparatus, and this relay in turn acts to close the circuit of lamp No. 1. When pin No. 2 makes contact with the second mercury cup it sends current into relay No. 2, which throws on lamp circuit No. 2, and so on [illegible]

series. The shaft (A) which is used for the hour figures has in consequence 12 projecting pins and 12 corresponding mercury cups. It thus makes the circuit for 12 different relays which operate the lamps showing the hour. The third shaft (C) shows the minute figures in the same way, and to this end it carries 10 pins with 10 mercury cups.

In order to have the system work properly it was necessary for throwing on the lamp circuits to have a relay of simple and strong design, using a series of contacts which are made by carbon pencils and mercury cups. It was also needful to avoid the use of springs in connection with the relays. Thus the relay device has no parts which need adjustment or cleaning, and it can be left running for an indefinite period without having to be looked after. All the relays for the lamps are mounted together upon a large board which serves as the base, and over this is placed a removable cover.

The construction of the relay is shown in Fig. 2, in plan and elevation, and all the relays are alike. A light rectangular frame (A) (A) of brass strips is made to pivot upon the shaft (B), which is fixed in the end support (S). Fixed across the frame is an armature (C), which lies over an electromagnet (D). An arm projecting back from the frame carries at the end a counterweight (J),

[illegible] against the attraction of the electromag[illegible]. Against the other end of the frame is fixed [illegible] insulating material [illegible], and upon the [illegible] screwed a [illegible] piece of cast iron (F) [illegible] are mounted the vertical carbon pencils (H), of about one-quarter inch diameter, which dip into corresponding mercury cups (G), when the armature is attracted by the electromagnet and causes the frame to drop. In this manner the car[illegible] make the necessary contacts for the circuits (L), which are of heavy wire and pass out to the lamps. The carbons are not insulated from the support.

There are two points which remain to be seen, first, the manner of making the needed contacts for the lamps, and second, the method of controlling the rise and fall of the relay without the use of a spring. In general there are but five of the mercury cups used, and in some cases the number runs as low as two. As above stated, each of the figures on the lamp board is made up of a certain number of elements or separate lamp circuits. Thus, the figure 1 uses but two elements, the figure 2 takes three elements, the figure 3 requires four elements, which is the maximum, and so on. Each lamp circuit has a common wire running to the + pole of the dynamo, while the other wires from the lamps

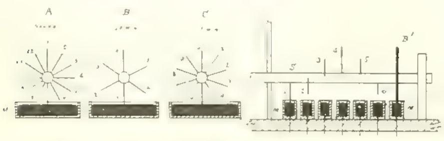


FIG. 1. METHOD OF MAKING CONTACTS. THE HOUR 7:15 IS INDICATED.

run to mercury cups 1, 2, 3, 4, respectively. The remaining mercury cup has a wire running to the — pole of the dynamo. When we insert into the cups the common bridge-piece of the relay, all the lamps are connected to the — pole of the machine and are thus lighted at the same time.

In order to allow the relays to be operated without requiring the use of springs an apparatus was devised in which each relay, as it is operated under the attraction of the electromagnet, serves to release the preceding relay. In Fig. 3 the main parts

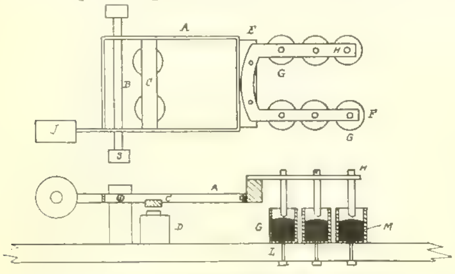
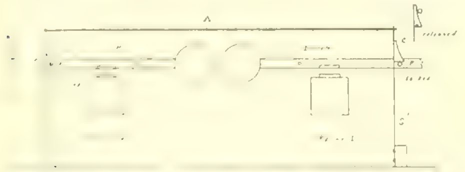


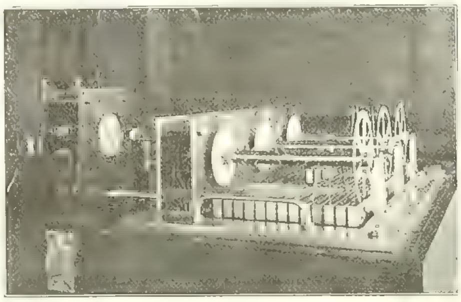
FIG. 2. PLAN AND ELEVATION OF RELAY.

of the relay are shown, including the frame or arm, the electromagnet and the counterweight, and two adjacent relays are shown interconnected. Upon the arm of relay No. 1 is mounted a projecting pin (P), and this is made to work in connection with a steel cam (C) having a concave profile. The cam is mounted upon a flat steel spring (S), which is fixed to the base of the apparatus. When, therefore, the armature is attracted downward by the electromagnet the pin slides along the cam and pushes it to the left. At the end of the stroke the pin [illegible] under the cam, as the spring has now moved the latter back to position, and the pin to-



[illegible]

[illegible] in the "down" position [illegible] until the pin is released by [illegible] relay No. 2 is [illegible] at this time, [illegible] the current [illegible] the [illegible] No. 2 [illegible] [illegible] cams are connected across from one relay to the other by a long steel rod (A), of one-twentieth-inch diameter, so that when cam (C') is driven to the right this action causes cam (C) of No. 1 to be also driven to the right. This releases the pin (P) and the counterweight is allowed to bring the arm back to the normal or "up" position. At the same time it is relay No. 2 which is in the "down" or



CLOCKWORK MECHANISM IN ELECTRIC TIME-INDICATING DEVICE.

locked position. In this way each relay as it comes into action causes the preceding relay to be released.

The lamps which were controlled by relay No. 1 are now cut out and the lamp circuit of No. 2 thrown in. It is this action which happens at every changeover of a number, such as when passing from 8—43 to 8—44. Upon changing from 8—39 to 8—40 we require a change in the "tens" figures, and thus the action takes place among the relays allotted to these figures. For the changes in the hour figures the action is carried out in the same way, and it is to be noted that relay 12 is cross-connected to relay 1. In the case of four figures, such as 11—45 or 12—30, suitable means are provided for taking care of the extra figure 1.

By the above arrangement it is seen that we can make any combination of lamps, starting from 1—00 and ending at 12—59. In practice, however, it is not necessary to throw the current from the machine (or city mains) into the lamps until after nightfall, as during the day the lamps could not be seen at a distance.

High Voltage on Incandescent Lamps.[1]

By Herbert S. Evans.

The energy consumed by the incandescent lamp of stated candlepower and efficiency is a known quantity so long as the conditions on which the ratings were determined are maintained. In actual practice, however, the voltage applied to the terminal of the lamp, and to which the above ratings are very sensitive, is quite certain to differ a small percentage from normal, and in many instances the difference is considerable. The effect of this feature in incandescent lighting is not often dealt with as a practical problem, but more often discussed as of theoretical interest. To the small consumer, who only pays the lighting company for the lamps which he has in use in his private residence, the question loses its theoretical interest and becomes a practical one of no small relative importance.

There is no need to discuss the necessity for a steady voltage either on account of the life and efficiency of the lamp or the pleasing of the customer. The importance of this is always understood and an attempt at least made to take care of it. The question which is not so often given proper attention, either from the central station, usually on account of neglect, or by the consumer, because of ignorance, is the use in each particular [illegible] of a lamp that is rated at the voltage which is actually supplied.

A few central-station managers have fully appreciated the need of their private-residence customers, and by furnishing free renewals and maintaining a lamp wagon and crew to replace lamps as soon as they are impaired are able to see to it that the proper voltage lamps are placed in each house. Unfortunately, the percentage of companies so careful of their patron's interest is small. In many instances the lighting company and customer have no relation whatever with each other in the replacement of lamps; and in others, where free renewals are maintained, providing old lamps are brought to the office to be exchanged, little more care is exercised in furnishing a lamp which is suited to the voltage of the circuit on which it is to operate.

It is an undisputed fact that if quantity of light alone is to be considered, electric lighting is in general more expensive than gas, acetylene or kerosene. Probably on this account, as well as the fact that these types of light units have no popular candlepower rating, the incandescent lamp is a distinct disappointment to many users when first installed. This proves particularly true when the monthly bill is presented. To try and offset this feeling of disappointment in the general effectiveness of the light, the central-station manager is placed under strong temptation to boost the voltage a little and so make the customer think he is getting extra good treatment. If this is not deemed advisable, the placing of slightly lower voltage lamps will of course produce the same result. There may be cases in which such steps as these just mentioned are warranted and of decided advantage, but under no circumstances should they be resorted to unless conscientiously carried out in the genuine interest of the customer. The average consumer, being entirely ignorant of any of the principles of electricity, is often possessed of vague and erroneous ideas of the treatment he is receiving at the hands of the company, and serious criticism can only be avoided by honest and fair dealing.

The boosting of the potential on a lighting circuit, above the rated voltage of the connected lamps, has several important effects, each of which should be carefully considered. That most often mentioned as of first importance is the effect on the useful life of the lamp. It is well known that even a small increase in potential will cause the carbon-filament incandescent lamp to blacken and fall to 80 per cent. of its original candlepower in a comparatively short time, but we must not forget that the ratio of this shortening of life to increase of voltage is dependent upon the original efficiency of the lamp. This is soon learned by the lamp user in one way or another. If he buys his lamps of a supply house his complaint must be met either by a higher voltage lamp or one of lower efficiency. If the former, the very end for which the voltage was increased will be defeated, and the lamp will be condemned as good for nothing and returned. The only alternative, therefore, is to supply the lower efficiency unit. The result of this substitution will be an increase in the meter bill, which will also cause dissatisfaction. If the company furnishes free renewals, the difficulty may be partially overcome by supplying lamps of high efficiency and renewing them as often as may be necessary. As a high-efficiency lamp has a much shorter useful life than one of low efficiency, and in addition is more sensitive to the increase in voltage under discussion, this solution will mean much more frequent renewals. These frequent changes are the cause of much bother to the customer, and it is all too often that the other course is taken—that of supplying a lower efficiency lamp. This is done not with any intention of unfairness, but with the one end in view of trying to give satisfaction. The importance of the amount of the small individual bill in the eyes of the man who pays it, is often lost sight of by the company. If lamps consuming four watts per candlepower be substituted for those which give the same amount of light on 3.1 watts per candle, an increase in the meter bill of approximately 29 per cent. will result.

The increase in the amount of energy consumed by each lamp, when the voltage is raised, is often not considered as being of sufficient importance to take into account. In the carbon-filament lamp a slight increase in voltage causes a much greater proportionate increase in current because of the higher temperature and consequent lower resistance of the filament. The percentage of this change

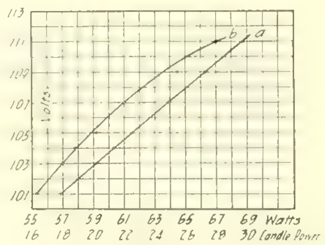


Fig. 1

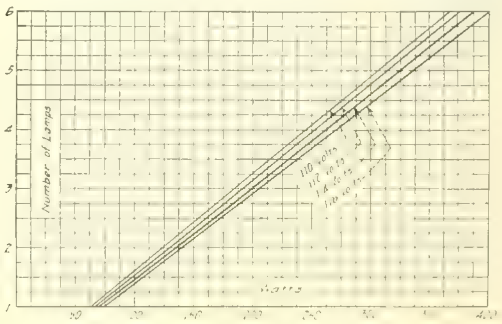


Fig. 2

HIGH VOLTAGE ON INCANDESCENT LAMPS.

[1] From the Journal of Engineering of the University of Colorado. The author is professor of electrical engineering in that institution.

will depend upon the efficiency of the lamp in question, but in any event [illegible] expected.

In Fig. [illegible] (page 488) [illegible] curve [illegible] the relation between voltage applied and [illegible] consumed in a lamp rated at 16 candlepower, 104 volts, 3.5 watts per mean horizontal candlepower. [illegible] change from 104 to 121 volts [illegible] approximately 6.5 per cent. the wattage [illegible] of 14 per cent.

The candlepower is also increased out of all proportion to the amount of extra energy [illegible] or, in other words, the lamp efficiency [illegible]. This is shown in curve (b), Fig. 1, [illegible] lamp as curve (a). This tends to offset [illegible] ment against such increase in voltage under certain special conditions, but has little to do with the general case under discussion. A residence is supposed to be equipped with 16-candlepower lamps where this size unit is best suited to give satisfaction. A rise in voltage will give more light without a proportionate increase in energy consumed, it is true, but if this extra light is not needed, it is so much waste and increases the meter bill unnecessarily. It may be suggested that if the 16-candlepower lamp, operated on a higher potential, gives more light than is needed, an eight-candlepower of same rated voltage may be substituted for it, or a four-candlepower for an eight, with an actual saving in energy consumed. In this connection, however, it should not be forgotten that these low-candlepower lamps are necessarily less efficient than those of higher rating, often consuming as much as five watts per mean horizontal candlepower, as against 3.1 for a good 16-candlepower lamp.

The curves in Fig. 2 (page 488) show graphically the increase in meter registration for varying loads of lamps on different voltages. The abscissas of the curves represent the mean indication on each load of four standard makes of induction wattmeters connected in series. The lamps, all rated at 16 candlepower, 110 volts, 3.5 watts per candle, were taken indiscriminately, without previous test, from a case of first-quality lamps of recognized standard make.

With a high voltage on the line, therefore, there will be forced upon the lamp user certain undesirable results—shorter life of lamps, a source of expense if they must be paid for and of annoyance if exchanged at the company's office; greater consumption of energy, which becomes very excessive if a lower efficiency lamp is substituted in order to prolong the life, and is far too much to be justly allowed, even when the usual high-efficiency lamps are maintained.

From the experience of the best regulated and most successful companies, the only way to gain the permanent good-will of patrons is to supply a well-regulated voltage, and whatever its value may be in each district, to see that the houses are equipped with high-efficiency lamps, rated at the voltage maintained, and if possible to see that the lamps are renewed at proper intervals.

Electrolysis Situation in St. Paul.

In 1901 the city of St. Paul, Minn., made an investigation for electrolysis, taking readings between rails and water mains. Readings ranged from 0 to 80 volts with mains negative, and from 0 to 17 volts with mains positive. At the same time numerous excavations were made to examine the condition of pipes, some of which were found to be affected. With these tests as a basis, the city, in 1902, brought suit against the traction company. In 1903 this suit was suspended to give the company an opportunity to remodel its return-feeder circuits, and, as a temporary compromise, the traction company entered into a contract with the city, agreeing to reimburse the city for all expense incurred by previous investigation and for all pipes damaged in the past and future. Up to the present time the company has paid the city about $16,000.

Since this first investigation the traction company provided heavier rails in many localities, placed all the bonding in good condition and made [illegible] The water mains were found variously positive and [illegible] son, expert for the city, made an investigation and [illegible]

Signaling and Telephoning to Moving Trains.

[illegible] phoning to moving trains. The invention also provides a telephone system between moving-train units, and between moving and stationary points and between stationary points upon railways. It is intended to accomplish such signaling and telephoning only within certain predetermined limits. Further objects are to provide means upon moving railway units, enabling the operator of each unit to determine whether the other is behind or before him, and at what speed such other unit is moving; to apprise the operator of a moving car or train of an open switch, or signal of danger ahead of him; and to adapt these means to a block system, or local system, wherever such system is desired.

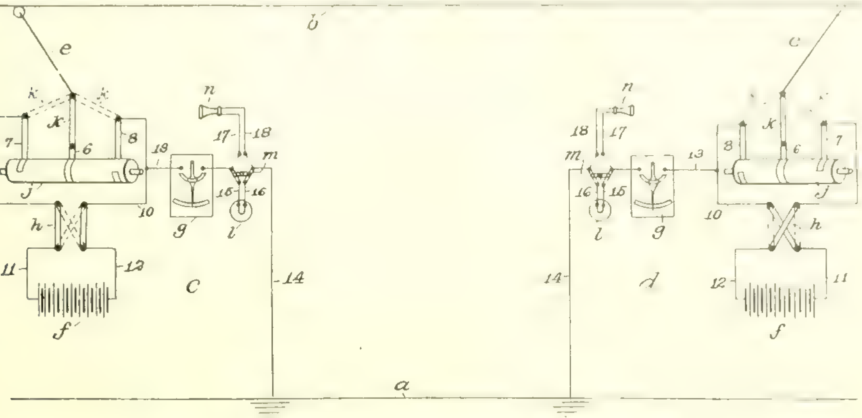


FIG. 1. SIGNALING AND TELEPHONING TO MOVING TRAINS.

Fig. 1 is a diagram showing the system applied to two train units headed toward each other on the same track. Fig. 2 illustrates the system as installed in a moving train unit, a railroad switch and a crossing tower or terminal.

Bearing in mind that the fundamental idea of the system is found in the fact that two train units, or one train unit and a short-circuit, will constitute a block and give a danger signal, the operation of the system in its various applications may be readily understood.

The length of the block, or the distance over which signals are given, can be determined by the amount of current sent out by the generators or other source (f) as related to the amount of resistance in the line conductor (b). Therefore, two trains placed upon the same track within dangerous distance will automatically signal one to the other. Open switches will give a signal upon a train within this distance. A train approaching within the said distance of a crossing or terminal will signal the crossing tower or terminal station, as the case may be; and the tower or station attendant may stop the train by a signal in the engine cab. All the persons mentioned may telephone to one another. Likewise, the operators of trains are apprised of the approximate location, speed and direction of movement of other trains entering within the aforesaid fixed distance.

Referring to Fig. 1, (c) may be considered a train coming in, and (d) a train going out. The commutator (h) and switch (k) of the respective trains are normally set as shown, so that current from generator (f) of train (d) would, when the [illegible] normal flash of the lamp alternating with a much stronger flash, or an almost constant light, show [illegible] show this by moving to the side corresponding to [illegible] current through the reduction of line resistance, [illegible] proaching train, as will also the rapidity of the [illegible] pletes the circuit for the other train by throwing the switch (k) to the head of the brush (8).

By throwing the switches (k) to (7), and throwing over the switches (m), it will readily be seen that [illegible] limited distance may telephone each other. A train may also telephone a crossing tower or terminal station (s) in the same way, when the attendant at (s) has thrown over his switch (m) and closed his switch (q).

If upon a train there is a normal flash of the lamp (l), intermitting with a weak one, there is another train in the rear. The indicator (g) will also show the direction of the other train. Then, by throwing the commutator (h) so as to join the local generator (f) with the generator in the rear train, an increased flash of lamp (l), alternating with a normal flash, and the indicator (g) still pointing in the same direction, will confirm the first signal.

If a regular single flash only is observed, with no other lamp effect, it indicates that a stationary short-circuit has been made with the train. This may be made by an open switch (o), or by a crossing tower or terminal (s), or by any temporary danger signal which may be made anywhere along the road by electrically connecting the line conductor (b) with the track (a). This signal may also be made by a standing train, which latter, when it comes to a stop, should throw out its generator (f) and ground its trolley (e) by throwing its switch (k) to (8).

The revolving switch (j), as will be understood from the diagrams, alternately sends out the local current, and runs to ground to take up a signal from an outside source. The lamp (l) and galvanometer (g), it will be noticed, are not cut out in grounding the trolley pole (e). It will also be noticed that the two generators (f) on locomotives in danger of a head-on collision run out in such a way as to form one; but that two locomotives following each other will naturally set theirs against each other, and if they are equally strong no lamp flash would result; but, since each generator is cut out and in automatically, and since there is no danger of their synchronizing, there is always a chance for each to do its work during part of each revolution of the rotatable switch (j).

The ends of the line conductor (b) may be either open or closed. If open, the incoming train will get no signal. But if the end of (b) is grounded the incoming train will get a signal as soon as it has reduced the resistance of the line (b) enough to operate its lamp (l). At crossing towers, and at terminal stations when desired, the switches (q) should be closed to ground the conductor (b), so that the guard may know of an approaching train. The guard may then telephone the train, or, by opening the switch (q), may stop the train, for in the latter case the lamp on the train has ceased to glow upon the opening of the switch (q).

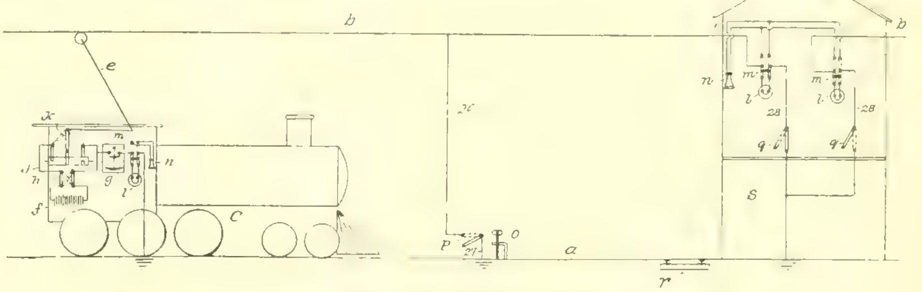


FIG. 2. SIGNALING AND TELEPHONING TO MOVING TRAINS.

Electrolytically Formed Lamp Bases.

[illegible] improvement in the [illegible] bases for incandescent [illegible] invented by Matthew M. Merritt [illegible]. This process was recently protected by letters patent assigned to the National Electric Lamp Company of Cleveland, O. The process consists essentially in electrolytically depositing the metallic shell for the base, and can be carried out in a variety of ways, only one of which will be described here.

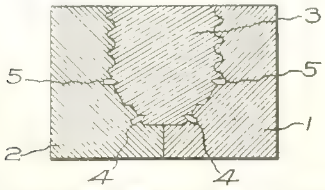


FIG. 1. MOLD FOR FORMING FALSE LAMP BASE.

As shown by the drawings herewith there is provided a mold, such as in Fig. 1, comprising two separated portions (1) and (2), with a recess having the shape of the desired lamp base and suitably dimensioned to allow for the subsequent shrinkage of metal and the deposition of copper.

The mold is filled with some material, which, after the deposition of the copper, may be readily withdrawn or extracted. For such material there is preferably taken a fusible metal, such as Babbitt metal having a low melting point. Instead of fusible metal, wax, paraffine or other like substance may be employed. This substance when hardened forms the false or dummy base (3), having substantially the outline of the finished lamp base.

In order to have suitable anchorage for the subsequently deposited conducting material, provision is preferably made in the mold by having near its bottom inwardly projecting pins (4) and just below the threaded portions other pins (5), so that the false base when taken out is provided with corresponding recesses. The base is then dipped in or coated by some substance which will prevent the copper from clinging to it too tenaciously when it is desired to separate the same. This substance may be bronze powder or graphite, which assists the metal in dropping away from the copper when it is melted. If a non-conducting substance, such as wax or the like, is employed for the false or dummy base, it is of course necessary to coat the base with a substance like bronze powder or graphite as a prerequisite to the electroplating operation.

The bases are subjected to the action of the electroplating bath as long as may be necessary to secure a deposit of copper of sufficient or desired thickness, and the latter, when formed, provides a thin, tenacious skin of conducting material over the exposed portions of the false base and conforming to the irregularities in the surface of the latter.

Having formed the shell of conducting metal in this fashion, the false base is withdrawn from the

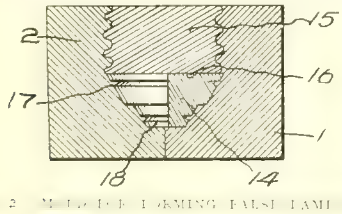


FIG. 2. MOLD FOR FORMING FALSE LAMP BASE.

shell by fusing it at a relatively low temperature, which, of course, has no effect upon the copper, which has a relatively high fusing point. The bottom of the shell is then partly filled with a plug [illegible] insulating material having an axial passage for the lead wire of the lamp. This button preferably is formed of some plastic substance [illegible] by machinery about a suitable form so as to leave the [illegible] harden. A good cement for this purpose is a substance which is [illegible]

Instead of forming the insulating plug or button in the shell as described, a previously formed button, such as (14), in Fig. 2, may be placed in the bottom of the mold, which latter is shaped accurately to receive the same, and the false base is then cast on top of this button, as represented at (15). Suitable interlocking surfaces may be provided between the button and the fusible metal portion of the base to cause adherence between the two.

This button is of such shape as shown, whereby there is provided the groove (17) and the smaller groove (18) nearer the tip, these grooves acting effectively to anchor the subsequently deposited metal shell thereto. This false base with the insulating button attached is then electroplated as above described, the fusible portion of the base melted out and the strip of metal overlying the truncated conical portion (19) of the base cut or ground away, as described.

Instead of cutting away the strip or area of metal intervening between the two terminal contacts of the lamp the metal may be deposited upon separated areas, if desired, by omitting the coating of bronze powder or other conducting material along the portion (19) of the button, or where the deposit of metal is not required.

The base after completion may be applied to the lamp in any desired way, such, for example, as is shown in Fig. 3, where it is cemented thereto by a body (22) of cementitious material consisting of

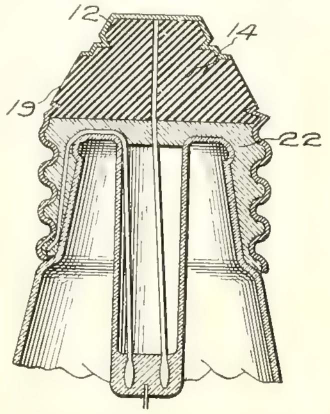


FIG. 3. COMPLETED BASE AS APPLIED TO LAMP.

plaster, cement or any other suitable substance, the lead wires being secured to the end contacts and the threaded shell portion, respectively, as shown.

The lamp bases as constructed by this process may be made economically in large quantities and with almost exact uniformity.

Plans for Electrifying German Railroads.

A start is to be made soon on the work of equipping some of the steam railroads of Prussia for electrical operation. The railroad ministry will permit the first great attempts to be made with electrical power in connection with the electric generating plants now existing in the administrative district of Magdeburg. In the first place, the short sections, Güsten-Stassfurt and Güsten-Bernburg-Köthen, will be arranged for electrical operation. Later there will be a change of power on the line Magdeburg-Bitterfeld-Leipzig, and afterward on the line Halle-Leipzig. Upon these electrical power will wholly supplant steam.

The line Leipzig-Halle has been chosen for a special reason. By the electrical operation between these two points there will be a greater increase in the speed and frequency of the trains dispatched, so that in this way Leipzig will be brought into closer connection with the western main lines. The two lines are under the district management of Halle, which has been instructed from the ministry at Berlin to make a detailed inquiry how far electrical power can be economically used in comparison with the present method of operation. It is said that the preliminary work for this statistical inquiry has already been done by the ministry, so that the administration at Halle has only to verify the results already obtained.

The most favorable factor for the economical determination of the question is the bituminous deposits (Braunkohlen) between Halle and Leipzig. This kind of coal is not considered a suitable fuel for locomotives. One electric power house will suffice for the operation of both lines, and this will be built in the midst of the coal strata. Some years ago the favorable location of these strata suggested the electrifying of the railroad between [illegible] but the [illegible] abandoned.

[illegible] the present [illegible] will be handled in [illegible] the road Berlin Lichter-felde-Ost, namely, with small trains and quick service. The express and freight trains will be drawn by electrical locomotives. The length of the two lines together amounts to 102½ miles, the line Leipzig-Magdeburg being about 80 miles and the line Leipzig-Halle 22½ miles. The transmission voltage will be 10,000 volts. It is calculated that the change in the system of operation will take two years.

Electricity Applied to Butter-making.

For many years electric motors have been used extensively for driving cream separators and churns in dairies where butter-making is carried on on a large scale. By an invention of George V. Frye and Frank B. Hinkson of Lexington, Ohio, which was recently patented, the electric current is applied directly to the cream to be treated. Thus a new field is opened for the use of electricity for electrolysis as well as for machine driving in dairy work.

In the ordinary methods of butter-making the milk is separated, the resultant cream ripened by the use of butter culture, and the material so produced is churned to collect the fat globules. The ripening, or practical souring of the cream, is absolutely essential in all commercially effective butter-making processes now known, and as the quality and flavor of the product depend largely upon churning the cream at exactly the proper point in the ripening process, the best results require extreme care and expert knowledge.

The newly patented process is intended primarily to dispense entirely with the ripening of the cream. Broadly stated, it consists in subjecting sweet cream to the action of the electric current immediately preceding the churning operation. In thus subjecting the cream to the action of the electric current it has been found that more or less heat is imparted to the material, and that by virtue of this heat the proper separation of the butter fats held in solution is to some degree retarded. Therefore, particularly in view of the fact that unripened cream is utilized as the material, an important and essential step of the present process is the initial reduction of the temperature of the cream to such a degree that the subsequent electrolytic action will not raise the temperature of the material to a point beyond that best adapted for the proper gathering or separation of the butter fat held in solution.

In carrying out the process, the cream, which has been initially treated to reduce its temperature, is subjected to an electrolytic action, the current strength and duration of which depend upon the percentage of butter fat in the material being treated. After the electrolytic action is maintained for the desired length of time the material is delivered directly to the churn, in which the fat globules are massed in the usual manner.

Further details of the process are that the sweet cream of the desired temperature is delivered to a tank in which are mounted removably a series of electrodes, preferably so constructed as to permit the flow of the material below them. These electrodes may be in any number and any desired distance apart, both of which details depend primarily upon the specific nature of the particular cream being treated. It has been found by experiment that the process is equally effective under ordinary conditions by connecting the electrodes in series, in parallel, or in bipolar arrangement, the essential and necessary characteristic being that the entire quantity of the cream be thoroughly subjected to electrolytic action.

The effect of the current on the cream is primarily to separate and mass in globule form the butter fats held in solution, therefore adding these heretofore lost solids to the butter fats held in suspension. This is so particularly noticeable in carrying out the process that the butter fats will be found to collect on the positive electrodes, massing themselves in butter form, and in fact exactly and directly making butter in the electrolytic receptacle. Therefore, the process of butter-making, as theoretically considered, is complete by the electrolytic action, though the inventors prefer to additionally churn the material in order to permit a proper working and finishing of the product in a commercial way.

There are really three steps to the process: First, cooling entirely sweet cream without any ripening whatever; second, subjecting this cream to an electrolytic action, and third, churning the product to unite the fat globules and bring the butter to marketable form. These are comparatively simple steps, so that the new process as a whole is said to materially improve the quality and quantity of the product.

The Hammer Photometric Method Employing Selenium.

[illegible]

lating devices (not shown) and to its terminals is connected a voltmeter (C) to show variations [illegible]

[illegible] a similar way, are not illustrated. Such an arrangement [illegible]

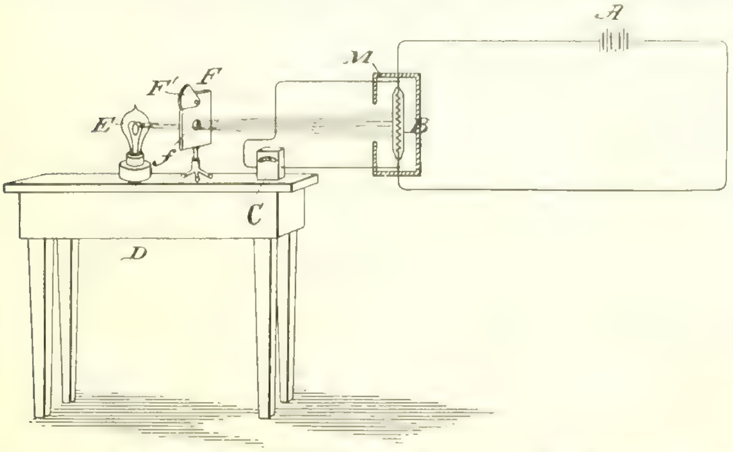


FIG. 1. APPARATUS FOR MEASURING LIGHT IN A PURELY ELECTRICAL WAY.

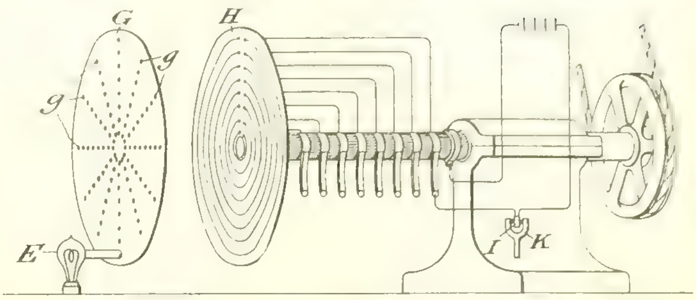


FIG. 2. [illegible]

mination worthless. In addition, the practical impossibility of maintaining a standard light which will not vary from time to time with the pressure of the atmosphere and its specific composition at the place of test, and with the purity of materials used to produce the flame, affects the precision of comparison to a greater or less degree.

As a standard of comparison the now well-known "Pentane" lamp is commonly used. The color of this standard is toward the red end of the spectrum, and to most eyes it shows decidedly pink. Hence, when an attempt is made to compare a yellow incandescent lamp, for example, with the standard, the results obtained from different observers are often so discordant as to make them of little use. It has, therefore, become a practice to have a single observer compare a number of incandescent lamps with the selected standard with great care, so as to make them secondary standards, which when burned at proper voltage will give for a considerable period a substantially unvarying light. Obviously, however, this introduces still further inaccuracies, since the lamps will, in spite of all possible care, differ among themselves, and comparisons made with them will necessarily differ by the personal equations of the different observers.

There has been invented by William J. Hammer of New York city a new and interesting method by which lights may be compared without introducing the variable physiological factor present when estimating light intensities by the eye, as in the common forms of photometers now in use. This new method, which has been recently patented in this country, was devised to obviate present photometric difficulties by causing the light to be measured to vary a selected physical quantity and measuring the variations so affected. It is said that the accuracy of the method can be made very great by taking necessary precautions, and that it is wholly independent of the peculiarities of different individuals, or at least may be made so by proper care.

Several different ways of carrying out the invention are possible. The simplest and best of all consists of arranging in an electric circuit a selenium cell through which a current is passed, the changes in which, due to the action upon the cell of the light selected for test, are shown on an appropriate form of electrical measuring instrument. In another and modified method sound-waves are caused to be affected indirectly by the light-waves; but this method, although far more accurate than direct comparisons of light by the eye, is more difficult and more complex to practice than the one just referred to.

The preferred method is shown clearly in Fig. 1, in which (A) is the battery or other source of current through the cell should be of as low a value as can be conveniently maintained constant for several reasons, one of which is that a large current evolves so much heat that the cell is subjected to alternate expansions and contractions which are detrimental; but the most important reason is that for very small currents a proportionately larger variation of voltage is caused by the action of the light upon the cell, rendering the device more sensitive and accurate.

Upon a suitable table (D) is arranged the lamp (E) to be tested. At (F) is indicated a screen having a hole (f) of standard dimensions, which may be closed by a slide (F¹). In practice it is preferable to place the selenium cell in a light-tight box (M) (shown partly broken away) having free ventilation, so that the indications may not be affected by exterior light; and inasmuch as the effect to be observed is not detectable by examination of the cell, it is only necessary to open the box at long intervals.

The method of operating the arrangement thus

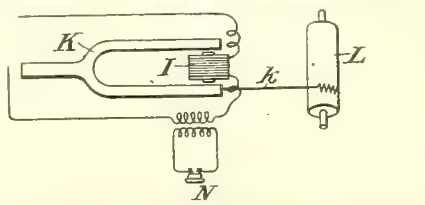


FIG. 3. DETAILS OF ELECTRO-ACOUSTIC APPARATUS FOR MEASURING LIGHT.

described is substantially as follows: A standard lamp, such as the pentane lamp referred to, is placed in proper position adjacent to the apparatus and lighted, being screened completely from the cell. A small current, preferably a small fraction of an ampere, is then caused to flow in the circuit including the cell, and after it has attained a steady value, the fall of potential around the cell is measured by the voltmeter. After this the light of the standard lamp is allowed to fall upon the cell, and the change in the resistance of the circuit (as indicated by the change in the drop) caused by the action of the light upon the selenium is measured and recorded; this then becomes a "constant" of the particular cell employed.

After this the light which is to be compared with the standard may have its specific effect upon the cell determined in substantially the same way. Obviously the indications of the cell for the first specimens constructed must be calibrated by comparison with the results obtained by photometers, since the measurements of light now in use are purely arbitrary and of no relation to any definite physical quantity; but this relation, fork, which at the normal rate of rotation will respond to its appropriate tone; these, being all substantially like the fork (K) and arranged in a similar way, are not illustrated. Such an arrangement will enable the observer to conduct a number of tests at the same time, when desired.

The apparatus thus described is brought up to normal speed, which should be maintained as nearly constant as possible. The tuning-fork (K) will begin to vibrate as soon as the standard lamp is turned on, and the amplitude of its vibrations will be recorded upon the cylinder (L). Upon turning off the standard and turning on the lamp to be tested the amplitude of the fork's vibration will indicate the intensity of the lamp to be tested, relative to the standard.

A telephone (N) may be connected in circuit, if desired, either directly or inductively, and the note of the fork will then sound in the ear of the observer. An operator with a good musical ear may reach a very close approximation to a correct comparison by the relative intensities of the sounds produced by the two lights; this is, however, open (though in a less degree) to the objections pointed out with respect to visual photometers.

As already mentioned the first method (Fig. 1) is the preferable one. To get a high degree of precision with it several precautions must be observed. The selenium cell should be enclosed in a vacuum. The supporting wire for the selenium must be constructed of some material which is not readily attacked by it; nickel is probably best. The surface of emission of light must be standardized so that the same extent of surface of the standard and compared lights is exposed to the selenium cell. The resistance of the circuit in which the selenium cell is placed should be very high to make it more sensitive; in some cases as much as 10,000 ohms was put in series with the cell. For the same reason the voltmeter or galvanometer employed should be of high resistance.

Glass Handling by Magnets.

The British consul at Philadelphia reports that there has been an electric method recently introduced there for the easier handling of large sheets of plate glass, by the use of heavy magnets placed against the glass on one side, while on the other are flat plates of iron or steel. The magnet holds the plate tight to the glass, thus enabling a heavy plate of glass to be handled with ease by the use of as many magnets as may be required, each magnet being connected by wire with the current producer, which current can at once be cut off when necessary to release the glass plate from the steel or iron plate at the back. Many mechanical improvements have been introduced of late years into the glass-making industry of the United States, by which the output has been largely increased and the quality greatly improved.

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DEPARTMENTS.

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have a capacity of transmitting about 300,000,000 words per annum, whereas it is said only about 25,000,000 words are actually sent. Mr. Henniker Heaton, M. P., thinks that if the rate were reduced to two cents a word, the full carrying capacity of the cables would be utilized and the service would be remunerative. It may be doubted whether fully loaded 24-hour cable operation will ever be achieved, but it is probable that a substantial reduction could be made, while the lines would still show a good profit by reason of the increased business. A 60-per cent. cut in price, as in the case of mail carriage, would result in a 10-cent rate, which would be a great stimulant to increased cable communication.

ELECTRICAL UTILITIES are conspicuous at the Republican national convention, which is in session in Chicago as this issue of the Western Electrician goes to press. The two telegraph companies have installed a large number of instruments, with quarters for operators, at the south end of the basement of the Coliseum, where the convention is in session. The working room of the Associated Press is between the two telegraph operating rooms. Here, also, are tables and instruments for newspaper telegraph operators, while pneumatic tubes connect this basement room with the space reserved for the Associated Press representatives at the speaker's platform. Conspicuous in the main hall, in the press section and near the chairman's desk, is a table fitted with telegraphic apparatus. Here sits an operator, reputed to be one of the fastest in the country, who is said to transmit an outline of the proceedings as they occur to Mr. Taft in his office at Washington.

A large number of telephone booths have been installed, both for local and long-distance service, while many other desk telephones are scattered through the building, on the platform and in the various committee rooms and convention offices. The isolated electric plant in the building, with its capacity of 2,200 amperes, is supplemented by central-station service, and all the electrical arrangements seem to be carefully planned. A feature rather new to political conventions is a number of electric signs spelling out the names of "Knox," "Uncle Joe" and other "favorite sons" about the hotel headquarters of delegates.

One of the earliest uses of the electric telegraph was in announcing the result of the Baltimore convention of 1844, and ever since then the great quadrennial political conventions have furnished scenes of great telegraphic activity.

RECENT ELECTRIC-RAILWAY accidents of a serious nature show that it is necessary for the managements of these popular means of transportation to exercise greater vigilance over the men and material in their charge. The number of steam-railroad accidents seems to be decreasing, fortunately, but, to judge by the reports in the daily newspapers, the same statement cannot be made in relation to the electric lines. Electric and steam railroads are now frequently in competition, and the cars used on the former are often nearly as long and heavy as those drawn by steam locomotives. Constant improvement is made in methods of operating electric roads, including train dispatching, but it is evident that much remains to be done. It will be a false and disastrous economy that attempts to save money in any direction that clearly interferes with safety of operation.

The "electrics" are now popular with the traveling public because they are more convenient and afford a more pleasant journey than the steam-drawn cars. But what will happen to the interurban-railway industry if the traveling public becomes convinced that the electic railways are more dangerous to life and limb than the steam roads? This conclusion has not been reached, for there is no warrant for it as yet; but it is disquieting to see improvement in the matter of avoiding accidents proceeding at a more rapid rate on steam railroads than on the electric lines [illegible] apparently the [illegible]. It is true that there was greater need of [illegible] in the case of the steam roads, but [illegible] that there [illegible] far too many elec[illegible] and the men in charge of the expenditures and operation of these railways should fully realize the serious nature of their business and should strive, even more earnestly than at present, to make riding over their lines an undertaking of assured safety as well as of speed, comfort and convenience.

BUTTER-MAKING by electricity—not by the use of electric power in driving cream separators or churns, but by the direct application of the current to the cream—may be accomplished if a recently patented process, described briefly on another page of this issue, proves to be of practical value. It is declared that the effect of the current on the cream is primarily to separate and mass in globule form the butter fats held in solution, adding these, hitherto lost, to the butter fats held in suspension. If this is so, the invention is an important one, for obviously the amount of butter made from a given amount of cream will be increased.

Last week we spoke of the application of electric power in cow-milking machines as a possible appreciable load on the central station in dairying districts. There now appears the further possibility of using the current directly in the butter-making process itself. Practical dairymen will of course have to pass on the merits of the electrical method, but the enterprising central-station manager in the country will note the process as one which may afford an outlet for current in a new direction.

BOSTON has its transportation problem, like all large cities. The Metropolitan Improvements Commission was appointed in pursuance of a law passed last year, and its consulting engineer, Mr. George W. R. Harriman, has recently submitted a comprehensive plan for a system of interdependent steam-railroad and electric-railway facilities to serve the Hub and the thickly populated territory immediately surrounding it. One especially interesting feature of the report is the recommendation of the formation of a corporation to take over all the physical railroad property in the district, the state to hold 51 per cent. of the stock.

Other suggestions are: Connection of the subway and tunnel systems of Boston and its suburbs with the lines of railroads entering the city; construction of connecting links between the different railroads to form a belt line reaching the docks, wharves and industrial areas; a tunnel between the railroad and steamship centers in East Boston and South Boston, in which freight terminals have been concentrating in recent years on opposite sides of the harbor; electrification of railroad lines, so that they may be operated within the district in conjunction with the existing and projected elevated structures, subways and tunnels; utilization of the abandoned Park Square terminal station of the New Haven road as the center of the electrified street-railway and railroad service; purchase by the new corporation of the Boston and Maine stock held by the New Haven company, which has been the subject of so much controversy for several months; authorization of the purchase of the trolley systems which the New Haven company must relinquish, in view of the Supreme Court's recent decision, by the Boston Elevated Railway Company; adequate provision for the financing of the project and for future development in accord with the general scheme; appointment of a permanent commission to direct the work.

From the foregoing condensed outline of the salient features of the plan it will be seen that the commission and its consulting engineer have given the subject a minutely comprehensive study, with the object kept steadily in view of securing unity and facility of operation in every way possible.

Legislative enactments in Massachusetts have greatly curtailed the freedom of action of both the steam roads and the electric railways, and the roads are held strictly accountable to governmental regulation. If the latest plans, as outlined in Mr. Harriman's report, commend themselves to the citizens after they familiarize themselves with all the details, it is apparent that Massachusetts will have achieved a success in dealing with the issues involved that should add much to the prestige of the commonwealth as an exponent of progress in its treatment of urban and suburban transit problems.

Illumination and the Eye.

[illegible] and took dinner together before the doctor rose to [illegible]

[illegible] how color values were affected by contrast, and Dr. Gradle emphasized the point that the retina is greatly influenced by contrast of light. The eye is entirely different from any artificial instrument in its adaptability to illumination. Its sensitiveness is very great and may be expressed [illegible] ratio of from 1 to 2,500. The artificial illumination required for [illegible] at 30 meter-candles, but to be entirely satisfactory the illumination should approach 50 meter-candles. Beyond that it is considered that the illumination is excessive.

Dr. George F. Suker followed with a brief discussion on the subject. He said that [illegible] should be made to allow the eye to adapt itself to varying intensities of lighting. Lamps should be made to give uniform light throughout the whole term of their use. Flicker is very objectionable. There is a uniformity in electric lighting which is not attained in gas lighting, and this fact constitutes one of the principal reasons for the superiority of electric lighting. The speaker made a plea for exact regulation of electric-lighting circuits. He also noted that the light should be shaded or diffused and not a direct glare. In all living rooms the source of illumination should be above the head. If the eye were a perfect optical instrument it would make little difference if flicker was present, but it cannot adapt itself instantly to changes in intensity of light.

Dr. Gradle added, in answer to a question, that the eye works to best advantage in medium illumination, that is, light neither too strong nor too weak. Answering another inquirer he said that he thought that, as the eye has a certain tolerance, no very injurious effects are to be apprehended from moving-picture shows, particularly if properly performed.

Among others who participated in the discussion were J. R. Cravath, the chairman of the section, who presided, and W. P. Clawson of Hibbard, Spencer, Bartlett & Co., Allen S. Pearl of the Central Electric Company, F. R. Beebe of the People's Gas Light and Coke Company, W. F. Holzmann of the Holophane Company, and G. H. Jones of the Commonwealth Edison Company.

Tungsten Lamps in Chicago.

In introducing the new tungsten lamp in Chicago the Commonwealth Edison Company has paid especial attention to a four-light fixture consisting of four 60-watt lamps and a special porcelain shade. This fixture, with the wiring complete, is put out by two methods. One of these is a flat rate of $1.15 (net) a week, which includes everything. In this case the lamp unit is burned from dusk to 10 p. m. on every day of the week except Saturdays, when it may be burned until midnight. The central station turns on and cuts off the current at the time agreed upon. It also furnishes all lamp renewals and the cleaning and care of the fixture, so that the customer need give no attention to it whatever. The lamp unit is rented to the customer, not sold.

The other plan is on a meter basis. In this case the same outfit is rented for $1.50 a month, which charge includes renewals and care and cleaning of the fixture. Put the current furnished is paid for at the regular Wright-demand meter rates. However, if the cluster burns more than 150 hours a month, a charge of 20 cents extra is made for each 30 lamp-hours, or fraction thereof, during the monthly period. This provision is to prevent the lamps being burned continuously or excessively long hours, in which case the renewal charge would be too high to be covered by the $1.50 rate.

About 1,000 of these tungsten lamp units have been installed during the last six weeks, in many cases displacing "gas arcs." One four-light unit is sufficient for lighting the general interior of a small store, and with the superior quality of the light the new fixtures are popular with customers. It is

[illegible]

Electric Club of Chicago to Enlarge Its Outlook.

[illegible] timely address. He called attention to the fact that many other associations, having no electrical men [illegible] themselves in questions of importance to the electrical business and make their presence felt in the community when matters are up for decision that affect the individual welfare of the Electric Club members more than it does theirs. "Why should we sit idly by and see others, not having our knowledge and experience, mold the opinion of those in authority when the responsibility is clearly ours?"

As an example of one of the projects the carrying out of which would benefit the club members and the community in general, Mr. Howlett cited the necessity of "electrifying" the Illinois Central Railroad and other steam railroads within the city limits. Co-operation and concerted effort on the part of the members would do much to bring about this needed improvement; and the club members would be the greatest gainers—first, the consulting engineer members, then the contractors, supply men and manufacturers.

Concerning Mayor Busse's recent statements as to absence of reliable data of the cost of operating the city light plants and of the plant value, Mr. Howlett said that "if there is any question about our not lighting our streets properly it would seem that it would be this club's duty to display some interest in the matter and take some action that would assist those in authority out of their difficulty."

Referring to the seeming difference between the city authorities and the Sanitary District concerning the electric power now available from the Lockport plant of the Drainage Canal, the speaker said that any action or lack of it that hinders the rapid introduction of current-consuming devices is inimical to the club's best interests, and each one of the members should arouse himself and do what he can to see that a rapid adjustment of the difficulty is brought about.

A resolution was adopted at the meeting expressing the club's appreciation of the work done by the Co-operative Electrical Development Association. A committee was appointed, to be known as the civic committee, which will investigate, agitate, discuss and take action on electrical questions of a quasi-public nature.

Bondholders Want Sunday Railway Operation.

Judge Anderson of the Federal Court at Indianapolis has under consideration an unusual plea for the appointment of a receiver for the Winona Interurban Railway Company. The principal point involved is whether the interurban company can be compelled by mandate to operate its cars over the Goshen division on Sundays for the alleged purpose of increasing the earnings of the company to make sure of the payment of interest on the outstanding bonds. The road is under the control of the Winona Assembly and Summer Schools Association. The association is a religious body, and on that account it had refused to operate the cars on Sunday. The complaint is filed by the Electrical Installation Company of Chicago, which accepted $425,000 worth of bonds as part payment for installing the equipment of the road. That company says that it took the bonds with the understanding that the road would be operated seven days a week. Because it is not operated on Sundays the complainant alleges that the railway loses a chance to increase its earnings at least 20 per cent., and that the action of the Winona company is impairing the security of the bonds. The appointment of a receiver is desired, so that the court may order that the road be operated on Sundays the same as other days.

Dr. S. E. Dickey, general manager of the Winona Interurban Railway, denies that any promise was ever made by the officials of the road to operate it on Sunday. He also alleges that the company has made sufficient money to pay maintenance and operating expenses and to pay the interest on the bonds when due.

[illegible]

The Shut-down at Niagara Falls.

[illegible] to assist a lake-survey engineering corps to secure [illegible] during the period when no water was being di[illegible] a. m. a party of engineers of the Niagara Falls Power Company went into the tunnel. A. H. Van Cleve, consulting engineer, was in charge of the engineering inspection of the pits and tunnel, while the mechanical inspection was under the direction of C. C. Egbert, mechanical superintendent. The engineering investigation revealed that the pits and tunnel are wearing well, their condition being practically perfect. In the connecting tunnel between pits No. 1 and No. 2 a few brick had fallen from the roof, but this was considered unimportant. The water line of the main tunnel shows that its size, 21 by 18 feet, is amply large for carrying off the turbine discharge. Here and there, between the power houses and a point under Third Street, was found a leak through the walls, but below Third Street there is no leak.

About half a foot of water ran through the tunnel as the result of the leakage, etc., making it necessary for the inspecting party and guests to wear rubber boots and coats. The power company officials were delighted with the conditions, the tunnel not having been inspected since June 1, 1902. Among those who made the trip were General Manager Philip P. Barton of the Niagara Falls Power Company, Major Charles W. Kutz of the Taft Scenic Commission, Secretary W. E. Wilson of the International Waterways Commission, A. Monro Grier, Mayor Douglass, W. S. Humbert and several newspaper men; also Dr. E. W. Schoder, professor of hydraulics at Cornell University.

About nine o'clock in the morning the water was again turned on the tunnel. At 9:30 a. m. the first machine was thrown in, and at 11:20 a. m. all the machines were again in operation. All of the Niagara Falls factories were shut down, and the trolley load of Buffalo and the Niagara locality was carried by the Canadian Niagara Power Company's station, the load being about 45,000 horse-power.

Francis C. Shenehon, in charge of the Lake Survey Corps of the Niagara locality, had his men stationed at the entrance of the river and also at Port Day, Schlosser Dock, Willow Island and at Prospect Point taking levels. It is understood the depth increased 1 1/5 inches at Prospect Point. The water was running high all the time. There was no wind, the morning being quite ideal for the test.

During the time the water was off the tunnel a force of men worked hard about the abutment of the Upper Steel Arch Bridge, three divers being in this party. They examined the foundation very thoroughly, finding that the rushing water had washed away the shale back of the retaining wall, which does not appear to have been given a proper foundation. Engineer R. S. Buck, who built the bridge, and Mr. Moran of the Foundations Company of New York were present at the investigation of the abutment. Now that the exact conditions are known, it is understood that repairs can be made from the shore side while the tunnel stream is rushing by.

The Berkshire Street Railway Company plans to construct a trolley line to the summit of Greylock Mountain, also to extend southward to Connecticut from Great Barrington, Mass., the cost to be about $2,000,000. The absorption of the Bennington and North Adams railway is a part of the plan. The Berkshire road is owned by the New York, New Haven and Hartford.

The Fourth German X-ray Congress

[illegible] of the Western Electrician.

[illegible] developments in the technique [illegible] X-rays were discussed at the [illegible] German X-ray Congress held at Berlin.

Professor Eberlein gave an account of the [illegible] opening of an X-ray exhibition, and the forth coming foundation of a museum representative of the evolution of skiagraphy. The behavior of photographic plates in regard to both light and X-rays was discussed by Dr. Walter, a Hamburg physicist who has recently analyzed and examined a number of those photographic plates which are found on the market for the purposes of X-ray records. As there is no apparent difference in the behavior toward either kind of rays, the designation of "X-ray plates" frequently is both misleading and unjustified. The majority of those plates at most show an increase in their sensitiveness, but as this tends to favor the formation of "veils," it cannot be considered a real advantage. The temporary increase of effects is two and one-half to one-third times greater in the case of light than in that of X-rays. There is therefore considerable room for improvement in the manufacture of photographic plates for the purposes of skiagraphers.

Dr. Cowl emphasized the importance of a physical investigation into the processes of current opening and closure, in connection with which Weber's familiar electro-dynamometer should be used. Dr. Rosenthal of Munich submitted the results of his researches on the importance of secondary-current curves for the operation of X-ray bulbs. Current-closure induction should be strictly avoided, to which effect the lecturer has designed a number of special devices. The speaker also gave some data as to the admissible load on X-ray bulbs.

Possibly the most important lecture of the Congress was delivered by Mr. Holtzknecht, a Vienna engineer, on the problem of causing Roentgen rays to act with the same, or even higher, intensity in the depth than at the surface of the body. A solution of this problem is bound to have a special bearing on the successful treatment of cancer and tuberculosis. By using different methods (employing extra-hard X-ray bulbs, ray filters, or several bulbs, acting at considerable distance) the lecturer, in conjunction with Mr. Schmidt, engineer to the Berlin General Electric Company, has reached a remarkable result, concentrating into the interior of the body under treatment the same amount of radiation as on the surface.

In connection with these experiments H. Bauer then discussed the solution of the task of generating hard X-rays during a length of time as considerable as possible by replacing the induction sparks by some other form of energy. This, in fact, was found to be indispensable, the current of an induction coil proving unsuitable in the case of multiple operation. Electrical vibrations similar to those used in wireless telegraphy were therefore resorted to, thus affording a suitable means of actuating X-ray bulbs with considerable amounts of energy.

The same physicist has constructed an apparatus for a novel radio-therapeutical method called fulguration, which is being tested by some prominent Berlin practitioners (first of whom should be mentioned Professor Czerny).

After an account of plastic work in X-ray records given by Dr. Alexander, A. K. Fürstenauer demonstrated a novel regulator of the hardness of X-ray bulbs, viz., a new air cock used by Mr. Bauer in connection with the bulbs constructed by him, for the purpose of regenerating their vacuum.

After the [illegible] new measuring methods, the subject of rapid and instantaneous [illegible] came up for discussion. This deserves especial attention, because of the voluntary [illegible] of patients, especially [illegible] of motion [illegible] the most important [illegible] [illegible] posure. Dr. Groedel lays especial stress on the [illegible] medicine. One of the first steps toward reducing [illegible] and stomach records at one-third to one-half second. Frontal records of the stomach have been obtained with specially satisfactory results. Dr. Frankel then drew attention to the surgical importance of rapid X-ray records, and Dr. Koch of Dresden told of having obtained records within about one-fiftieth of a second by a single current interruption, effected in a somewhat strange manner by the discharge of a pistol projectile.

Special interest was evinced in the demonstration of color photographs, according to the Lumière process, cancerous and tuberculous tumors, as well as the effect exerted on them by X-ray radiation, being demonstrated. A process designed by Dr. Gottschalk of Stuttgart allows X-ray pictures in relief to be obtained, the bones appearing in dark and the soft portions in light shades. The diagnostical value of this process was proved by the demonstration of brain tumors. Other new and practical devices were exhibited by several members.

General Electric Engineering Convention.

For nine days ended June 6th the engineers of the General Electric Company were in session at their annual meeting for discussing the last year's development in the art and considering plans for the future. Engineers from the local offices of the General Electric Company throughout the country and Mexico were in attendance, as well as representatives of all branches of the engineering department of the company. Every phase of the company's engineering work was considered in detail. The engineers of the various departments presented interesting papers on a great variety of important subjects, and profitable discussions followed.

The meeting was opened at the principal works at Schenectady, N. Y., by E. W. Rice, Jr., vice-president. After spending five days at Schenectady the meeting was adjourned to Pittsfield, Mass., where C. C. Chesney, manager of the Pittsfield works, opened the meeting and introduced the engineers at that factory. The meeting was continued at Lynn, where the engineers were welcomed by W. C. Fish, manager of the Lynn works. The company's incandescent-lamp works are located at Harrison, N. J., and when the convention assembled at that place G. F. Morrison, manager, outlined the remarkable development in incandescent-lamp engineering during the last year.

Among the engineers from the field present at this meeting were: J. Lyman, Chicago; J. L. Monges, San Francisco; W. F. Wright, Denver; H. H. Barnes, New York; C. T. Mosman, Boston; W. S. Culver, Cincinnati; L. F. Deming, Philadelphia; H. E. Bussey, Atlanta; W. H. Hand, St. Louis, and C. A. Chase, Mexico.

Electrical Contractors' Convention in Chicago.

The eighth annual convention of the National Electrical Contractors' Association of the United States will be held at the Auditorium Hotel, Chicago, July 15th, 16th and 17th. It is expected that a large attendance will be present, including contractors from every state in the Union, and the usual complement of guests, consisting of contractors' wives and people interested in supplying materials to the trade.

An excellent programme of business, papers and discussions is being prepared and will be printed later in the Western Electrician, together with other details of the convention. The morning sessions on the 15th and 16th will be open ones for general discussions, and talks on matters of interest will be given by prominent architects and engineers. The afternoon sessions will be for members only.

Entertainment features will not be lost sight of, and an elaborate programme is being prepared, including banquet, entertainments and an all-day outing to Michigan City on the lake steamer Theodore Roosevelt.

The matter of local arrangements is in the hands of an excellent committee, which is making energetic efforts to have the convention prove profitable and successful [illegible]. The local committee on arrangements is composed of C. R. Kreider, Arthur Frantzen, Ernest Freeman, Henry Newgard and Warren Orne. Those desiring advance information may address the chairman of the committee, C. R. Kreider, Fisher Building, Chicago.

[illegible] Duluth, Minn. [illegible] telephone [illegible] company [illegible] enlarged [illegible]

Some Features of Naval Equipment.

At a meeting of Armour Institute Branch of the American Institute of Electrical Engineers held on May 21st, Lieut. W. F. Sims, past assistant engineer of the Illinois Naval Reserves, read a paper on "Some Features of the Electrical and Mechanical Equipment of the United States Navy," from which the following is taken:

A first-class battleship of the Connecticut type is practically a floating city, having its waterworks and sewerage systems, its central lighting, heating and refrigerating plants, in addition to the machinery necessary for propulsion and for offense and defense. In the construction of a merchant ship, cost of construction and operation must be as low as possible in order that she may prove profitable to her owners. In the case of a man-of-war the end in view is fighting ability, and to a certain extent economy in construction and operation is sacrificed. In the navy the coal bunkers must be so located that they afford protection to the vital parts of the ship.

In modern naval installations water-tube boilers are becoming generally used, for the reason that their use permits the installation of a larger number of smaller units than is possible with tubular boilers, and the danger of the ship being crippled in case of damage to one boiler is materially lessened. This type of boiler also has the advantage of much less weight per boiler horsepower and permits the use of higher pressures. The boilers are usually installed in a number of separate boiler rooms. The coal bunkers are also subdivided, one of the chief reasons being to prevent a spread of coal-bunker fires.

Mechanical draft is almost universally used, as the height of stacks allowable is insufficient to create the proper natural draft. The system usually employed is to make the stoke hold air-tight and force air into the hold. This system furnishes a good air supply for the men.

The engines installed are generally of the inverted, vertical, four-cylinder, triple-expansion, reciprocating type with two low-pressure cylinders. Two of the scout steamers now nearing completion are being fitted with turbines, one installation being with Curtis and the other with Parsons turbines, and a third ship has reciprocating engines. As in all other respects these ships are practically identical in design, the results of the tests on their trial runs is being awaited with great interest.

The electrical equipment on a first-class battleship is subject to very rigid requirements, especially as regards insulation, due to steel construction of the ship and exposure to moisture. Separate circuits are provided for general lighting and battle service. The battle circuits carry only such lighting as necessary in action day or night. As far as possible all feeders are run below the protective deck or behind armor. Originally the standard voltage was 80 volts, but owing to the rapid increase in motor load within the last few years only 125-volt installations are now being made.

On the larger ships a generating capacity of about 800 kilowatts is provided in eight units of 100 kilowatts each, direct-connected to high-speed, vertical cross-compound engines. In the later ships fully 80 per cent. of the generating capacity is used for power purposes. The Connecticut, for example, carries 213 motors, ranging from one-quarter to 80 horsepower, in addition to 73 portable fan motors.

Lieutenant Sims took up many interesting motor installations, such as for turret turning, ammunition hoisting, etc. He also described the telegraph and signal systems.

Canadian Commissioners Would Limit Niagara Power Development.

In its report, just presented to the Dominion Parliament by the Canadian section of the International Waterways Commission, the commissioners review the whole question of the development of power from Niagara Falls, and place on record their opinion that it would be a sacrilege to destroy the scenic effect of the Falls, and that, with this object in view, an agreement should be made for 21 years limiting the amount of water which may be used for power purposes to 36,000 cubic feet per second on the Canadian side and on the American side to 18,500 feet. One-half of the production, on the Canadian side, would be sufficient, the commissioners think, to satisfy the demands of the Canadian market for many years to come, and the companies on the Canadian side might be at liberty to export the other half (200,000 horsepower) to the state of New York.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By [illegible] B. [illegible]

[illegible] XII.

Special Equipment and Methods

(Continued.)

TESTING ON INDUCTIVE LOAD.

For testing alternating-current meters on inductive load a reactive coil of considerable capacity and adjustable inductance is ordinarily employed, connected in series with the load [illegible] the current, i. e., establish the required phase relation between the current in the series and potential circuits of the meter. This [illegible] however, objectionable, owing to the inconvenience of having to adjust the inductance when the load is changed in order to maintain the power factor of the circuit constant at a determined value.

The following method accomplishes the same result without the cumbersome reactive coil, by connecting the series winding of the meter in circuit in the usual way, but exciting the potential winding of the meter from a small double transformer, thereby producing a resultant potential in the latter winding which virtually leads the current and thus gives the desired phase displacement between the current and potential windings. The method also serves to control the potential impressed upon the meter. The diagram (Fig. 17)

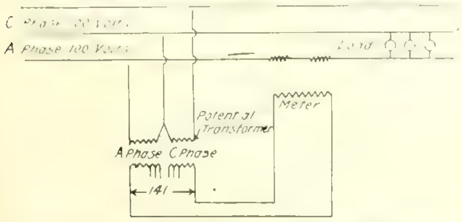


FIG. 17. TESTING ALTERNATING-CURRENT METERS ON INDUCTIVE LOAD.

shows the application of the scheme to a three-wire, two-phase system. The special transformer consists of two potential transformers connected to the (A) and (C) phases of the circuit, respectively. The secondaries of these transformers are provided with taps and are connected in series, with their outside terminals connected to the potential winding of the meter.

Assuming that the transformer has a ratio of 1:1, and that the primary electromotive force is 100 volts, it is evident that the resultant electromotive force on the secondary side of the potential transformers will be 141 volts. Moreover, this resultant electromotive force will lead the current in the (A) phase by 45 degrees, and lag behind the current in the (C) phase by 45 degrees. Therefore, if the meter is supplied with current from the (A) phase and takes its potential from the secondaries of the two transformers, as shown, the current which passes through the meter will be 45 degrees behind the electromotive force impressed upon the potential circuit. If this is the desired phase relation the (non-inductive) connected load may be varied at will without disturbing the power factor. The taps of the secondary windings of the transformer are provided in order to vary the phase relation.

If a different power factor than is given by the full secondaries is desired, it is only necessary to connect the two secondaries together at taps which will give a different number of turns on one secondary than on the other, thereby changing the power factor. For example, if the number of turns on the secondary of the potential transformer connected to the (C) phase is made greater than the number of turns in the secondary on the (A) phase the power factor will be decreased. An arrangement of switches can be provided so as to produce any desired power-factor condition.

Of course, the taps may be utilized to vary the potential taken by the meter without changing the power factor by varying the number of turns on each secondary equally.

MISCELLANEOUS APPARATUS.

The laboratory equipment should include, in addition to the storage battery heretofore described—

A battery of six or eight cells giving heavy cur-[illegible]

[illegible] by combination connections of the separate coils of its secondary winding.

[illegible] plemented with a small wire rheostat for fine ad[illegible] potential regulation; special rheostats for currents not exceeding five amperes, carbon rheostats for [illegible] terminating in mercury cups, with jumpers for effecting different parallel and series combinations for currents up to 1,000 amperes, and a water rheostat for very heavy currents.

A portable testing set.

Dynamometer [illegible]

Kelvin balances.

Direct-reading ohmmeter.

Curve-drawing instruments (graphic recording instruments, etc.), etc.

CARBON RHEOSTAT.

The carbon rheostat, operating on the principle of the variation of contact resistance between carbon surfaces with varying pressure, makes a serviceable form of resistance for testing meters. The accompanying sketch, Fig. 18, shows a form of carbon-plate rheostat designed to carry currents up to 100 amperes. The device, which is compact, although not very light, consists of a strong frame containing a number of carbon plates three inches square and three-sixteenths-inch thick, arranged so that the group of plates may be compressed between a fixed head at one end of the frame and a tightening screw tapped into a similar head at the other end.

The terminals consist of three copper plates three inches square and three-thirty-seconds-inch thick, with binding posts. With one terminal at each end and one in the middle, as shown, the entire group of carbon plates may be put in series in the circuit, or the group may be divided into two halves, which may be connected in parallel. By tightening the screw a smooth variation of the current may be obtained, from a low value to the maximum carrying capacity of the rheostat.

Another size of this device adapted to carrying heavier currents (up to 200 amperes) consists of a larger frame, with larger and more numerous carbon plates, and with five instead of three terminal plates, by means of which several different series-parallel or parallel-series connections may be used to obtain different carrying capacities and ranges.

SLIDE-WIRE RHEOSTAT.

A convenient form of slide-wire rheostat, employed in the calibration of meters at the factory, is shown in side elevation and cross-section in Fig. 19. It consists of a solid slate cylinder or

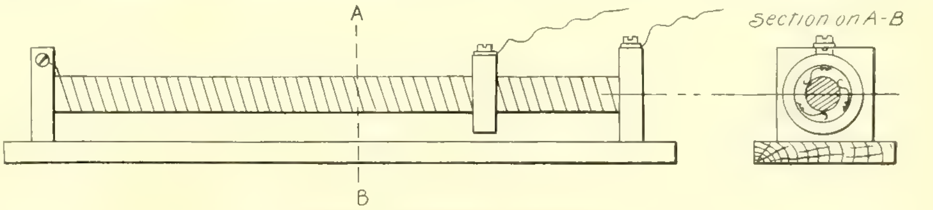


FIG. 19. SLIDE-WIRE RHEOSTAT.

column 24 inches long and 1½ inches in diameter, with a thread turned upon it in which is wound a length of german-silver wire. For clearness, the wire resistance is shown in the illustration as an open helix, but as actually constructed the adjacent turns are as close together as they can be wound without actually touching. The size of the wire that is employed depends, of course, on the carrying capacity and range of resistance desired.

The column is fitted with square slate or wood ends, to facilitate mounting it upon the wood base. The adjustment is by means of the brass ring, of inside diameter greater than the diameter of the wound column and enclosing the latter as shown. The contact between this sliding ring and the helix

[illegible]

(To be continued.)

NOTE.—This serial article, begun in the Western Electrician of April 4, 1908, is an advance publication of a portion of a forthcoming book by Mr. Baker on the general subject of "Electric Meters." It will be understood that the present serial refers to watt-hour meters used on customers' premises.

QUESTIONS AND ANSWERS.

Shunted Ammeters.

A. S. A., Chicago: What proportion of the full load current does a shunted ammeter take on a 550 to 600-volt direct-current circuit?

ANSWER.

Shunted ammeters are arranged so that the instrument part is of standard construction and substantially identical for nearly all ranges. The resistance of the instrument itself is about four ohms in switchboard work, and the maximum it carries is about 12 milliamperes (0.012 ampere). The potential difference across the instrument and shunt is usually close to 50 millivolts (0.050 volt) for all sizes. To obtain different ranges the conductivity of the shunt is changed. Thus in an ammeter reading up to 1,000 amperes the ratio of instrument current to line current is about $\frac{12}{1,000,000}$; for an ammeter reading to 2,000 amperes it is but half this, or $\frac{12}{2,000,000}$; for a 500-ampere set it is $\frac{12}{500,000}$. Since the shunt is connected in series with one side of line, the voltage of the circuit does not affect the ratio. It depends only on the line current and would be the same on 110-volt as on 600-volt lines, if the maximum current were the same.

Electrolysis of Telephone Cables.

M. A. L., South Bartonville, Ill.: We have a central-energy telephone system with all lead cables placed underground. The second year after it was installed we found a 15-pair branch cable all eaten up by electrolysis. We then banded all lead cables, including power and telephone cables, with No. 4 copper wire and grounded this on the water mains. Since then no trouble has been noticed. Was this the correct remedy?

ANSWER.

This plan doubtless protects the cables if the grounding to the water pipes was done near the power house. In a railway system, however, this would transfer the trouble to the water mains unless they are properly connected to the negative bus in the station. The practice is to connect all underground pipes and cable sheaths to the negative side of the system at and near the power house, so that any return currents that may have strayed from the rails to the underground network may pass from the latter through good conductors back

[illegible] shown that the corrosive action takes place only where the current leaves the metallic conductor and enters an electrolytic path, such as through the fluids of the soil.

The Responsibility of Electrical Companies for Accidents.[1]

[illegible] H. Montgomery

Notwithstanding the well-recognized efforts which [illegible] person and companies engaged in the supplying of electricity, accidents will and do occur, causing great loss of life and property. The highly dangerous character of the article supplied, its invisibility and the difficulty and in many cases the impossibility of determining in advance the existence of conditions creating a source of danger, the fact that the appliances used in the distribution are scattered over so wide an area and situated frequently in the premises and under the physical control of third persons over whose acts the company can exercise no supervision, places electricity in a class almost by itself as regards the difficulty of the task imposed upon those engaged in its production and distribution. With these inevitable conditions, the failure of appliances to perform the functions which they are relied upon to fulfill, the carelessness of employes, and more frequently the reckless imprudence and gross negligence of the public, afford very easy channels for the arrival of accidents against which human foresight cannot adequately provide. This being so, it is felt that a paper dealing with the legal responsibility of electrical companies for such accidents must be of interest to the members of this association, particularly in view of the widely divergent opinions which have been expressed by the various courts in the comparatively few years during which the distribution of electricity for purposes of lighting and power has been in vogue. The present paper lays no great claim to originality other than an attempt to reconcile these decisions, where reconciliation is possible, and to extract from them certain principles which should at this stage be capable of more or less exact definition.

Inasmuch as the distribution of electrical current is almost entirely in the hands of incorporated bodies, a few preliminary remarks as to the legal position of companies authorized by their charters to produce and distribute electricity may be in order. In the first place, it is now a well-recognized principle that when Parliament authorizes a person or company to do a particular thing, the mere exercise of the right conferred cannot, in itself, render the company responsible for the damage which the exercise of the right may cause to others unless there has been some failure on the part of the person or company upon whom the power has been conferred to perform some of the duties expressed or implied attached to the exercise of the power granted. In other words, notwithstanding the extremities to which courts of justice have in some cases gone in defining the position of those engaged in supplying electricity, they are not insurers against accidents, but, at the most, are only bound to adopt every approved means of precaution and to exercise a degree of care commensurate with the danger. Thus in a case recently decided by the Supreme Court of Canada in re Gloster v. Toronto Electric Light Company, 38 S. C. R., page 27, it is remarked:

"The defendant company transmitting such a dangerous element as electricity through their wires thus strung along the public highway fall short of being insurers, but are bound to exercise the greatest possible care and to use every possible precaution for the protection of the public."

Idington, in the same case, lays down the rule as [illegible]

"The statute enabling the company to use the public highway enables them to maintain works so constructed and must, I think, be taken by implication to mean a maintenance in a proper manner so as not to become a public nuisance."

A large number of earlier decisions went to the extent of enunciating the principle that a company introducing a new element of danger for their own [illegible] of a person keeping a ferocious wild beast upon his own premises, which, if it escaped and caused damage, would render the owner responsible, whether it escaped through his negligence or not. This doctrine, however, is not in accordance with more recent thought upon the subject, since it would have the effect of [illegible]

[illegible]

[illegible]

or over the streets and public highways, all such pipes, lines, conduits and other constructions as might be necessary for the purposes of its business. A contractor had erected a derrick in dangerous proximity to one of the transmission lines of the company, erected overhead, and carrying a pressure of between 4,000 and 5,000 volts. The company had warned the contractor of the danger and had seen that the arm of the derrick was anchored in such a way as to prevent its coming into contact with the wire. Upon the occasion of the accident the contractor's foreman, in order to facilitate the moving of a stone, had taken the chain off the arm of the derrick, the result being that the current ran down the wire cable of the derrick and through the man who was operating the winch. The foreman and the plaintiff's husband (who was a passer-by) rushed to the assistance of the workman at the winch, and both were killed instantly, while, strange to say, the workman who received the first shock received injuries so slight that he was able to give evidence at the inquest. The learned judge presiding at the trial instructed the jury that the company, being authorized by its charter to erect its lines in either of two ways, that is to say, either overhead or underground, was bound to adopt whichever method afforded the greatest protection to the public, and that if it failed to do so, it would be responsible for the consequences. The jury accordingly exonerated the contractor and condemned the company, the principal ground being that it was guilty of negligence in not placing the wires underground instead of overhead. This judgment was confirmed by the Court of Review for the same reasons. It was, however, unanimously reversed by the Court of Appeals, which held that where a company was authorized to adopt either one of two methods, that it had the absolute right to adopt whichever of the two it saw fit. The case was then carried to the Privy Council, with the result that the judgment of the Court of Appeals was affirmed for the same reasons, and the plaintiff's action against the company dismissed.

As has been stated above, while the company distributing electricity is not an insurer against accident, it is held to a certain degree of care. As to what that degree of care is various expressions have been made use of. Thus, in the case of Gloster v. Toronto Electric Light Company, above cited, it was stated that the company was bound to exercise "the greatest possible care and to use every possible precaution for the protection of the public." Other expressions have been made use of by American courts, such as "highest degree of care," "highest degree of care commensurate with danger," "high degree of care," "very great care," "reasonable care," "all care that a reasonable person can take," "ordinary care and skill," "at least ordinary diligence," "only ordinary, depending upon circumstances," etc., thus affording a text for almost any proposition which the hard-pressed lawyer might require to suit his particular exigency.

Between these wide extremes of opinion the most generally accepted, and, it is submitted, the most logical, is that the care required can only be defined as a degree of care commensurate with danger. In the application of this principle the subject divides itself, on the one hand, into the degree of care required in construction and appliances made use of as distinguished from the degree of care required in maintenance and operation, and, on the other hand, into the degree of care required by a company as toward its employes and as toward its customers as distinguishing from that required as toward outsiders generally.

As to the protective devices to be made use of, it was held by the Supreme Court of Canada, in the case of the Citizens' Light and Power Company v. Lepitre, 29 S. C. R., page 1, "that persons dealing with dangerous material are obliged to take the utmost care to prevent injuries being caused through their use by adopting all known devices to that end, and where there is evidence that there was a precaution which might have been taken by a company making use of electrical currents to prevent live wires causing accidents and that this precaution was not adopted, the company must be held responsible for damages." This ruling, however, was criticized by Mr. Justice Nesbitt in a later decision of the Supreme Court in the case of the Montreal Park and Island Railway Company v. McDougall, 36 S. C. R., page 1, where he says:

"I [illegible] the fact that the headnote of the case of the Citizens' Light and Power Company v. Lepitre is based merely upon an oral opinion of the chief justice in that case. That expression was not necessary to the decision of the case, which simply proceeded upon the fact that the company had failed to provide ordinary appliances in such a dangerous work. I certainly would not concur, as at present advised, in the expression of opinion by the chief justice. I think the doctrine there laid down is only applicable as [illegible] a dangerous employment and third parties.

"I do no myself see any difference between an [illegible] em[illegible] the extreme hazard of the work, precautions proportionately commensurate with the danger would have to be taken by the employer under the ordinary rule of law requiring reasonable care. The duty is the same in each case; the evidence of the performance of the duty must necessarily vary according to the circumstances."

The ruling is, moreover, inconsistent with a decision of the highest court in England, in the case of the National Telephone Company v. Baker, where it is held that a company is not bound to immediately adopt every protective device which comes upon the market. It is only held to a reasonable diligence in adopting such as have been thoroughly tried and approved. It is, moreover, difficult to see what distinction is to be drawn between electrical companies and railway companies as regards the adoption of safety appliances. In the case of railways it has been frequently decided that the mere failure to adopt such well-known devices as automatic couplers would not, in itself, constitute such negligence as to render the company responsible for accidents, but would simply impose upon the company a greater degree of vigilance in protecting its employes.

The duty of a company as regards insulation has been defined and illustrated by the editor of Electrical Cases as follows:

"Bearing in mind that reasonable care under the circumstances is the fundamental requirement, it not only follows that a very high degree of care should be required to keep electric wires properly insulated in places where persons may be reasonably expected to be; but follows none the less logically that a much less degree of care is requisite in places where persons are not reasonably expected to go. Thus electric companies have been held not liable for injuries occasioned to a person walking upon the girder of a bridge many feet above the roadway (Freeman v. Brooklyn Heights R. Co.); on the top of a wooden awning 16 feet above the street (Brush Elec. L. & P. Co. v. Lefevre); upon structures so high that no person could reasonably be expected to be injured by them, however extraordinary his duties (Calumet Elec. St. Ry. Co. v. Grosse); upon a jet in front of a house (Keefe v. Narragansett Elec. Lt. Co.)."

It was held in the Dunphy case, above referred to, that the failure to attempt insulation where the weight of evidence was that insulation would be impracticable, would not, in itself, constitute negligence.

As regards maintenance and inspection, although a certain divergence of opinion is found in the jurisprudence, the weight of authority is that a company is not bound to constantly patrol its lines, but, on the other hand, the failure to exercise reasonable diligence in repairing breaks and other sources of danger would, of course, be negligence and would render it liable.

In the case of the Guardian Assurance Company v. the Quebec Light and Power Company, one of the judges in the lower courts expressed the opinion that it was the duty of a company regularly to test its transformers from time to time, but as this decision was reversed by the Supreme Court on other grounds, the obiter dictum of the learned judge cannot be said to have the weight of authority.

Regarding the duty of an electric company toward its employes, the law of Quebec differs very considerably from that of the other provinces, being much more severe upon the employer. In the first place, contributory negligence on the part of the employe in the province of Quebec would not, in itself, defeat the action, but would only go to reduce the damages. The jurisprudence in the province of Quebec is, moreover, that employers are bound to protect their employes, not only against their own imprudence, but even against their own disobedience, and that it is not sufficient to issue instructions, but employers are bound to see that these instructions are obeyed. Inasmuch as no workmen's compensation act is in force in the province of Quebec, the consequences are somewhat severe upon employers.

As to the other provinces of Canada, the rule laid down by Joyce would probably apply:

"Electrical companies do not insure the safety of the employes, but the latter are subject to the general rule that one who chooses to enter into an employment, involving danger of personal injury, which the master himself might have avoided, assumes all risks incident to the employment, and which are known to him or are either plain and obvious, and which he has no reason to expect will be counteracted or removed, and that the employe cannot recover for injuries resulting from such dangers. So the company is not compelled to furnish employes with printed rules for their government, guidance and safety, when the nature of an employment makes it dangerous, and the danger incident thereto and growing out of it are of common knowledge and are fully known to and understood by the servant, and the safety of others cannot be imperiled by any act or omission of his in the performance of his duties, and his safety depends wholly upon the degree of care, skill and caution used by himself. And if an employe voluntarily chooses the most hazardous of two or more methods of performing his work it is held that

he does so at his own [illegible] But [illegible] person is employed in the presence of [illegible] ger, it is held that [illegible] ligence it [illegible] tarily and unnecessarily exposes [illegible] unless it is of that character that he must assume the risk from the very [illegible] which he is exposed."

As toward its customers [illegible] ion again exists. Thus, in [illegible] Electric Company v. Hevé, where the customer was killed, owing to high-voltage current getting into his premises through some unknown cause, the late Mr. Justice Hall expressed [illegible]

"But, in my opinion, [illegible] legally speaking, where this current originated. The appellants should be held responsible for it under any circumstances. They deal in a commodity of a recognized dangerous character, the control of which is a matter of technical knowledge and experience, and entirely uncomprehended by the general public. When a company like the appellants, organized under the name of an electric company, hold themselves out to the public as dealers in and suppliers of that commodity, for gain, and make contracts with private individuals for furnishing light or power over a system constructed and controlled by themselves, they are bound to deliver it in a form and under conditions of safety for the person and property for whose use the company charge and receive compensation, and they are also bound, in the discharge of their part of the contract, to a supervision and diligence proportionate to the peculiar character and danger of the commodity in which they deal."

The Supreme Court, however, in confirming this judgment, expressed divergent opinions upon Mr. Justice Hall's remarks. Mr. Justice Taschereau cited them with approval, but Mr. Justice Davies, on the other hand, expressed a different opinion.

"I fully agree with the law as stated by Mr. Justice Hall that the defendants, while dealing in and disposing of a commodity of so recognized a dangerous character as electricity, are bound to a supervision and a diligence proportionate to the peculiar character and danger of the commodity in which they deal.

"I cannot concur with him in thinking that they can be held responsible for the effects of the electric current 'under any circumstances.' This would be placing their liability too high and be constituting them insurers. They are bound to carry on their business with all possible skill, care and foresight, and are bound, in doing so, to anticipate and take into consideration such conditions of weather as may be reasonably expected in our climate. The law in requiring from them the highest care and skill and the exercise of constant vigilance in their business and operations does nothing more than, having regard to the extremely dangerous character of the article or substance they supply, is necessarily for the proper protection of those with whom they deal. But, on the other hand, before they can be held liable, there must be shown to have been the absence of some one of these necessary precautions, or of the required skill and vigilance; in other words, some negligence to which the accident can be reasonably attributed must be found."

These latter remarks would equally apply to the duty of companies as toward the general public.

As to the duty of electrical companies toward the public, the matter cannot be summed up better than is done by Joyce, paragraph 438:

"As a general rule, electrical companies, aside from their obligations to employes and other companies, while not insurers of the absolute safety of the public against all dangers arising from the lawful erection and maintenance of their lines in the streets, are bound to exercise such reasonable care in the maintenance of such lines as a prudent, careful person would take of property of a similar character, in constant use and continually exposed to the effect of the atmosphere and of the weather."

The last question which I propose to touch upon briefly is as to the burden of proof, a question which is very fully discussed in the recent case of the Guardian Assurance Company v. the Quebec Light and Power Company, 37 S. C. R., 636, where the actual cause of the fire, although admitted to be electrical, was not susceptible of actual determination. It was held by the Court of Review in Quebec, reversing the decision of the trial judge, that upon its being shown that the fire was electrical, that the burden of proof fell upon the company to show that it was not caused through its fault. Fortunately for electrical companies generally, this decision was reversed by the Supreme Court, where it was held that the ordinary rules of evidence apply and that it was for the plaintiff to prove his case, and, that in the absence of absolute proof or overwhelming presumption, the action must be dismissed.

Statistics collected by the Bureau of the Census in co-operation with the United States Forest Service from more than 2,100 saw-mill operators in Michigan, Wisconsin and Minnesota, show that the cut last year was only 5,500,000,000 feet of lumber, 12 per cent. less than the cut of the preceding year.

The Daniels Boulevard Lighting System.

[illegible] could have attained such large proportions. But [illegible] third, while incandescent lighting is now under [illegible]

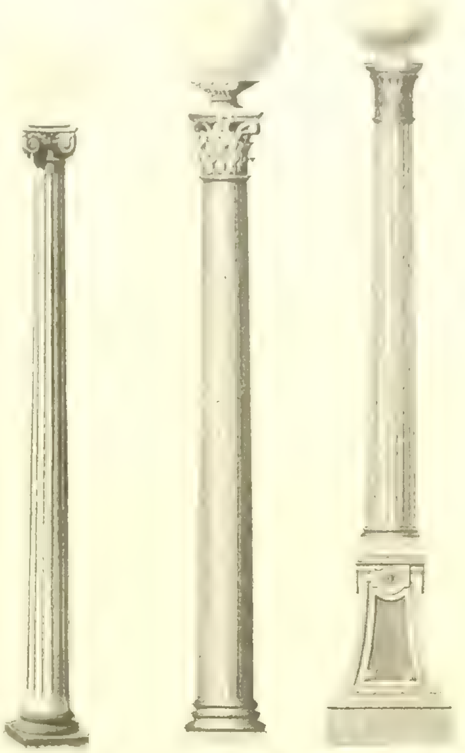


FIG. 1. THREE TYPES OF ARC LAMP POSTS [illegible] IN DANIELS BOULEVARD SYSTEM.

FIG. 2. LAMP MECHANISM AND [illegible] OF DANIELS SYSTEM.

specialties, each one both electrically and mechanically superior to its predecessor, we note that most manufacturers in their eagerness to produce an article possessing higher efficiency and greater mechanical strength, have overlooked the development of apparatus embodying artistic, as well as utilitarian qualities. In other words, the production of light has been viewed from the standpoint of an art (a means to accomplish an end), and everyone was contented to enjoy the many advantages accruing therefrom without making a scientific study of the art and without appreciating the inherent possibilities of making indoor and outdoor lighting a part of a general decorative scheme.

A radical change has taken place within the last five years, and today illuminating engineers are exerting every effort to plan installations in which the esthetic as well as practical taste is gratified.

The question confronting the electrical engineer has been how to produce illumination, that is, what particular device should be employed to produce the proper diffusion and, at the same time, harmonize with surroundings. This scientific study of electric lighting has been productive of excellent results, and we find many of the antiquated and barbaric productions in lighting fixtures disappearing, to be replaced by ornamental and classic designs. But while interior lighting has been greatly benefited by this course of investigation, design and study, the development of ornamental outdoor lighting fixtures has been overlooked.

The need of artistic outdoor lighting was early appreciated by Mr. W. E. Daniels of the South Park Commission, Chicago, Ill., whose position gives him an excellent opportunity to study all phases of outdoor illumination, the result being the invention and patenting of the Daniels system of boulevard lighting. The manufacture and exploitation of this system has been undertaken by the Jandus Electric Company of Cleveland.

As indicated in Fig. 1, the complete fixture consists of a rectangular base, molded reinforced concrete post of Ionic or other design, covered by the regulation concrete capital, and the whole surmounted by a 20-inch opal-glass ball globe, containing within which is a complete arc-lamp mechanism. The system has been designed to operate on either multiple direct-current or series alternating-current circuits, and is therefore adapted for use either in city business quarters, where direct current is usually furnished, or in residence and outlying districts, where alternating current is used.

[illegible] sures perfect diffusion of light and eliminates the glare and travel of the arc, and produces a quality of light heretofore unequaled. The question of handling the large globe while trimming the lamp has received careful consideration, and several satisfactory methods are being employed in different installations. Local conditions vary so widely that a method entirely applicable to one system will, in all probability, not be suitable for another.

Electrical Engineering at "Tech."

The faculty of the Massachusetts Institute of Technology has just conferred the degree of master of science on three graduate students in the electrical engineering course, Mr. R. B. Anthony, who graduated from the University of Wisconsin, Mr. E. L. Moreland, who graduated from Johns Hopkins University, and Mr. F. W. Willey, who graduated from Purdue University. Thirty-eight students have been granted the degree of bachelor of science in the electrical engineering course.

Graduate fellowships for electrical engineering study during the next year have been granted to Mr. Walter S. Rodman, now instructor in electrical engineering at the Rhode Island Agricultural College, and Mr. H. S. Osborne, who graduates from the electrical engineering course of the Institute this year. Mr. Osborne has been elected Saltonstall fellow in recognition of his unusual attainments as an undergraduate student.

Professor Laws and Professor Shaad of the electrical engineering department each spent several days during the spring intermission studying the methods of instruction in electrical engineering and related subjects at Cornell University.

Mr. W. V. Lyon, instructor in electrical engineering, is completing the manuscript for a book on "Electrical Engineering Problems."

In connection with the lectures on electric light and transmission of power during the last term Mr. A. S. Michener, comptroller of the Stone & Webster organizations, lectured to the senior students in electrical engineering on the theory of accounting and the relations of the engineering, operating and executive departments to the accounting department. Mr. R. A. Phillip of Stone & Webster lectured on modern switching practice with high-tension circuits. Last term Mr. Walter Goodenough of Stone & Webster lectured on boiler-room practice, in connection with the same course.

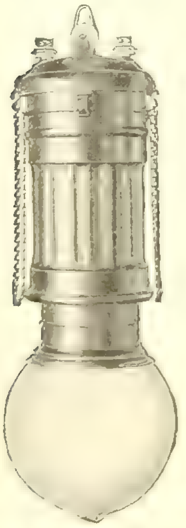
Electrical Engineer and Mechanical Draftsman.

The United States Civil Service Commission an- [illegible] June 2 [illegible] 24 1908 [illegible] to fill one or more vacancies in the position of electrical engineer and mechanical draftsman, at an entrance salary of from $100 to $200 a month, and upward, in the Reclamation Service, and vacancies requiring similar qualifications as they may occur. Eligibles from this examination may be appointed as electrical engineers or assistants for the design, installation, or operation of hydro-electric and steam-power plants in the West, or as mechanical draftsmen for office work and drafting in connection with preparation of plans. The examination will be on mathematics (through calculus), 10 points; hydraulics, 10; electrical engineering, 15; turbines and engines, 10; drawing and design, 20; training and experience, 35; total 100 points. Optional subjects of examination are pumps, water- [illegible]

Applicants must indicate in their applications that [illegible] in connection with electrical engineering work in one capacity or another. Graduation in electrical engineering from a reputable technical university will be accepted as two years of this experience. Applicants who have not had sufficient training and experience to entitle them to a rating of at least 70 per cent. in that subject will not be admitted to the examination. Applicants should bring for use in the examination drawing board not less than 18 inches square, slide rule, T-squares, triangles, and other necessary drawing instruments. Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any of several cities in the different states, for application Form 1312. No application will be accepted unless properly executed and filed with the commission at Washington prior to the hour of closing business on July 11, 1908. In applying for this examination the exact title as given at the head of this announcement should be used in the application.

A New Flame Arc Lamp.

The accompanying cut shows the new flame arc lamp of the General Electric Company. The external appearance of this lamp is similar to the G.E. enclosed lamp, the casing being drawn seamless from either sheet copper or steel. The standard finish for the copper casing is antique and bright japan for the steel. This lamp has no chain feed or complicated escapement and clock mechanism. It is of the inclined carbon type, with nothing below the arc to obstruct the light, and both carbons feed by gravity simultaneously, while the regulation of the arc is accomplished by the lateral move-



[illegible]

[illegible]

[illegible] surrounds the points of the carbon, just above the [illegible]

The economizer, therefore, is well protected from [illegible] appreciable amount of the products of the arc [illegible]

During operation the lower surface of the bottom plate of the lamp and of the economizer becomes coated with white deposit from the arc, which acts as an excellent reflector for the upward light from the arc.

These lamps are designed to burn two-in-series or singly across 100 to 125-volt direct or alternating-current circuits. They can be used on any frequency between 40 and 140 cycles. The lamps may be wound for either 8, 10 or 12 amperes, the latter current being considered standard. All lamps are equipped with light opal globes. The life of the carbons is about 12 hours on indoor circuits and between 10 and 11 hours on outdoor circuits.

Rockford's Electrical Interests Are Progressive.

At a recent convention stereopticon views of street-lighting displays from 15 cities were shown, and only two surpassed Rockford. The sign lighting is better than that of any other city in the country of 100,000 population or less.

Much can be said of the superior mechanical equipment of the local electrical institutions. Rockford has two first-class telephone systems, a fine electric-railway system and a strictly modern and up-to-date electric-light and power system. But the secret of the development lies deeper than that. Men are responsible for it. The contractors, the sign builders, fixture men, telephone and power experts, the consumers, manufacturers and sellers of the current, all had a finger in it. Brains, energy and countless hours of hard, earnest work have brought this result.

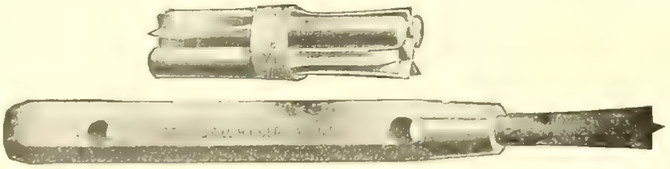
Rockford has more electric automobiles than any other city in the country outside of the larger cities, like Chicago, New York and Boston. The American Gas and Electric Company considers that Rockford has the brightest future, electrically speaking, of any of the 10 cities in which the parent company operates. We need more men, live men, like the electrical men of Rockford.—Rockford Register-Gazette.

Chicago Telephone Company Requires Deposit.

Each year the Chicago Telephone Company is put to a large loss by persons who contract for a telephone and after paying one or two months' rent move out or leave the contract unfulfilled. In this way, especially in the outlying districts, the company goes to the expense of installing the telephone, and taking it out again, with practically no return for the work and service. To stop this loss the company announces that hereafter it will require a deposit of $9.50 with each contract for a new telephone. The money will be retained for a year, and at the end of that time, if the subscriber has paid his bills, it will be returned with 50 cents interest. In case the subscriber violates his contract, orders the telephone out before the year expires, or fails to pay his bills, the money will be forfeited to the company to pay for the cost of installation and removal.

Holder for Drills and Bits.

The Star Expansion Bolt Company of Bayonne, N. J., has brought out recently a device in the form of an improved holder for electrician's special drills. As shown in the illustration, the holder, while comparatively light, is solid and substantial, enabling a firm hold to be taken and a heavy blow struck, with no danger of breaking even the smallest drill point. Any diameter bit may be had (1/4, 5/16, 3/8, 7/16, 1/2 inch), and one size fits in the



[illegible] DRILL AND BIT HOLDER.

holder [illegible] another. Beyond a large [illegible] Star drill holder possesses another advantage which will appeal to the man who is in the habit of carrying around a big, cumbersome kit, with different diameters of drills, all in full 12-inch lengths. The entire set of Star special drills and the holder itself can be slipped into the pocket, their weight and bulk being scarcely perceptible.

Electric Illumination of a Large Clock.

What is perhaps the largest clock in the world was recently installed on the factory of Colgate & Co. in Jersey City. The clock is electrically illuminated at night with about 1,200 four-candle-power lamps. The dial has a diameter of 38 feet by day and 40 feet at night, because the lights [illegible] daytime dial. The hour hand is 15 feet long and 3 feet 10 inches at its greatest width; the minute hand is 20 feet long and weighs 640 pounds with its counterpoise.

Each minute mark is shown by a four-candle-power lamp at night and each hour mark requires an average of 24 lamps. The minute hand is outlined with 40 lamps and the hour hand with 34.

A New Nernst Lamp Holder.

The Nernst Lamp Company is putting on the market a new type of holder for use in connection with multiple glower lamps. It is to be known as the "Wafer" holder, and is characterized by extreme simplicity of design. The part from which it gets its name takes the place of the heater tubes used with the older holder and does away with the use of the heater porcelain entirely. The wafer consists of a long thread of heater material wound back and forth over the surface of a porcelain base

NEW HOLDER FOR NERNST SINGLE-GLOWER LAMP.

and firmly attached to it by means of wires. The wafer is secured in position by two wire prongs, which at the same time serve as terminals, to which it connects automatically. The holder porcelain is provided with a groove to admit the wafer. The wafer can be changed in a moment's time. It requires no instrument for its removal, and the operation can in no way injure or interfere with the glowers or connections.

Since the testing and replacement of heater tubes has always been one of the chief items in the maintenance of Nernst lamps, the labor required to maintain them will, by the use of the new holder, be much reduced. Likewise, the cost of maintenance will be reduced, since the heater porcelain will not have to be considered, and there is no possibility of glower breakage through handling of heaters.

The successful development of this heater permits of a non-renewable holder for single-glower units, employing horizontal glowers. The use of such a renewal in the single-glower units simplifies the maintenance, as no mounting of heaters and glowers is required—in fact, the trimming of the single-glower lamp is similar to that of incandescent-lamp systems, except that the renewal is "pushed" into place instead of being screwed into place.

The Lightning-rod Question.

While there is some question of the efficiency of protection afforded by lightning rods, the preponderance of opinion is that where installed in sufficient number and in the proper manner they are of use. In many instances, however, they are not so installed. State Fire Marshal Creamer of Ohio, who is something of a student of electricity, in commenting on the best material for lightning rods, makes some interesting observations:

"The choice should be between copper and steel. The smokestacks of the United States government power plants are all rodded with copper, which better resists the acid in smoke. Copper is superior to steel for carrying electricity, but the thunderbolt is an oscillating current, moving to and fro perhaps a million times in a second, like a bent spring when it is released. Steel, having but one-seventh the conductivity of copper, damps out the oscillations better, and it is not so likely to melt, for copper is consumed at a heat of 1,994° F., while steel will stand 2,786°. In a copper rod the electricity will surge down and back and is more likely to 'splash off.' The fusing of a rod is a rare accident. A rod will carry to earth a thunderbolt that melts it. Steel rods are star-shaped and copper ones are made in strands in order that they may have a large surface; then, too, it makes them look as if the farmer had more metal for his money. For the ordinary farm building the galvanized steel star-shaped rod is ample. Where more expense is justified by the value of the building or contents, the same rod, copper-covered, is desirable. Three-fourths of the rods now up are of star variety, and they have stood the test of time. Experience has shown that the woven copper [illegible] are also effective."

BOOK TABLE.

[illegible]

At the beginning of the book [illegible] the theory of light and the color values of some of the different types of [illegible] various units and give the values and discuss the merits of the different standards of illuminating power. [illegible] ber of lamps and of the construction and operation of the lamps themselves. Among the lamps discussed are the carbon-filament, Nernst, tantalum, tungsten, arc lamps, flaming [illegible] and the vapor lamps. A chapter is devoted to the theory, design and selection of reflectors. The subject of photometry completes the chapter on the theory of light.

The second section deals with the mechanical problems of transmission, such as the strength of cables, and their construction, the design and computations of transmission lines, insulators, splicing and fastening of cables, pole and tower construction, subway work and underground cables, high-potential lines and examples of long spans.

This section is followed by the electrical theory of transmission; the effect of inductance and capacity, the comparison of the different systems of distribution, lighting dynamos, parallel operation, compounding, asynchronous motors and generators, transformers, and the theory and operation of the lead accumulator balancer systems and automatic regulators.

Consideration of fuses, cut-outs, switches, circuit-breakers, lightning arresters, and protective relays and devices is followed by a discussion of the methods of measuring power and energy, the theory and installation of wattmeters, frequency meters, ground detectors, the location of switchboards and power houses.

The latter part of the book deals with the central station. The different types of prime movers and sources of power are discussed as well as the location of the machines, the boilers, condensers, switchboards, storage battery, sub-stations and distributing transformers. The book contains several drawings showing the plans of power stations, the arrangement of switchboards, and the practice of distributing power throughout a district. This book will be found a valuable reference for engineers versed in the German language.

FORTSCHRITTE DER ELEKTROTECHNIK (Part II. of the volume for 1907). Edited by Dr. Karl Strecker. Berlin: Julius Springer. Pp. (9½ by 6 inches), 340. Price, 10 marks.

The second quarterly installment of this well-known work comes fully up to the standard of the 21 preceding volumes. It contains 3,197 references to articles appearing in the electrical journals throughout the world, many of which are abstracted at length. This careful compilation of current electrical literature is the most extensive and valuable work of the kind and has found for itself an enviable place in all technical libraries.

Uniform Rules for Interurban Roads.

Representatives of the interurban electric railways of Michigan met with the state Railroad Commission in Lansing on June 4th and after discussing operating methods appointed a committee of the railway men to formulate uniform rules for the management and operation of all the roads. The committee is composed of Harry Bullen, general superintendent of the Detroit United Railway, chairman; Streathern Hendrie of the Grand Rapids and Holland line, Superintendent O'Mera of the Michigan United Railway and General Manager Morley of the Muskegon lines.

This committee is expected to report to the commission within the next two months, and after a further meeting with the commission the report will be submitted to all the roads for adoption.

One of the matters to receive serious consideration by the committee is that of written orders, where orders outside of those contained in the time tables are given. Chairman Glosgow of the commission stated that if it was finally agreed that the written order should be adopted it must be uniform, with a third copy of the order left in the telephone booth. This will be a change from any of the written-order systems used in the state at the present time.

The suburban-road auditors also met with the commission to discuss the proposed uniform system of accounting proposed by the Interstate Railway Commission.

CORRESPONDENCE.

Continental Europe.

[illegible] plants. Single-phase locomotives will no doubt be [illegible] the electric system.

[illegible] carrier of the dispatch. The latter first delivers [illegible] has been lately occupied with the problem of transmitting [illegible] solved the problem at the present stage, he has [illegible] points of a small image by means of two superposed biograph films which have horizontal and vertical [illegible] to travel all over the image in the space of one-tenth second, and this is constantly repeated. The selenium cell will therefore receive what is practically a continuous image. The receiver, which is yet to be designed, will throw the corresponding image on a screen. This can be done on the oscillating mirror principle, and the eye will perceive a continuous image, owing to the persistence on the retina.

Abbazia, the well-known resort on the Adriatic coast, is to be the center of a short electric railway line which will take in Mattuglia, Abbazia and Lorrana. The line will be narrow-gauge and will be eight miles long. A generating station erected for the purpose contains two gas engines of the Korting type connected to 125-kilowatt generators. There will be a buffer storage battery in parallel on the circuit, giving 300 ampere-hours. The trolley line will be operated at 750 volts, using motor cars and trailers. Some of the latter will be used as freight and baggage cars. Two motors of 35 horsepower are used on the motor cars.

A company has been recently formed at Barcelona for the purpose of manufacturing metallic-filament lamps of the wolfram type.

I have already had occasion to speak of the construction of the Lotchberg Tunnel, which gives a new connection with the Simplon route, and it will be remembered that the main tunnel is 8.2 miles in length. The railroad line starts from Frütingen and connects with the Simplon line near Brigue. The selection of the type of electric traction to be used has now come up, and it is proposed to adopt a 300-ton locomotive for passenger trains and a 600-ton type for freight trains. Current will be used on the south section from the Lonza plant and on the north of the tunnel it will be secured from the Kander and Hageneck plants. A. DE C.

Great Britain.

London, June 5.—The reorganization of Messrs. Bruce, Peebles & Co., the necessity for which somewhat startled the electrical industry a few months ago, has turned out to be a very drastic affair. Briefly, it means to the preference shareholders a loss of 70 per cent. of their present capital and to the ordinary shareholders a loss of 90 per cent. The scheme of reorganization is that a new company shall be formed to take over the business with a capital of £250,000, into which the present shareholders shall exchange preference shares on the basis of one old £5 share for three new £1 shares and ordinary shares on the basis of one old £5 share for one new £1 share, each share carrying a liability of 10 shillings, to be immediately called up.

A prospectus has been issued this week by the Marconi Wireless Telegraph Company in respect of an issue of 250,000 seven per cent. preference shares of $5 each, of which the directors and their friends have already bespoke 50,000. There is said to be some demand for these shares from Italy. It may be noted that Mr. Marconi has himself personally taken over the managing directorship, in succession to Mr. Cuthbert Hall. Since this change the company has come into complete agreement with the government on the question of the Berlin convention.

The question of street lighting in the city of [illegible] the city electrical engineer, which should do much to remove the undoubted prejudice which exists in [illegible] comparison with gas. This report strongly favors the system of centrally hung lamps, especially in [illegible] flame-arc-lamp lighting, assisted by metallic-filament lamps, the average illumination throughout the whole of the city streets could at least be doubled, and a saving of at least £6,000 per annum be effected. The tests which have been carried out by the City of London Corporation electrical engineer have, the report says, confirmed his view that, light for light, high-pressure incandescent gas costs four times as much as the flame arc light.

[illegible] revise its syllabus for examination in electrical wiremen's work, to which committee the Institution of Electrical Engineers was invited to nominate representatives. The City and Guilds of London Institute also expressed the opinion that considerable good would result in raising the trade status of the electrical wireman if the Institution could see its way to recognize the certificates of the City and Guilds of London Institute. It has therefore been decided that the Institution of Electrical Engineers will in future appoint qualified persons to attend the practical examinations on behalf of the Institution. These gentlemen, one of whom will be selected in each district, will report to the Council of the Institution upon the manner in which the candidates carry out the practical part of the examination.

The surprise of the week in connection with the investigation now being carried out by the House of Lords committee into the London electric power bills was the production by the opposition of the chairman of the company which promoted the Administrative County of London and District electric power bill, the measure which started the whole controversy, as to the want of cheap power in the metropolitan area. This gentleman made the statement that the promoters of the bill were advised by the engineers to the scheme that their plans of 1905 would not apply in the present circumstances in London, and, in fact, that the days of a bulk-supply scheme for London were gone. Improved methods of operation on the part of existing stations were given as the reason for this change of opinion. The case for the first bill has now been concluded, but the committee will hear all three bills before coming to a decision. The next proposition is by eight of the existing companies, which propose to do much the same thing as that intended by the first measure, viz., to cheapen the supply of electricity, but by a different method. Their suggestion is that they should be allowed to link up the more modern of the existing generating stations and to use the more antiquated ones as peak-load stations. G.

New York.

New York City, June 13.—The bill to place telephone and telegraph companies under the jurisdiction of the Public Service Commission was defeated in the Assembly Thursday, 55 to 36.

In furtherance of its dealings with the receivers of the Metropolitan Street and New York City railways the Public Service Commission has passed a resolution calling for an inventory and appraisement of all the property, tangible and intangible, of the surface-railway companies in Manhattan. The resolution was introduced by Chairman Willcox, and the inventory and appraisement will be conducted under his direction. This action is taken to determine whether a "mismanaged" corporation can escape its obligations.

The Hudson Companies, which is the holding company for the various completed and projected tunnels under the Hudson River, connecting New York and Hoboken and New York and Jersey City, has arranged an issue of $5,000,000 of one-year notes secured by the deposit of [illegible] of the company's 4½ per cent. bonds. As a result of the success with which the new note issue is meeting the company is practically assured of funds with which to carry through to completion all the work it now has in contemplation.

In defiance of the Public Service Commission, Adrian H. Joline and Douglas Robinson, Federal receivers for the New York City and the Metro-

[illegible] on Wednesday refused to [illegible] at two public hearings on [illegible] by the commission. Previously they had criticized the work of the com[illegible] along present lines it would result in breaking up the old Metro[illegible] and practically wiping out the transfer privileges.

Following are the bids opened on June 4th at [illegible] architect, Treasury Department, Washington, D. C., for the installation [illegible] and wiring system for vacuum-tube lighting in the basement of the courthouse and postoffice, New York: Lee & Bellmer [illegible], New York city, $1,619; Reis & O'Donovan, New York city, $2,439; C. F. Brown, New York city, $[illegible].

Bids will be received by C. B. J. Snyder, superintendent of school buildings, until June 22d, for alterations and additions to the electric equipment [illegible] schools 2, 22, 23, 78, 88, 92, 105, 131, 140, [illegible] and 174; also alterations and additions to the electric-bell and electric-light systems in schools 46, [illegible], 184 and [illegible] in Manhattan.

Architects for the Radio Telephone Company have filed plans for a wireless-telephone tower to be constructed on the roof of the Terminal Building. The tower will be of steel and extend 85 feet above the top of the Terminal Building, with poles extending above the tower itself for an additional 40 feet, bringing the tips of the poles 300 feet above the pavement. Lee De Forest planned the device, and it is hoped to transmit telephone messages to any point within a radius of 250 miles. W.

Michigan.

Detroit, June 13.—The Owosso and Corunna Electric Company will install some new equipment and put the plant in first-class condition.

The city of Escanaba will begin receiving current for the Escanaba Electric Pulp and Power Company on July 1st, as provided for in the ten-year contract entered into several months ago. It is quite likely that this will make possible a decrease in the rate to customers. The city has $37,500 in electric-light bonds outstanding, and the new rate will be made sufficiently high to provide a fund to retire these bonds as they become due.

The Public Lighting Commission of Detroit will receive bids for the installation of new generating units up to July 8th.

The Commonwealth Light and Power Company has made an offer to Grand Ledge to purchase the municipal light and water plant, to sell the city power to operate its pumps and light the streets, and to sell power to private consumers.

The proposition to bond the village of Tekonsha for $12,000 for the purpose of establishing an electric-light plant was defeated. It is expected that another election will be held soon. D.

Northwestern States.

Minneapolis, June 13.—The Sidney Light, Heat and Power Company of Sidney, Iowa, has been incorporated with capital of $15,000. John T. Hodges is president.

The water and light committee at Alexandria, Minn., reports that the plant is badly worn out and entirely inadequate to the needs of the town.

The Cannon Falls Electric Service Company of Cannon Falls, Minn., has been incorporated with a capital stock of $25,000. Incorporators include E. L. Twiss of Meadow Grove and L. F. Blinco of Cannon Falls.

An official test of the electrical pump installed by the General Electric Company for the light and water department of Duluth, Minn., at the Lakewood station has been made. Its efficiency is more than the manufacturers promised.

The City Council of Ely, Minn., will furnish 24-hour service. A 50-kilowatt generator and exciter will be installed by the Westinghouse company of Pittsburg.

It is said that a saving of $1,760 per annum [illegible] can be effected by selling the municipal electric-light plant in Town[illegible]

The electric-light plant at Edgeley, N. D., will [illegible]

The Ashland Lighting Company of Ashland, [illegible]

Indiana.

[illegible]

earnings to be $315,560.19. This report was considered very favorable, considering the industrial depression.

The Indiana Municipal League will hold its annual meeting in Laporte on June 23d to 25th. A number of prominent advocates of municipal ownership will address this meeting.

The Gem Electric Company of South Bend is a newly organized company, to do a general electrical contracting business.

The Farmersburg Telephone Company of Farmersburg has filed articles of incorporation, capitalized at $10,000. A. J. Akers, T. H. Kendall and others are directors.

The Home Telephone Company of Chandler has applied for a franchise to extend its line to and through Boone, at which place a modern system will be installed. The company expects soon to be in the market for equipment.

The Bell Telephone Company has stopped the work of putting its wires underground in Richmond, and it is said that an agreement has been reached between this company and the Richmond Home Telephone Company whereby the latter will monopolize all of the business within the city, and that the Bell company will merely retain a long-distance toll station in Richmond.

The annual meeting of the stockholders of the Citizens' Telephone Company of Columbus, Ind., was held on June 11th. The report of the treasurer showed that the past year has been a successful one; that business had increased gradually, and that the plant had been greatly improved. The following-named officers were elected: President, Chas. S. Norton; vice-president and manager, J. L. Hosea; secretary, E. V. Haynes.

Western Canada.

Winnipeg, Man., June 13.—A further delay of two weeks has been agreed to in connection with the sale of the power debentures by the City Council of Winnipeg. It is proposed to raise $600,000 by debentures in order that the work on the civic power plant at Lac du Bonnet may proceed. Cecil B. Smith, civic power expert, Winnipeg, may be addressed.

Trouble has arisen at Rosthern, Sask., between the Bell Telephone Company and its subscribers, due to a rule that rentals be paid half-yearly in advance.

Engineers have received instructions from E. W. Backus of Minneapolis, Minn., to at once start work on the waterpower dam at Fort Francis, Ont.

Reports of the city electrician state that electrolysis, due to leakage of current from the rails of the street-railway system, is doing considerable damage in this city to private water mains and city mains. The gas mains, owned by the street-railway system, are also damaged. The Winnipeg Electric Company is taking extra precautions by installing new and extra heavy bonding.

The City Council of Portage la Prairie, Man., has decided to engage an electrical expert to determine the best method for lighting the city by electricity. Mayor Brown may be addressed.

Cecil B. Smith, civic power expert for this city, has written the City Council asking that his contract be changed so that instead of devoting half his time to the city's work the firm of Smith, Kerry & Chace, of which he is the senior partner, shall have the contract. Mr. Chace would then make his headquarters at Winnipeg and devote his whole time to the city's interests. So far the City Council has not considered the proposition.

A by-law is being prepared which will be submitted to the ratepayers of Boissevain, Man., to enable the city to purchase the electric-light plant owned by the Mill Company or else construct a municipal system. Address J. T. Elliott, mayor, Boissevain, Man.

The Bella Colla (B. C.) Telephone, Light and Power Company has been incorporated with a capital of $25,000. R.

Pacific Slope.

San Francisco, June 10.—The Great Western Power Company of this city has just let a contract to the Globe Construction Company for the erection of a transformer station on a triangular block of land bounded by White and King streets and Fourth Avenue, in Oakland, Cal., which was quietly acquired last December. The intention is to have this plant completed and in operation in six months. The power company also purchased another parcel abutting the first and lying between Matthews Avenue and White Street. Recently it was announced that the company had purchased seven acres of land on Sessions Basin, at the foot of Fifth Ave[illegible] than $150,000. On this site it is intended to install a steam plant costing $500,000, where 25,000 horsepower will be developed with fuel oil. In locating the steam relay plant [illegible] the company had in mind the deep water off Fifth Avenue, enabling tank steamers to deliver oil. The sub-station, which will be built at White and King streets, is to be [illegible] design, and ma[illegible] installed for the transformation of [illegible] plant on the Feather [illegible] in length will connect the sub-station and the steam power house at the foot of Fifth Avenue.

The Great Western Power Company has already spent millions of dollars in California, and additional millions will be expended before the work is finished. The chief source of power is the Feather River, where a tunnel takes the waters to the big impulse wheels at Big Bend, 18 miles above Oroville. The construction force is now building a large diverting dam at the intake to its big tunnel. It will be 125 feet high and will turn the river through the tunnel, conveying the water to the great electric plant at the lower end. Electric cars are now running through the three miles of tunnel, conveying materials from the power plant to the dam site. The tunnel is 18 feet high. The transmission lines are now in course of construction, and about 40 miles has been finished. Stretches have been completed above Oroville, in Sacramento County, and in Contra Costa County. The transmission cables are carried on steel towers 30 feet in height, and it is expected that the first installation will have been completed by October 1st. At this time the delivery of 65,000 horsepower of electrical energy will begin. The transmission lines, when completed, will pass through Butte, Sutter, Sacramento, Yolo, Contra Costa and Alameda counties, crossing the San Joaquin River at Antioch, finally reaching Oakland. Later on an entrance to San Francisco will be effected, although the exact route to be followed in getting around the bay has not been announced.

The Northern Light and Power Company, the only bidder, was awarded a franchise to erect poles and string and maintain wires in the municipality of Redding, Cal., for the transmission of electric power and lights. The term of the franchise is 50 years.

Julian P. Jones and Frank M. Packard, who have a franchise for an electric railway between Ventura, Cal., and the Ojai and Matilija, have arrived here and are making arrangements for preliminary work on the line.

It is the intention of the Grand Ronde Electric Company to construct 33 miles of electric transmission line this summer from Union, Ore., to connect with the Rock Creek line in Baker County, at a cost of about $50,000. The line will connect with the lines of the Fremont Power Company, at the Red Boy mine, to the south of Sumpter, assuring patrons of the Grand Ronde company ample power the year round.

The Columbia Basin Water, Light and Power Company of Kennewick, Wash., has changed its name to the Kennewick Electric Company and increased its capital stock from $25,000 to $50,000. A.

PERSONAL

Messrs. John F. Gilchrist and E. J. Fowler of the Commonwealth Edison Company, Chicago, returned from their European journey last week.

President Charles L. Edgar of the Edison Electric Illuminating Company of Boston sailed for Europe this week and will tour in Germany, France and Italy in his automobile.

Mr. Francis M. Hartmann will take charge of the department of physics and electrical engineering at Cooper Union, New York city, succeeding the late Prof. William A. Anthony.

Mr. E. L. Lambert, who has been with the Citizens' Gas and Electric Company of Waterloo, Iowa, for two years, has been chosen manager of the St. Charles Lighting Company of St. Charles, Mo.

Mr. Bion J. Arnold was one of the delegation representing the Chicago Association of Commerce at the presentation of a silver tablet to the steamship Chicago of the Compagnie Generale Transatlantinque in New York, on June 11th.

Mr. W. J. A. London has recently accepted the position of chief engineer of the Terry Steam Turbine Company, Hartford, Conn., succeeding Mr. C. E. Terry, deceased. Mr. London's experience in the turbine industry has been extensive, dating from his early connection with the C. A. Parsons Company, Newcastle, England, and about 15 years later with the Brown-Boveri Company, Baden, Germany, and the British and American Westinghouse Companies. His work has taken him into the field not only of power-house turbines, turbo-generators and condensers, but also that of marine propulsion.

Following the recent tragic death of Robert C. P. Holmes, who was purchasing agent for the Commonwealth Edison Company of Chicago, the purchasing agent's department of that company has been reorganized. The office of purchasing agent is abolished, and the five branches of the office have become separate departments, the heads of which are directed to report to Mr. John F. Gilchrist, assistant to the president, who will have supervision of the departmental organization. These five departments are: Stores department, in charge of Mr. Charles Marden, general storekeeper; purchasing department, Mr. C. A. Harding, chief clerk of purchasing department; merchandise sales department, Mr. W. H. Fairclough, Jr., general merchandise [illegible]; [illegible] department, Mr. C. A.

Ind., and accept a temporary position [illegible] C. F. Clark, [illegible]

Marvin M. Stanton [illegible] city lighting commission, of [illegible] Mich., died in that city on June [illegible] was a prominent [illegible]

Mr. George [illegible] bought the interest of M. M. [illegible] Pleasant Hill Electric Light Company [illegible] sumed the management of the plant. Mr. Humphrey goes to Liberal, Kan., where he will manage the ice, light and power plant of that city.

ELECTRIC LIGHTING.

The city of Pender, Neb., will issue bonds for the construction of an electric-light plant.

Kewaunee, Wis., has voted bonds to the amount of $20,000 to establish an electric-light plant.

Arrangements whereby the city of [illegible]view, Okla., will have an electric-light system are being perfected. Bonds will be issued soon.

The Greenfield Electric Company, of Greenfield, Mo., has been incorporated by [illegible] and associates. The capital stock is $3,000.

The Board of Works of Logansport, Ind., is asking for $22,000 with which to make needed improvements on the electric-light plant.

The Memphis Ice and Electric Light Company of Memphis, Tex., has been incorporated with a capital stock of $25,000, and is now installing its plant.

Harry G. Fisher has been appointed receiver of the Home Light and Fuel Company of Wapakoneta, Ohio, which owns and operates a lighting plant at New Carlisle and other places.

The Consumers' Light, Heat and Power Company of East St. Louis has been incorporated, to do a general light, heat and power business. The incorporators are John L. Flanigan, W. H. Hauss and A. A. McBrien.

The municipal electric-light plant and the city water plant at Lisbon, Iowa, were demolished by a tornado a few days ago. The path of the storm was about 300 feet wide and a mile long. Many other buildings in the town were wrecked.

A 250-kilowatt Allis-Chalmers alternating-current three-phase generator has recently been ordered by the Northampton Electric Lighting Company of Northampton, Mass., to be used to furnish current for the recently extended street lighting area at Northampton.

It is planned to make Toledo, Ohio, one of the best lighted cities in the state. Summit Street is already brilliantly illuminated, and the business men on other streets have taken the matter up with the city officials with a view of extending the decorative lighting.

Receivers' certificates to the amount of $6,000 have been ordered for making extensions and improvements to the lighting plant of the Public Service Corporation of Hampton, Va. The appointment of F. L. Marshall as manager of the plant has been approved by the court.

Officials of the Commonwealth Power Company of Jackson, Mich., have offered to buy the municipal electric-light and water plant at Grand Ledge and in turn would supply current at a reasonable figure for operating the city's pumps and lighting the streets, the power company also to supply current for commercial light and power business. City officials of Grand Ledge have been in Jackson to discuss the proposition.

The village of Manton, Mich., has engaged a civil engineer to determine if the flow of Cedar Creek is sufficient for the development of a waterpower plant to drive the generators of the municipal lighting plant. Once there was a dam in the creek at Manton, which created a beautiful lake of 15 acres. The dam broke recently, draining the lake. If the creek will develop sufficient power a plant will be built and the lake will be restored.

The directors of the Mexican Light and Power Company have declared a dividend of one per cent. on the common stock. This is not a quarterly or half-yearly dividend. It is simply one per cent. declared to the shareholders out of earnings. The directors make no pledges in regard to future payments, although they feel confident that if more waterpower can be used the company will easily be in a position to go on a regular one per cent. quarterly basis.

It is reported that the men constituting the entire new-business department of the Union Gas and Electric Company of Cincinnati, including Manager C. E. White and over 30 illuminating engineers, solicitors and others, have been notified that after July 1st their services will be no longer required. The Cincinnati Post, from which this information is obtained, does not give the reason for this wholesale dismissal, but it is to be supposed that it is due to a desire to reduce expenses. The department was established at the suggestion [illegible]

[illegible] relieve the corporation from all financial responsibility and show a profit calculated at £65,000. The [illegible] Trade.

At the meeting of the Council of Bray, England, the electric-lighting scheme came up for discussion on the recommendation of a committee that a sum of £5,000 should be expended upon the existing works for the purpose of making the concern efficient and self-supporting. The chairman of the electric committee set forth the details of the improvements, which he believed were the only way out of the fact that the works involved a loss of £1,000 per annum.

A new 1,500-kilowatt Allis-Chalmers synchronous motor-generator set, with suitable switchboard and controlling apparatus, will soon be installed in the West Temple sub-station of the Utah Light and Railway Company of Salt Lake City. The new unit is to be supplied with 60-cycle, three-phase, 4,000-volt alternating current and will consist of a revolving-field synchronous motor direct coupled to a compound-wound, direct-current, railway-type generator, mounted on a common base.

ELECTRIC RAILWAYS.

The City Council of Cheyenne, Wyo., has granted to Thomas A. Cosgrove a 25-year franchise to operate electric street railways in the city and furnish electric light and power.

Confusion in the orders as to where two cars should pass is said to be the cause of the head-on collision on the Washington, Baltimore and Annapolis electric road recently in which eight persons were killed.

The Guthrie and Interurban Railway Company of Guthrie, Okla., with a capital stock of $100,000, has been chartered to build an electric railway from Guthrie to a point on the Cimarron River, five miles out, at an estimated cost of $20,000 a mile.

On June 7th the interurban service between Shawnee and Tecumseh, Okla., which had not been operating since the high waters, was restored. The bridge was in bad shape as well as the embankment, and it was necessary to drive 60 feet of piling. The interruption to service lasted two weeks.

Electric lights have replaced the oil-switch lights on the Lake Shore Electric Railway of Cleveland. Each switch target has a 250-volt incandescent lamp, two targets being placed in series. White lights for indicating clear track have been replaced by green lights, this being done to avoid an unintentional clear signal resulting from a possible breaking of a red lens.

The Northwestern Electric Railway Company, principal offices in Chicago, has been incorporated with a capital stock of $50,000. The road is to be constructed from Woodstock to Sycamore, Ill., through the counties of McHenry and Dekalb, in the state of Illinois. The incorporators and first board of directors include Clinton G. Lumley, E. C. Spinney, William L. Abbott, B. E. Livingston and Darius R. Leland.

Switch lights on the interurban lines of the Detroit United Railway are to be placed under the control of operators at the sub-stations. The plan includes a transformer in each sub-station with a 250-volt circuit in each direction for supplying the switch lights. Failure of any lights will be shown by instruments in the sub-station, and a system of flashing the lights will be used to direct the motorman to call the dispatcher for orders.

The Athens Electric Railway Company, Athens, Ga., will install a second 1,000-kilowatt steam turbo-generator unit which was recently ordered as an addition to the company's present equipment. This is a 1,000-kilowatt Allis-Chalmers machine, wound for 60-cycle, three-phase circuits, at a terminal pressure of 2,300 volts, and was selected by Mr. C. D. Flanigan, general manager of the company, after an inspection of various turbine installations in the South, notably the power house of the Memphis Consolidated Lighting and Power Company, Memphis, Tenn.

The Milwaukee Electric Railway and Light Company's franchises in Racine, Wis., granted in 1883 for a term of 25 years, have been extended until 1942, when all franchises of the company in Racine will expire. The company agrees to double-track streets about to be paved, saving the city $22,000, and will pay $4,708, the cost of certain material used in building Main Street bridge. The company agrees to furnish electricity for lighting and swinging Main and State Street bridges and also to give [illegible]

benefit of [illegible]

POWER TRANSMISSION.

[illegible] electric plant at Florence. The Real Estate Exchange is now asking the city to engage engineers to make the surveys and estimates necessary. At a meeting of the exchange it was decided to push [illegible] to determine whether the city should issue $6,000,000 or a smaller amount of bonds to build the waterpower electric plant.

The Central Colorado Power Company is again doing construction work on a large scale, following the adjustment of the affairs of the Knickerbocker Trust Company. It is expected to deliver current generated at Glenwood Springs into Denver by November 1st. It was announced in Colorado Springs that the transmission line from Leadville to Dillon had been completed and, through a subsidiary company in Leadville, the Central company is operating and distributing power for operations in Lake and Summit counties. Some 400 men are now at work installing a transmission line from Glenwood Springs to Leadville, and the operations will be conducted from Leadville to Dillon, thence to Denver over the Argentine Pass, taking in Georgetown, Idaho Springs and Golden before reaching the capital city.

TELEPHONE.

The Truro Telephone Company of Truro, Iowa, has been organized with a capital of $10,000.

The Chaney (Okla.) Mutual Telephone Company has been incorporated with a capital stock of $6,000.

The Barney Telephone Company of Barney, Okla., has been incorporated with a capital stock of $10,000.

The Brenham-Long Point Telephone Company of Brenham, Tex., has been incorporated by Andrew Kamerer and others.

In the month of May 15,730 changes in telephones were made by the Chicago Telephone Company, due to the annual May moving.

The Providence Telephone Company of Rhode Island will ask the stockholders to authorize an increase of the capital stock by $500,000, making it $3,000,000.

The Buffalo Center Telephone and Exchange Company of Buffalo Center, Iowa, has been organized to operate in connection with the Western Electric Telephone Company. J. G. Daum is president.

At a meeting of the United Commercial Travelers' Grand Council of Iowa, at Davenport, a resolution was adopted in favor of compulsory cooperation between competing telephone companies where two occupy the same field.

The Interstate Telephone and Telegraph Company, which makes connection with the Dixon (Ill.) Home Telephone Company, is now at work constructing a new line from Sterling to Dixon. In addition a metallic circuit is being constructed from Sterling to Harmon. The new line will give the Home Telephone Company three direct lines to Sterling and will greatly facilitate the telephone service between the two cities.

PUBLICATIONS.

The Hazard Manufacturing Company of Wilkes-Barre, Pa., issues blotters calling attention to its insulated wires and wire rope.

The Triumph Electric Company of Cincinnati is sending out some little flyers calling attention to its induction motors, multipolar generators and motors and engine-type generators. Descriptive bulletins will be sent on application.

Bulletin No. 4588, just issued by the General Electric Company, describes the GE-202 railway motor, which is similar in design and construction to the latest standard GE railway motors, containing all their improvements and, in addition, being provided with commutating poles. The details of construction are given at some length in the bulletin, and an interesting article on rating, with suggestions for the proper selection, is included. Dimension diagrams, characteristic curves and a

[illegible] in ordering, complete [illegible]

[illegible] University of Illinois [illegible] [illegible] "Tests [illegible] Reinforced Concrete Culvert Pipe" [illegible] Prof. Arthur N. Talbot.

[illegible] Company of Toledo, Ohio, is issuing [illegible] advance card, being one of the series which show experiences and incidents connected with the travels of the "Bissell Frog." These [illegible] will be [illegible] to anyone on request.

A supplement to the 1907 catalogue of the American Steel and Wire Company shows some new rail bonds and appliances. The circular is handsomely [illegible] and its contents will be of interest to those looking for the best bonds and time and money saving appliances.

New price sheets on Holophane globes and reflectors have just been issued by the sales department of the Holophane Company. There have been made a few advances in prices, but these are more than balanced by reductions due to cheapening of cost of production of certain globes and reflectors.

A circular of Union enclosed fuses and blocks is being distributed to the trade generally by the Chicago Fuse Wire and Manufacturing Company. It gives a full list of N. E. C. standard fuses and blocks, making it unnecessary in looking up these appliances to refer to the company's complete catalogue, No. 19, on fuse material. The company has also prepared a circular of especial interest to architects and engineers. It sets forth briefly the merits and advantages of its enclosed fuses and blocks, including sectional switch boxes and stamped conduit boxes and covers.

With its Bargain Sheet for June, 1908, which is one issue of a familiar and valued visitant in the electrical trade, the Gregory Electric Company of Chicago encloses a neat booklet entitled "What We Do and Where We Do It." The works at Sixteenth and Lincoln streets are illustrated, and the reader is given an idea of the large stock of second-hand electrical machinery carried by the company. There are also portraits of President A. L. Kuehmsted, Vice-president A. O. Kuehmstedt, Secretary G. C. Besold, Sales Engineer E. H. Nagelstock, General Superintendent J. D. Zook and Assistant Superintendent J. A. Vincent.

The Western Electric Company has recently issued a wall circular descriptive of the various types of Sunbeam lamps which it distributes. This publication undoubtedly will be found useful by dealers, contractors and central stations to hang up for reference, being more convenient to refer to than catalogues. It is very comprehensive, covering all the standard types of Sunbeam lamps on the market, such as battery, miniature, candelabra, round-bulb, tubular, reflector, stereopticon, train-lighting, street series, Gem, tantalum, tungsten, etc. A copy will be sent to anyone desiring it upon request to the Western Electric Company at Chicago, New York or any of its branch houses.

The Crocker-Wheeler Company has issued a number of new bulletins of interest to all power users. Bulletin No. 96 is devoted to alternating-current switchboard panels (single and two-phase) drawings and complete and valuable data being given. Bulletin No. 101 illustrates and describes form D machines, being belt-type direct-current motors and generators. Valuable information with drawings about alternating-current switchboard panels for voltages from 1,150 to 2,300 is given in bulletin No. 102. A description of the Crocker-Wheeler apparatus used in the Lockport plant of the Sanitary District of Chicago is given in Bulletin No. 103. In Bulletin No. 104 will be found interesting illustrations and reading about the Crocker-Wheeler direct-current railway generators.

The General Electric Company has issued a handsome pamphlet describing briefly its line of electric heating and cooking devices. The illustrations show flatirons of various types, water heaters, combination cereal cookers, teakettles, percolators, chafing dishes, stoves, frying pans, grids, ovens, etc. Cooking and baking outfits, consisting of com[illegible] domestic appliances, are also [illegible] cigar lighters, [illegible] heating pads, corn poppers, new designs of luminous radiators and tubular air radi[illegible] complete [illegible] capacities, voltages, prices, etc., which will be of great assist[illegible] [illegible]

SOCIETIES AND SCHOOLS.

[illegible] Engineering [illegible] Philadelphia [illegible]

[illegible]

[illegible] at the Atlantic City convention of the Institute. Meeting of the local organization will now be abandoned until the first Friday in September.

The Street Railway Association of the State of New York will hold its twenty-sixth annual convention at the Clifton Hotel, Niagara Falls, Ont., Canada, on June 30th and July 1st. The programme has a large number of interesting topics for discussion, and a number of unusually interesting papers will be read.

The Society of Wireless Telegraph Engineers, organized in 1907 by members of the technical staff of the Stone Telegraph and Telephone Company of Boston and others associated with the company, held its first annual meeting at the home of J. S. Stone, president of the society, in Boston on June 1st. The society aims to widen the range of usefulness of wireless telegraphy by intelligent discussion and study of practical subjects and apparatus in the art. It is understood that membership is to be extended soon to all qualified electrical engineers, regardless of affiliations. J. S. Stone was re-elected president and C. E. Russell of Somerville, Mass., was elected secretary.

AUTOMOBILES.

A run of 76 miles, from Philadelphia to Atlantic City, with a Studebaker electric runabout on one charge of the battery, is reported. The roads were bad and rain fell during the entire trip.

The Studebaker company says that the introduction of its mercury rectifier for charging automobile batteries has reduced the already low cost of operation considerably more than one-half, so that where the cost of charging and operating an electric two-passenger pleasure vehicle was formerly from $25 to $30 a month the cost may now be safely reckoned at from $8 to $10 a month, making the electrically propelled vehicle the most inexpensive form of local transportation known.

According to E. Q. Cordner of the Studebaker Chicago branch, the electric pleasure vehicle is now receiving more favorable attention than ever before. Mr. Cordner says that scores of men who own gasoline cars never undertake to drive their cars through the congested downtown section. But in an "electric" it is child's play to go anywhere. The simplicity of control of the electric vehicle, its safety and graceful appearance, combined with a low initial and maintenance cost, proclaim it an ideal car for city use.

TELEGRAPH.

At the fourth regular convention of the Commercial Telegraphers' Union of America in Milwaukee last week it was stated that the recent strike of the telegraphers cost the union about $200,000, and that $69,936 of this amount was received in donations at national headquarters of the union from locals; $119,000 was received by local unions, only three-fourths of the unions reporting to the national office. The total receipts at the national headquarters aggregated $142,380. The convention was attended by 100 delegates representing about 50 cities.

A dispatch from Moline, Ill., says that the Western Union and Postal telegraph companies have increased the rate for 10 words from Moline to Chicago from 25 to 30 cents, and that from Moline to St. Louis from 30 to 35 cents. The charge of two cents a word for every word more than 10 remains as formerly. Rates from Moline to Chicago, St. Louis and four other cities are special rates, being lower than the state rates or those based on distance. Rates to the other four special cities remain unchanged, and the general scale of state rates is also unaltered.

Net revenue of the Western Union Telegraph Company for the quarter ended March 31, 1908, amounted to $1,330,886.11. A dividend of 1¼ per cent. (in stock) and interest on the bonded debt amounted to $1,663,162.50, decreasing the surplus at the end of the quarter, according to the official report, to $13,744,804.49, compared with $14,077,080.88 on January 1, 1908. The net revenue for the quarter ending June 30th, partially estimated, will amount to $1,400,000. A dividend of one-half of one per cent. (in cash) is ordered for this quarter, deducting which and the interest on bonded debt, the surplus will stand at $14,214,191.90.

MISCELLANEOUS.

A recent erroneous report that the U. S. S. Colorado was aground at the entrance of the Straits of Fuca, near Seattle, Wash., was due to the mistaken reading of an intercepted wireless message.

Plans for forming a permanent organization of Kane County (Ill.) mayors will be advanced at a conference of the executives of Kane County cities and villages to be held soon. The purpose of the organization will be the consideration of public-policy questions important to all municipalities [illegible] to put up a combined [illegible]. The primary object of the first conference will be to consider telephone questions.

It is reported that the Canadian Northern Railroad has arranged with Thomas A. Edison for the installation of an electrical water purifier at Portage la Prairie, Man. It will be attached to the water tank at that city to prevent the incrustation of boiler tubes.

Several miles of track of the East Maryland Railroad have been equipped for conducting tests in sending telegraph and telephone messages from moving trains. The method is that of the American Signal Company, and it will be used for protecting trains from accident.

Someone has observed that windmills on farms are rapidly being superseded by gasoline engines and electric motors. Where electricity is available from central stations or electric railways, motors on farms are becoming quite common. In other places gasoline engines are utilized.

The coal production of Arkansas in 1907 was the largest in the history of the state, amounting to 2,670,438 short tons, having a spot value of $4,473,693, and exceeding that of 1903, which has heretofore held the record for output by 441,266 tons in amount and $1,112,862 in value. Compared with that of 1906 the production shows an increase of 806,170 tons, or 43.3 per cent. in quantity, and of $1,473,354, or 49.11 per cent. in value.

The Benito Juarez Mines Company, Salinas, San Luis Potosi, with mines at Penon Blanco, Mexico, will shortly have in operation a new 150-ton mill and cyanide plant, whose equipment of machinery was contracted for a month or so ago with Allis-Chalmers Company, Milwaukee. Both the mill and the several mines of the company at Penon Blanco will be operated by electricity. The electrical energy will be generated at a power plant located at Salinas. It is expected to use Ebano fuel oil. The power-plant equipment comprises two 260-horsepower Sterling boilers for operating two engines direct-connected to two 150-kilowatt Allis-Chalmers engine-type alternators. Electric motors will be used to drive the various machines in the plant either direct or belt connected. The current will be transmitted 12 miles to Penon Blanco. A great economy will be effected by this arrangement, as it avoids the necessity of hauling fuel up hill from Salinas to Penon Blanco and will obviate the necessity for separate power plants. T. J. Leavitt, formerly chief electrician of the Real division of the Real del Monte Company at Pachuca, has accepted a position with the Benito Juarez Company, in charge of the mechanical and electrical departments.

TRADE NEWS.

A recent order for electric wire for inside wiring in one building in Chicago now nearing completion amounted to $30,000.

The supervising architect, Washington, D. C., will receive sealed proposals until July 23d for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the postoffice at Alton, Ill. Also, until July 24th for the postoffice at Belleville, Ill. Plans and specifications obtainable from the custodian of site at the respective cities or from the Treasury Department.

A report has been received from an American consul in the Levant in which he advises that a local engineer is anxious to secure information regarding American machine plows. He is especially interested in electric or gasoline-driven plows, and the consul in question suggests that American manufacturers of such machinery would do well to communicate in French with the engineer, whose name he furnishes (File No. 2319, Bureau of Manufactures).

The offices and works of the Hadaway Electric Heating and Engineering Company, which was acquired by the Westinghouse Electric and Manufacturing Company some time since, have been removed from 238 West Broadway, New York, to the works of the Westinghouse company at East Pittsburg. This change will permit the business to be carried on upon a much larger scale than formerly, and all the standard appliances for hatters, confectioners, printers and other manufacturers will be turned out in larger quantities. Special attention will be given to the manufacture of flatirons, glue pots and similar appliances that have recently become so popular. A New York office will be maintained in the City Investing Building, 165 Broadway.

The Condit Electric Manufacturing Company and the S. B. Condit, Jr., Company have moved to 76 and 78 Batterymarch Street, Boston, where they will occupy all the building. The structure is a five-story and basement brick building, extending 80 by 140 feet on the ground, with electric elevators, and is furnished with a private steam plant for power and heat. The first floor will be used for shipping and the storage of stock. The second floor will be devoted to offices, with packing department in the rear. The third floor will contain the assembling and testing departments, while the machine shop will be on the fourth floor, and

the fifth floor will be devoted to the [illegible] of [illegible] material and stock. In the basement will be [illegible] iron pipe and fittings. The building [illegible] to the use of its new occupants and will give the largely increased facilities for their [illegible] ne[illegible]

The Sanitary District of Chicago [illegible] for sealed proposals for materials as follows: Division A, centrifugal pumps; Division B, [illegible] motors; Division C, high-pressure pumping unit; Division D, lead-covered cable. The bids will be opened on July 8th. All proposals must be [illegible] upon blank forms furnished by the Sanitary District and in accordance with the plans, specifications and contract form on file in the office of the electrical engineer, Room 1500, American Trust Building, Chicago. Plans, specifications and form of contract, bond and proposal may be obtained upon application there[illegible]

The lead which the United States has in supplying electrical machinery and appliances to Japan is almost certain to continue, says Consul-general H. B. Miller of Yokohama. The question of the development of the iron and steel production in Japan, therefore, is of special importance to that class of manufacturers in the United States. Of Japan's imports of iron and steel from the United States there was an increase of 18 per cent in 1906, as compared with 1900, but the increase of imports of machinery of various kinds, made wholly or largely of iron and steel, was from $850,415 in 1900 to $2,601,146 in 1906, while imports from all countries combined increased from $2,566,664 in 1900 to $7,084,470 in 1906. This is a most gratifying showing for expansion of trade in machinery made of iron and steel, and it is largely along this line that American trade with Japan is likely to continue to grow.

The Vanderman Plumbing and Heating Company of Willimantic, Conn., has discontinued the name under which the company was organized May 1, 1892, and is now known as the Vanderman Manufacturing Company. The officers, management and line of business continue the same, with the exception that the plumbing and heating lines of the business are discontinued. The plumbing and heating business was established in the year 1878 by William Vanderman, and a few years later he added the manufacture of plumbing and heating specialties, which line was gradually extended until the business warranted the organization of the Vanderman Plumbing and Heating Company. A gray-iron foundry plant was added to the business; and to give more attention to the manufacturing and foundry business the plumbing and heating lines have been discontinued. The tool chests, pipe bending forms and other specialties of the company are well known.

The Consolidated Supply Company has been incorporated and will make a specialty in handling general steam and electric railway, mill and mining supplies, with headquarters at 321 Dearborn Street, Chicago. The office and store occupy the ground floor in the Manhattan Building, storeroom extending through and fronting on No. 60 Plymouth Place. The incorporators are L. C. Hopkins, John P. Mahoney and J. L. Benedict. Mr. Hopkins has had some eight years experience in the railroad and supply business. For the last year he was connected with the sales department of the Chicago Pneumatic Tool Company, and previous to that was four years with Fairbanks, Morse & Co. Mr. Mahoney and Mr. Benedict formerly had wide experience in the railroad business. The latter, for the last five or six years, was connected with the Chicago Pneumatic Tool Company as manager of its Chicago office and on the road. The success of these men is assured by their wide experience and large acquaintance. They have many friends in the railroad, mine and mill business.

BUSINESS.

The R. D. Nuttall Company of Pittsburg announces the establishment of a new department to be devoted exclusively to the manufacture of gears and pinions for air compressors. This company has for some time been supplying gears and pinions for all the standard makes of air compressors.

The Des Moines Electric Construction Company of Des Moines, Iowa, has recently received the agency for the Western Electric Company's power and motor apparatus for the city of Des Moines and for Polk County. It will be pleased to enter into communication with all persons interested in electrical machinery.

The Buffalo Foundry and Machine Company, Buffalo, N. Y., which, besides making exceptionally large castings, builds vacuum drying and impregnating machinery, vacuum drum, shelf and rotary dryers, compressors, pumps, condensers and the Bell steam hammer, recently established a New York office at 143 Liberty Street, having engaged Mr. H. E. Jacoby as resident engineer and manager.

The city of Austin, Texas, has recently contracted for a 500-kilowatt Allis-Chalmers steam turbo-alternator to be installed in the municipal station. Texas lignite coal from Rockdale, 62 miles distant, is used for fuel. The Winona Interurban Railway Company, Winona Lake, Ind., operating 50 miles of [illegible]

The new unit will be utilized for generating power [illegible]

[illegible] kilowatts capacity of Forest Park, near Chicago, [illegible]

Chicago, and consists of two banks of transformers of 12,000/2,300 volts, connected to the three-phase transmission lines of the Sanitary District, and several secondary banks, transforming from 2,300 volts to 110, 220 or 440 volts, as desired, for operating lamps and motors.

The Allis-Chalmers [illegible] appear from the number of contracts for standard electrical motors and generators received by it during the recent [illegible] more power facilities in all parts of the country is making headway daily against panic-bred conservatism. With each month's sales from the first of the year showing considerable gains over the month preceding, the outlook is decidedly encouraging. Among the recent contracts for power machinery are those with the city of Lawrenceburg, Tenn.; the Washburn-Crosby Company, Minneapolis; the Natural Food Company of Buffalo; the Pratt Light and Ice Company, Pratt, Kan.; the New Jersey Consolidated Water and Light Company, Elberon, N. J.; the Standard Hosiery Company of Philadelphia; the Great Western Portland Cement Company, at Mildred, Kan.; the Dan River Cotton Mill, Danville, Va.; the Citizens' Electric Company of Williamsport, Pa.; the Bend D'Oreille Electric Company of Sand Point, Idaho, and the Philadelphia Electrical Construction Company of Philadelphia.

DATES AHEAD.

American Society of Mechanical Engineers (semi-annual meeting), Detroit, June 23d to 26th.

Society for the Promotion of Engineering Education (annual meeting), Detroit, June 23d to 26th.

American Institute of Electrical Engineers (annual convention), Hotel Traymore, Atlantic City, N. J., June 29th to July 2d.

National Electrical Contractors' Association (annual meeting), Chicago, July 15th, 16th and 17th.

Michigan Electric Association (annual meeting), Grand Rapids, Mich., August 18th to 21st.

International Association of Municipal Electricians (annual convention), Detroit, Mich., August 19th, 20th, 21st.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay Island, August 25th, 26th and 27th.

New York Electrical Show (second annual), Madison Square Garden, October 3d to 14th.

Illuminating Engineering Society (annual convention), Philadelphia, October 6th and 7th.

Chicago Electrical Show (fourth annual), Coliseum, January 11 to 23, 1909.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 9, 1908.

889,891. Method of Preparing Carbon Articles. Peter M. Bennie, Niagara Falls, N. Y., assignor to the National Carbon Company. Application filed July 11, 1907.

This method of preparing hard carbon articles for machining consists in drawing an electric arc to the surface of the article along the path which is to be subsequently cut away.

889,907. System of Electric-motor Control. William Cooper, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 3, 1907.

In combination with means for effecting the motor acceleration are means dependent upon the current traversing the motor circuit for automatically confining the motor acceleration to a predetermined time interval.

889,908. Regenerative System of Control. William Cooper, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 3, 1907.

A subdivided transformer is connected to the field winding of an exciter for a set of machines and to the armatures of these machines so that the current supplied to the transformer is practically constant.

889,911. System of Distribution for Direct Current. Frederick Darlington, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 25, 1906.

A number of generators are mechanically coupled together and electrically connected in series to a set of motors.

889,929. Electrolytic Meter. George Hookham and Sydney H. Holden, Birmingham, England. Application filed November 20, 1905.

This meter contains electrolyte and hydrogen in a cell, an electrode capable of absorbing hydrogen partly immersed in the electrolyte, thus forming a depolarizing electrode, and a gas measuring chamber.

889,931. Electrical Transformer. Svend E. Johannesen, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 3, 1906.

The transformer has a set of sub-divided parallel-connected coils and a set of series-connected coils symmetrically disposed with reference to each other, one terminal of the latter set of coils being connected to any desired corresponding sub-divisions of all of the coils of the other set.

889,937. Electrode for Arc Lamps. George M. Little, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 10, 1906.

An arc lamp electrode comprises a rod of iron and strips of copper embedded therein.

889,956. Insulator. John P. Nikonow, Pittsburg, Pa. Application filed May 11, 1906. Renewed July 30, 1907.

This insulator has a core with a collar surrounding but insulated from it. Another insulating layer surrounds the collar.

889,963. Mercury Switch for Railways and the Like. Robert Pfeil, Grunewald, near Berlin, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. Application filed January 6, 1908.

A switchbox contains two superposed and connected mercury chambers with a contact in each connected with the signaling system. A rail-depressed plunger acts on the mercury to break one contact and close the other.

889,989. Transformer Regulator. Wilbur H. Thompson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 25, 1906.

In a regulating transformer there are in combination with a stationary hollow cylindrical and magnetizable core a number of symmetrically disposed coils which are mounted to revolve around the axis of the core and each of which surrounds the core wall. (See cut on next page.)

890,001. Electric Safety and Alarm System for Railroads. Herbert D. Williams and Marcus Leonard, Vermillion, Kan.; said Leonard assignor to said Williams. Application filed April 18, 1907.

Each train carries an electromagnetic signaling and braking system whose circuit is partly completed on entering a block and fully completed if another train enters the same block.

890,026. Mail Carrier. Charles B. Crabtree, Manchester, Ill. Application filed October 2, 1906.

An electrically propelled mail car has a longitudinally arranged trolley pole pivoted off its center of gravity, uprights carried by the pole on opposite sides of the pivotal point, wheels carried thereby and alternately engaging a trolley line wire, and means carried by the car for gripping and holding an end of the trolley pole at a predetermined point, to change the relative positions of the wheels and reverse direction of the car.

890,030. Electric-railway Bond. John Dolan, Dayton, Ohio. Application filed June 15, 1906.

A rail bond is composed of laminated strips with solidified terminals, each of which has two integrally-joined non-apertured lugs adapted to unite the bond terminals to adjacent ends of rails by compressing the lugs into holes in the rails.

890,042. Automatic Telegraphic Transmission Instrument. John Gell, London, England. Application filed August 12, 1907.

A main key-action comprises key levers pivoted intermediate of their length and arranged side by side and pins at the end of each lever operated thereby and co-operating with the perforated tape. A secondary key-action is arranged at an angle to the first key-action and adjacent the rear ends of its levers whereby the uniform pivotal movement of the levers of the main key-action will effect the reversal movements of the secondary key-action and the contacts controlled by the secondary key-action.

890,049. Electric Signal for Railways. Joseph H. Gunn, Cortland, N. Y. Application filed October 31, 1907.

Supporting posts are mounted along the track that carry an inclined arm on which a signal blade is adapted to slide when electrically released.

890,053. Electrical Instantaneous Water Heater. Louis C. Henriksen, Los Angeles, Cal. Application filed April 10, 1907.

A number of water-carrying coils are mounted over each other. Adjacent to each one is an electric heating coil.

890,058. Trolley. Samuel D. Hunt, Youngstown, Ohio. Application filed October 9, 1907.

In a trolley system there is in combination with a main feed wire and auxiliary side wires, a trolley head having a pair of upright rotatable spools, and a pair of oppositely located supplemental trolley wheels.

890,081. Incubator. George W. Moore, Parsons, Kan. Application filed January 14, 1908.

In this incubator there is an incandescent lamp mounted in a socket depending through a hole in the cap.

890,084. Process for the Production of Aluminum Oxide. Frank W. Morris, Victoria, British Columbia, Canada. Application filed March 13, 1907.

The process consists in treating aluminiferous material with sulphuric acid to form aluminum sulphate, then electrolytically treating the latter in the presence of a

[illegible] by [illegible]

890,085. Means for Testing Wires or Wire Ropes. Charles E. S. McCann, Johannesburg, and Richard Colson, Belfast, Transvaal. Application filed [illegible]

[illegible] which is placed [illegible] An [illegible] is provided for [illegible] electric current passing [illegible] the [illegible] being tested, which [illegible]

[illegible] Railway Signal Apparatus. Charles A. Pitts, Callahan, Cal. Application filed August [illegible], 1907.

A [illegible] by the passage of a railway [illegible] by gearing to a signal-transmitting [illegible] which [illegible] a set of circuit terminals a predetermined number of times.

890,134. Alarm Clock. Valere S. Gaillard, Torrington, Conn. Application filed March 16, 1908.

A [illegible] an electrically operated alarm.

890,144. Automatically Controlling Electric Motors. Harry W. Leonard, Bronxville, N. Y. Original applications filed February 6, 1897 and January 28, 1902. Divided and this application filed January 5, 1903.

The armature of the motor to be controlled is electrically fed from a [illegible] driven dynamo whose field is controlled by [illegible] device governed by its driving motor's input. (See cut.)

890,147. Mechanical Device for Displaying Advertisements. Everett M. Low, New York, N. Y. Application filed October 24, 1902.

A movable web is driven by a spring through gearing. An electromagnet winds up the spring automatically.

winding to close one gap, and the other armature being responsive to the increased magnetic flux due to the closure of this gap and to current in both of the windings to close the other gap.

890,244. Magnet-winding Machine. Frederick H. Loveridge, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed April 17, 1903.

In combination with speed rotating mechanism is a centrally grooved guiding roller for applying the wire to the spool and traverse mechanism for reciprocating the roller, this mechanism being adapted to delay the reversal of this roller at the limit of its traverse during a definite number of revolutions of the spool.

890,246. Electro-automatic Advertising Machine. Clarence Myers and Alonzo H. Burchard, Houston, Tex., assignors to Bruce Detrich, Kansas City, Kan. Application filed April 6, 1907.

A cabinet has an enclosed glass cover, an inclined mirror located within its upper part, and an endless indicator carrier having a successive series of self-adjusting display cards, one of which is adapted to be reflected in the mirror.

890,247. Igniting Mechanism for Internal-combustion Engines. Clarence A. Myers, Frederick W. Haas, Jr., and Alvah A. Myers, Chicago, Ill. Application filed March 7, 1908.

A plug with a threaded body has journaled in it electrode shafts having rotary and oscillatory movements.

890,249. Process of Obtaining Pure Tin from Crude Tin or Tin Alloys Electrolytically. Otto Steiner, Crefeld, Germany. Application filed August 10, 1907.

Crude tin is electrolytically dissolved in a solution of an alkali sulphide and the tin is simultaneously plated out upon a cathode of pure tin. An electrical tension of less than 0.2 volt is maintained between the electrodes.

890,421. Trolley-wheel Support. John H. Gross, Norwalk, Ohio. Application filed October 10, 1906.

A trolley pole consists of two longitudinally parallel bars carrying the trolley harp at the top. One of the bars is adapted to fold within the other.

890,451. Generator of Electric Oscillations. Valdemar Poulsen, Copenhagen, Denmark. Application filed February 1, 1908.

This apparatus for generating electrical oscillations by means of an electric arc comprises a circuit including inductance and capacity, two electrodes in the circuit, one having a thin coating forming the actual electrode substance, and means for continuously renewing the coating. (See cut.)

890,458. System of Motor Control. George B. Schley, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed March 20, 1907.

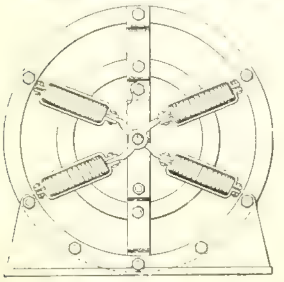
In a multiple-unit system the master controllers are so arranged that putting the handle on any one connects in that controller only for governing the train and removing the handle disconnects that controller.

890,482. Circuit Closer and Breaker. Alexander Winton, Cleveland, Ohio. Application filed September 15, 1904. Renewed March 12, 1908.

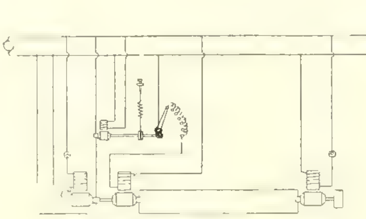
A commutator for a multi-cylinder engine igniter has a ring of insulating material into which are set contacts for each cylinder. A contact wheel runs on the interior surface of the commutator ring.

890,496. Protective Device for Electric Circuits. Herbert W. Cheney, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed April 29, 1907.

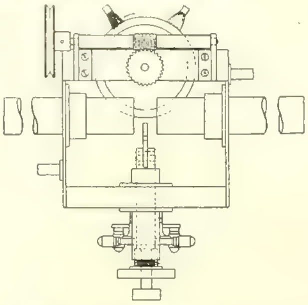
A starting controller for a motor contains a number of fuses, and connections whereby the controller when in starting position completes the circuit through the fuses in parallel, and when in running position cuts out part of the fuses.



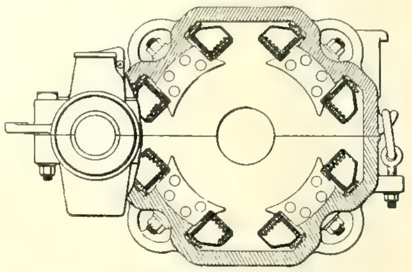
No. 890,989.—TRANSFORMER REGULATOR.



No. 890,144.—MOTOR-CONTROL SYSTEM.



No. 890,451.—GENERATOR OF ELECTRIC OSCILLATIONS.



No. 890,539.—FIELD-COIL SUPPORT.

890,183. Magnetic Circuit-breaker. Ralph Scott, New Brunswick, N. J., assignor to the Scott Electrical Equipment Company. Application filed January 17, 1906.

This circuit-breaker has a tubular casing with conducting terminals, a tubular support within the casing, a solenoid and a spring fixed to the support, the solenoid and spring forming part of the electric circuit, and means acted on by the solenoid for releasing the support.

890,190. Means for Automatically Weighing Powdery Substances. Albert F. H. Stephens, Camborne, England. Application filed March 9, 1907.

An electromagnet is mounted so that its vibrating armature taps against the base of the hopper and causes enough additional powder to drop therefrom to give the desired weight on the scale pan.

890,195. Telegraphone. Harve R. Stuart, Wheeling, W. Va. Application filed September 24, 1907.

In this telegraphone there is a uniformly rotating disk, a magnet with an elongated pole face movable over the surface thereof, and means for angularly displacing the pole face during movement.

890,197. Signal System for Railways. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed August 22, 1904. Renewed September 26, 1905.

An electric railway has insulated track rails for the return current. The individual block sections are supplied with alternating current for signaling.

890,198. Electric Railway. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 2, 1906.

[illegible] two sections of a working [illegible] indicator for showing the potential condition of the two sections, a relay for controlling indicator circuit comprising two windings, one in circuit with one section, and the other in circuit with the other [illegible]

890,200. Electric Cut-out. William C. Tregoning, Cleveland, Ohio, assignor to the Tregoning Electric Manufacturing Company, Cleveland, Ohio. Application filed April 8, 1907.

[illegible]

[illegible] John [illegible], Philadelphia, Pa. Application filed July 11, 1907.

[illegible]

890,220. Electromagnetic Signal-controlling Device. [illegible] Chicago, Ill. [illegible]

[illegible]

890,255. Enclosed Fuse. Frederick H. Weston, Jr., and Frank C. De Reamer, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed December 6, 1904.

This enclosed fuse consists of a tube, an end cap, a reinforcing strip inside the tube, a blade projecting from the end of the tube and secured to the strip, and a fusible element attached to the blade.

890,270. Controller for Gasoline Engines. John E. Gilson, Port Washington, Wis., assignor to the Gilson Manufacturing Company, Port Washington, Wis. Application filed January 6, 1908.

The controller comprises a rotary contact-wheel, a carrier yieldingly supported on a lever, a contact device on the carrier insulated therefrom and adapted to engage the contact-wheel, and a spring actuating the carrier to press the contact device in yielding engagement with the contact-wheel.

890,299. Automatic Regulation for Dynamo-electric Machines. Ferdinand Porsche, Vienna, Austria-Hungary. Application filed April 4, 1903.

The dynamo armature is mounted directly on the crank shaft of the gasoline engine on an automobile. The field magnet is mounted so as to be normally stationary but movable in order to vary the magnetic flux automatically and thus keep the dynamo output constant regardless of its voltage and current.

890,349. Alarm-signal Mechanism. Ellsworth E. Flora and Robert J. Zorge, Chicago, Ill., assignors to the Zorge Safety Railway Equipment Company. Application filed June 19, 1907.

A torpedo-placing mechanism consists of a carrier, a series of torpedo holders mounted thereon, a carrier actuating member, a holder actuating member, an electric motor geared to the members and electromagnetic controlling means for the motor.

890,367. Rail Bond. George A. Mead and Charles R. Sturdevant, Mansfield, Ohio, assignors to the Ohio Brass Company, Mansfield, Ohio. Application filed November 25, 1904.

The bond has a terminal provided with a raised [illegible] extending adjacent the [illegible] along the lower edge to form a recess which, when the terminal is applied to the surface of the rail is closed along the lower edge and open along the upper edge to receive solder.

890,374. Cable Switch. Edward H. Pryor, Medina, N. Y. Application filed July 16, 1907.

The switch has two arms converging in one direction, one arm being adapted to [illegible] and engage a supporting cable, the other adapted for the attachment of a [illegible] and laterally extending guide to direct the supporting hooks [illegible] cable.

890,403. Time-controlled Electric Switch. Richard B. Bracey, Richmond, Va. Application filed December 9, 1907.

[illegible] predetermined interval.

890,539. Field-coil Support. Emmett W. Stull, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed March 9, 1905.

The support consists of a plate of spring metal having tabs punched therefrom and bent out of the plane of the plate alternately in opposite directions, the plate and tabs coöperating with the coil and frame to form a yielding support for the coil. (See cut.)

890,577. Ventilated Laminated Core for Dynamo-electric Machines. Walter J. Richards, Norwood, Ohio, assignor to Allis-Chalmers Company. Application filed October 31, 1906.

This core construction comprises the main laminæ and groups of special laminæ arranged at intervals forming ventilating passageways, the special laminæ having overlapping openings adjacent the outer and inner peripheries of the core.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 16, 1908:

454,018. Electric Signal for Mine Shafts. F. W. Bacorn, Maryville, Mont.
454,020. Electric Railway Car. E. M. Bently, New York, N. Y.
454,021. Electric Motor Car. E. M. Bentley, New York, N. Y.
454,022. Conduit for Electric Railways. E. M. Bentley, New York, N. Y.
454,023. Electric Railway. F. O. Blackwell, Boston, Mass.
454,024. Electric Motor. H. H. Blades, Detroit, Mich.
454,031. Electric Switch. H. T. Clark, Bridgeport, Conn.
454,038. Incandescent Electric Lamp Controller. J. J. Fanning, Chicago, Ill.
454,057. Galvanic Battery. Wm. McMillan, New York, N. Y.
454,060. Insulated Electric Conductor. [illegible] D. McCracken, Alpine, N. J.
454,091. Secondary Battery. D. Tommasi, Paris, and C. Therye, Marseilles, France.
454,177. Conduit for Underground or Subway Electric Systems. J. J. Miller, Pittsburg, Pa.
454,178. Motor Car for Underground Electric Systems. J. J. Miller, Pittsburg, Pa.
454,181. Connector for Electric Wires. E. L. Nash, G. G. Stout and J. R. Davis, Parkersburg, W. Va.
454,184. Electric Head Light. R. Pattison and D. G. Desmond, Boston, Mass.
454,187. Secondary Battery. J. S. Sellon, London, England.
[illegible] Electric Current Indicator. A. B. Herrick, New York, N. Y.
[illegible] and [illegible] Electric Arc Lamp. S. W. Rushmore, Brooklyn, N. Y.
[illegible] Dynamo Electric Machine. R. Eickemeyer, Yonkers, N. Y.
454,338. Electric Telegraphic Apparatus. S. V. B. Essick, Brooklyn, N. Y.
[illegible] Electric Block System for Railways. A. H. R. Guiley, South Easton, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Electrically Operated Incline Railways at Valparaiso and Heidelberg.

By Frank C. Perkins.

Of the accompanying illustrations, Fig. 1 shows the novel car and a section of the track in use on the electrically driven rope railway at Valparaiso, Chile, which has the extremely steep grade of 85.1 per cent., which is constant. The electric incline railway is operated by the Compania de Tranvias Eléctricos de Valparaiso, and the car utilized, shown in the accompanying picture, has a capacity for 30 passengers and operates at a speed of 1.5 meters a second. The equipment was made at the Giesserei Berne (Berne Iron Works) of Berne, Switzerland.

The length of this electric driven incline rope railway is 43.1 meters, the horizontal projection being 32.8 meters, while the difference in level between the upper station and the lower station is 27.89 meters. Double-spur, Vignol track construction is employed.

The first section of the electrically driven rope railway between Heidelberg and Molkenkur, in Germany, is 490 meters long, and the difference in elevation between the lower station and the upper station is 171 meters. On this mountain railway the maximum grade is 43 per cent., while the minimum grade is 25.5 per cent. and the horizontal length of the railway is 457 meters. The cars are arranged with cross seats and designed to carry 50 passengers, while the speed attained is two meters a second.

This mountain railway was also constructed by the Giesserei Berne, and the same concern has equipped the second section of the Heidelberg electrically driven rope railway between Molkenkur and Königstuhl. The second section is more than double the length of the first section of the Heidelberg line, the difference in level between the upper station at Königstuhl and the lower station at Molkenkur being 261 meters. The total length of the line is 1,021 meters, while the horizontal length or projection of the railway measures 988.7 meters.

The maximum grade on the second section of the Heidelberg incline railway is 40 per cent., while the minimum grade is 22 per cent. Similar cars are employed, carrying 50 passengers, to those utilized on the first section, and the speed is also two meters a second. The accompanying illustration (Fig. 2) shows the construction and equipment of the second section of the Heidelberg mountain railway.

Fig. 1. Car of Valparaiso (Chile) Rope Tramway as Set Up by Swiss Manufacturer.

Fig. 2. View of Second Section of Heidelberg Line.

ELECTRICALLY OPERATED INCLINE RAILWAYS.

The Telegraph and the Telephone at Republican National Convention.

The Republican national convention at the Coliseum in Chicago last week was not without interest to electrical men aside from the political and social features. Both the large telegraph companies and the local and long-distance Bell telephone companies made careful preparations properly to take care of the large volume of business, whether in the nature of private communication with distant points or the rapid and accurate dispatching of convention news and bulletins.

The Western Union Telegraph Company and the Postal Telegraph-Cable Company had each system so thoroughly equipped that to handle efficiently even so large a volume of business as that incident to a national political convention requires only the installation of additional equipment at the scene of activities and a trained and competent force of men to carry out the work.

The telegraph equipment was installed in the south end of the Coliseum. The various newspaper and Associated Press telegraph operators were conveniently located near the two operating rooms in the rear of the speakers' stand and had pneumatic-tube connection with the press representatives in front of the stand.

The Western Union company installed six miles of additional 19-conductor cable between the Coliseum and its main Chicago office, constituting four cables and 76 wires. About 150 additional operators were employed. The newspapers were given a duplication of their regular leased service, and a special wire was utilized for a White House bulletin. The Postal company's equipment was about the same.

The total number of words transmitted by telegraph originating from the convention was not so large as at some former conventions. The Western Union company estimated that it handled about 1,500,000 words during the convention. The Postal company at the time of writing was unable to give a close estimate.

The convention offered an opportunity of noting the conspicuous advance of the telephone. Probably at no former convention were the facilities for telephone communication so complete. The service was extensively used, and its effectiveness was widely commented upon. The American Telephone and Telegraph Company (the long-distance company) and the Chicago Telephone Company co-[illegible] and delegate headquarters were connected through this board.

[illegible] many of the prominent leaders had their headquarters, the telephone held a prominent place. [illegible] all were needed. Some of the headquaters requiring extensive long-distance service were connected [illegible]

The newspapers also made extensive use of the telephone. The Chicago Tribune engaged a private wire for direct communication with the White House and the War Department at Washington. There were other instances of private long-distance service.

A feature of the long-distance service for which the American Telephone and Telegraph Company is receiving many compliments was the free bulletin service given to all the local telephone companies reached by the long-distance company throughout the United States. As the convention progressed condensed bulletins were sent out at frequent intervals, so that anyone in reach of a telephone, whether in Maine or California, could be informed of events within a brief time after they had transpired.

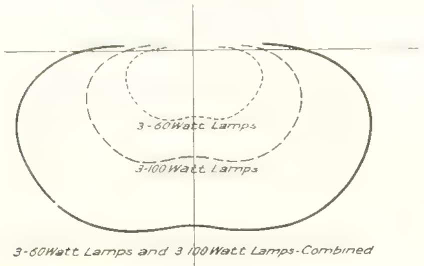
The telephone companies had a force of special representatives at the Auditorium and the Coliseum to guard against any possible interruption of the service. Mr. W. E. Bell of Chicago, division commercial superintendent of the American Telephone and Telegraph Company, was in charge of the convention service.

The Coliseum and the various hotels were gayly decorated for the occasion, electric lights and electric campaign signs being freely used. Many of the large business houses using electricity in advertising added to their equipment, so that the downtown streets were brilliantly illuminated at night. From the roof of the Tribune Building a powerful searchlight was kept playing upon objects within reach, and when the rays were projected to some of the box-kite banners floating in the darkness the effect was striking.

Illuminating Engineering.[1]

By W. D'A. Ryan

Illuminating engineering is rapidly becoming recognized as a necessary specialized branch of science. It is clearly subdivided into (1) commercial and consulting engineering, having to do mainly with the exploitation or application of existing apparatus, and (2) designing engineering, covering



APPARENT DISTRIBUTION OF LIGHT AT A DISTANCE OF 10 FEET FROM TUNGSTEN DIFFUSER.

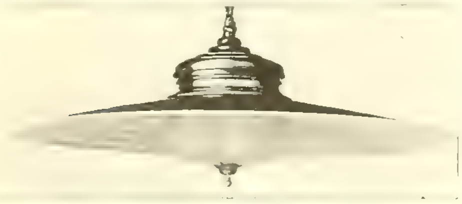
the development of new apparatus. Each of these branches can be subdivided into utilitarian, decorative and spectacular lighting, embracing indoor and outdoor work.

The general subject is very broad and cannot be covered in a short paper. I will therefore confine my remarks mainly to designing engineering as applied to apparatus for the illumination of large indoor spaces.

The designing illuminating engineer primarily starts with the initial efficiencies of the various lights developed by the lamp engineer.

After deciding upon an application, the problem resolves itself into determining to what extent the initial efficiency must be subordinated in the interest of improving the illuminating efficiency, and at the same time meet other practical requirements or considerations, such, for example, as color, distribution, intrinsic brilliancy, diffusion, steadiness, frequency effect, inherent physical and mechanical peculiarities, ventilation, dust and insect-proofing, reliability, accessibility, adjustability, initial and operating costs, underwriters' requirements, architectural and decorative considerations, and, last, but not least, the probable efficiency and limitations of new illuminants in a semi-developmental or productive stage.

In order to obtain reasonably good results from a high-intrinsic-brilliancy source, it is usually necessary to quench about one-third of the initial efficiency. This will vary between the limits of making no reduction whatever in certain crude work up to an absorption of 80 per cent. for highly artistic effects. For example, in making a balance between the utilitarian and the esthetic, we may have the design of apparatus for the lighting of a blacksmith shop or brass foundry, where utilitarian considerations are of the utmost importance, while esthetic considerations do not enter at all. Passing up through the lighting of mills and factories, we reach the department store, where the utilitarian and esthetic are about balanced, changing slightly one way or the other with individual tastes and local conditions.



[illegible] TUNGSTEN DIFFUSER

Finally, we arrive at the other extreme of the [illegible] attempt at improved efficiency would in all probability destroy the fixture design so that it would be historically and architecturally inaccurate and not in keeping with the surroundings. This applies to distinctive high-class lighting, where the illuminating engineer, as a rule, can be of little assistance to the architect, fixture designer or decorator, except possibly on the relative merits of available lamps, or on [illegible] fixtures as such do not enter the consideration.

On the other hand, the utilitarian branch of lighting offers to the illuminating engineer an unlimited field. I will present for illustration a few designs applicable to the intermediate field covering large indoor spaces.

Lighting Large Interiors.

Broadly speaking, the illumination of rooms having considerable dimensions can most satisfactorily be accomplished by the use of units sufficiently large to correspond with the surroundings.

In the lighting of new buildings the illuminating engineer has considerable latitude, but there are thousands of outlets in stores, mills and factories which must be utilized without change.

Modern department stores are usually divided into bays varying anywhere from 18 to 25 feet square. It is generally desirable to place one outlet in the center of each bay and select a unit of proper power, distribution and intrinsic brilliancy to give the desired results from these central points. This method of locating outlets is architecturally correct, and has the further advantage of simplifying and minimizing the conduit, circuit and control work, and reducing the initial cost of the installation.

ALTERNATING ENCLOSED ARCS IN A RAILROAD-STATION WAITING ROOM.

The tendency in lighting armories, concourses and other large high-studded rooms is toward the concentration of two or three kilowatts at each outlet. As time advances we shall see concealed and semi-concealed methods of lighting as applied to large interiors become more general, and the painful exposed high-intrinsic-brilliancy sources of light so common today, must necessarily vanish as the public becomes educated to higher standards of illumination.

Tungsten Economy Diffuser.

The name of this lighting unit is sufficiently descriptive when taken in combination with accompanying illustrations, so it will not be necessary to describe it extensively in detail.

FOUR-LIGHT ARC DIFFUSER FOR "WHITE ROOM" IN DEPARTMENT STORE.

The design was originated to meet the demand for a large tungsten unit required in the general illumination of stores, mills and factories.

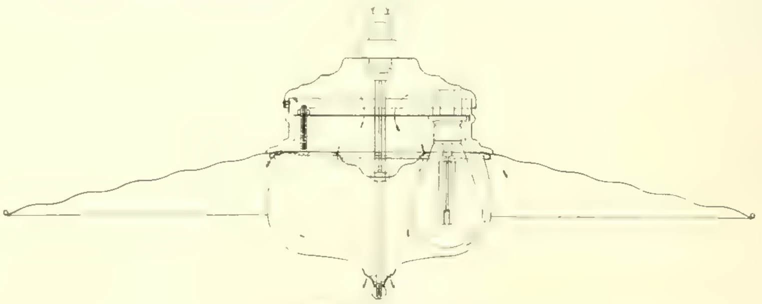
It can be interchangeably equipped with 26-inch or 39-inch diffusers. The latter give somewhat better distribution and diffusion than the former, but the appearance is not so pleasing. When assembled with a 26-inch diffuser, chain and canopies, it is more satisfactory from an esthetic point of view than the average gas or electric lamp commonly used today for store lighting, and the fixture designer is not handicapped in adding further ornamentation when desired.

By omitting the chain and canopies and substituting a 39-inch for the 26-inch diffuser, it does not look out of place in a mill.

In order to cover the field broadly five-light and six-light units are furnished. By using either 40, 60 or 100-watt lamps, the former becomes a 200, 300 or 500-watt unit, and the latter can be operated at 120, 180, 240, 300, 360, 420 or 480 watts, in various combinations.

The five-light unit must always be burned with a full complement of lamps; otherwise it will present an unsymmetrical appearance, while the six-light unit, for the same reason, must be operated with either three or six lamps.

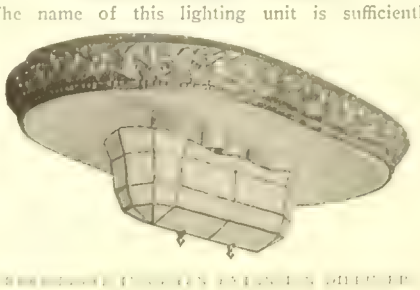
Owing to the relative cost of the lamps for a given illumination, it is cheaper to operate the five-light, 500-watt combination, but in cases where the quantity of light can be varied to meet the requirements at different times, the three-stage, six-light, 180-300-480-watt unit is preferable from an economical point of view.



Arrows Show Ventilation.

SECTIONAL DRAWING OF TUNGSTEN DIFFUSER.

In order to provide, without mechanical change, for the use of the tantalum or carbon incandescent lamps, the sockets have been mounted on a platform, adjustable in a vertical plane, so that the smaller lamps can be brought into the proper position with respect to the reflector and shade. This universal feature will probably appeal to many who are obliged to handle all types of lamps. By omitting the frosting from the bulbs, the life of the lamps is prolonged, and the same grade of frosting placed inside of the shade will give much lower intrinsic brilliancy, due to the diffusing medium being further removed from the filament.



[illegible] TUNGSTEN EXTENSION DIFFUSER.

[illegible]-LIGHT TUNGSTEN EXTENSION DIFFUSER.

[1] [illegible]

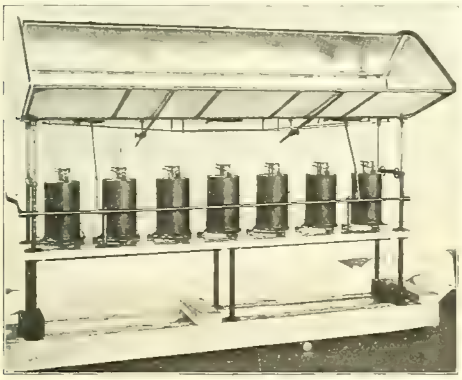
for applications where white light is essential, be-

what might be called ...

BALL ARC FIXTURE CLOSED AND OPEN FOR TRIMMING.

cannot be discerned under the tungsten light. This is also true in many applications of low-current arc lamps.

In order to make fine distinctions in color, there are two fundamental requirements in the light, namely, whiteness and intensity. To provide the first of these requisites we usually employ high-current carbon enclosed arc lamps with the light properly screened and diffused. The required in-



INVERTED-ARC LINEAR REFLECTOR IN TRIMMING POSITION.

tensity is furnished by using two or more watts per square foot of floor space.

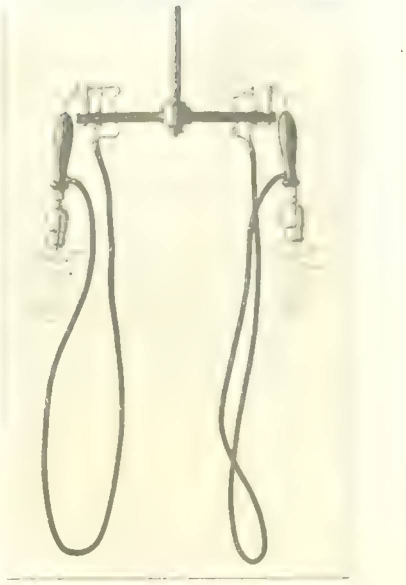
Now, the initial and maintenance cost of such a system, while well within reasonable limits for department or other large stores, is prohibitive for many applications where the merchant would ordinarily consider his store well lighted with one-half the light this expenditure of energy represents, in which case it would be impossible to distinguish delicate tints and shades with any kind of light, natural or artificial.

Under such circumstances a "white room" may be provided at very moderate expense, in which colored goods can be displayed with daylight results.

We are all familiar with the evening room provided for the display of goods for evening wear. Conversely, why should we not have "white rooms" for the display of goods intended for day wear? The equipment for such a room consists of a large diffusing surface, about five feet in diameter, covering four or five high-current enclosed arcs with diffusing globes. Below this combination is stretched a white silk diffusing screen. The unit is suspended as a complete fixture, and can be readily installed in a room set apart for the purpose or in a small screened-off section of the store. As the light is only required for intermittent service, it should not be expensive to maintain.

six light ...

desired, ...



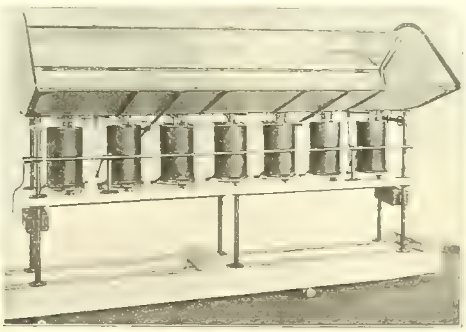
GRAVITY EXTINGUISHING ... FOR ... LAMPS.

a tungsten fixture, intended for use particularly on low-studded ceilings. It differs widely from the tungsten economy diffuser in that it is more shallow and the intrinsic brilliancy is not so high.

The efficiency when measured in lumens per watt is lower, but the illuminating efficiency is not very different, owing to increased diffusion and the lower intrinsic brilliancy mentioned. More expense has been put into the esthetic, and the diffuser is naturally of a higher order, but useful only in a much more limited field.

BALL ARC.

The ball arc consists of an 18-inch opal-glass ball suspended by three chains and having enclosed

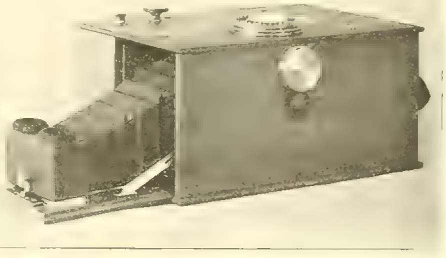


INVERTED-ARC LINEAR REFLECTOR IN OPERATING POSITION.

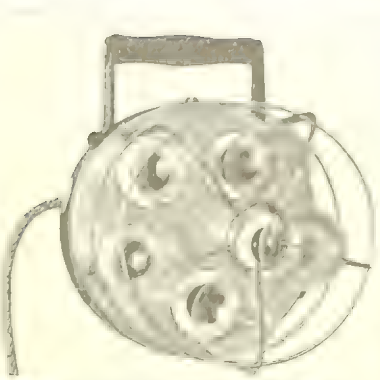
therein an arc lamp with small carbons, which are burned at a high current density.

The center of the sphere is cut by a horizontal reflector which diverts all the light into the lower hemisphere, mainly for economical reasons. In cases where economy is not paramount this reflector can be removed, in which case the ball will throw considerable light in the upper hemisphere, particularly when an alternating-current arc lamp is used.

This device is useful for the illumination of picture galleries, where a light whiter than any of the other existing illuminants is desirable, and where at the same time the appearance of the ordi-



RYAN LUXIMETER



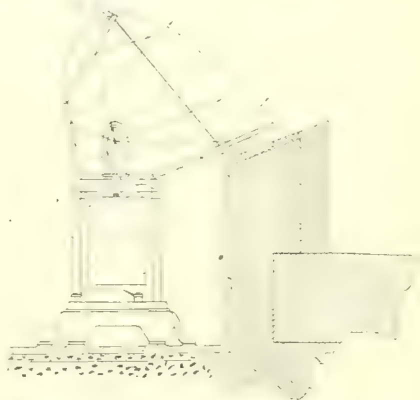
... Union Station at Washington, D. C.

It will be observed that the carbons are arranged above the mechanism, and in this particular case the lower carbon is positive. The reflector is adjustable, so that the light can be turned to the proper place on the ceiling or side walls, and a diffusing screen covers the arcs so as to eliminate strong contrasts. Notwithstanding the large cubical contents of the waiting room, and the fact that the light is of the totally concealed class, the efficiency is remarkably high and compares favorably with exposed sources, due to the fact that the intrinsic brilliancy of such sources by the system described is entirely eliminated and the eye is permitted to adjust itself properly for the general illumination.

LUXIMETER AND ILLUMINATING ENGINEERING DATA.

Aside from the design of suitable lighting units, it comes within the province of the illuminating engineer to design photometers and other light-measuring or analyzing devices.

While it is possible to do good illuminating engineering without the aid of candle-foot photometers, apparatus of this class will greatly assist in eventually placing the work on a scientific basis. For



INVERTED-ARC LINEAR REFLECTOR (SECTIONAL ASSEMBLY).

this purpose the luximeter will be found very convenient. It is a self-contained piece of apparatus, mounted in a mahogany box 5.5 by 7.5 by 10.5 inches, and weighs about six pounds. It contains a tungsten lamp, diffusing block, a shutter for changing the intensity of the light on the screen, a four-cell glycerine battery connected in series with the lamps and a resistance. It also contains a millivoltmeter for holding the current constant on the standard lamp. The instrument is made to read direct in foot-candles, and the diffusing block is so shaped and combined with a serrated screen that it gives commercially accurate readings for light simultaneously received from any direction from vertical to horizontal.

A more sensitive screen is substituted for measuring low intensities, such as would be received from street lamps at a distance of, say, 250 feet.

A self-contained calibrating tube is furnished, so that the instrument can be calibrated in a few minutes, regardless of extraneous light, thereby

[illegible] ... to check it by the usual [illegible] photometric method. An amplifier is also provided for raising the intensity on the screen when the illumination is very faint. This merely [illegible] ... tube provided with a suitable lens for gathering parallel rays.

In using this instrument for measuring interior lighting good judgment should be displayed in making comparisons of the relative merits of different light sources; otherwise some serious blunders are liable to occur.

While the value of the horizontal uniplane illumination is of considerable importance in certain applications, there are many cases where the vertical illumination in different planes is quite as important and should be given proper weight.

Furthermore, the uniplane horizontal or vertical measurements do not take into consideration the intrinsic brilliancy, which should be included in all comparisons.

An instrument for determining the relative intrinsic brilliancy will soon be available.

The illumination of large plants usually calls for two broad classifications, namely, the lighting of floors carrying small machines with proportionately small floor space per operator and the lighting of floors equipped with large machines where the floor space per operator is correspondingly large. Generally speaking, the former can be most economically and satisfactorily illuminated by a strong general illumination, while the latter more properly calls for a moderate general illumination and localized light on the tools.

A four-candlepower lamp with the light properly

DUPLEX CONSTANT-RADIUS PHOTOMETER (UNDER CONSTRUCTION)

In addition to conducting tests under factory operating conditions, where, among other things, the uniplane value of the light is determined, each combination is duplicated and tested in two new types of photometers in which the light is measured at constant radius. This enables us to de-

Daylight View.

Night View.

LIGHTING DEMONSTRATION IN ERECTING BAY IN TURBINE BUILDING OF LYNN WORKS.

screened from the operator's eyes is usually sufficient for localized work.

The general illumination of erecting or other high bays favors the use of large units properly spaced on the center line and hung sufficiently high to clear the cranes, and at the same time the light that is ordinarily wasted overhead should be diverted downward to the working level. This principle is illustrated by the accompanying day and night views. These cuts show the erecting bay in one of the Lynn factories of the General Electric Company, in which a practical test is being conducted to determine the costs and relative merits of various lighting systems suitable for the illumination of bays of this class.

Each of the groups on the center line is designed individually to illuminate 4,200 square feet of floor space. The energy in the different diffusers varies from one-quarter to one watt per square foot, and the lighting units represented include series and multiple tungsten, tantalum and carbon incandescents, alternating and direct-current [illegible] in current from 5 to 10 amperes each, magnetite arcs, short-life yellow-flame arcs, long-life white and yellow-flame arcs, [illegible] connected to opposite phases [illegible] effect in light on the [illegible]

[illegible]

[illegible] interest, depreciation, maintenance, etc.

termine the relative spherical, mean lower spherical and other candlepower values of the units as a whole.

This entire demonstration is to be permanent and open at all times to engineers and others interested, and the data referred to will soon be available for general distribution.

"Wireless" from Balloons.

Major Edgar Russel, assistant to the chief signal officer of the army, who was one of the passengers in the Signal Corps balloon which made a flight on May 13th from Washington to Patuxent, Md., said, according to the New York Sun, that the wireless experiments conducted during the flight were highly successful and will be continued.

"I think that I can safely predict," he continued, "that wireless telegraphy to and from a balloon can be used in war. This means that I am sure that we will shortly perfect an apparatus that can be safely and successfully used in both receiving and sending messages from a balloon to any station within a radius of many miles. Yesterday we carried only a receiving apparatus, and this worked perfectly. We did not try to send for fear of the danger that lies in sparks from the sending instrument. When up over Washington we could receive from the Annapolis station clearly.

"The apparatus we used was just the reverse of the ordinary type of wireless station. Instead of erecting the antennæ on a tall mast we hung them down from the basket, consequently the entire instrument was in reverse of the usual form. We covered the basket with a wire netting which took the place of the usual counterpoise cables extending from the bottom of the mast in the ordinary mechanism.

"A wireless-telegraph system from balloons will [illegible] useful in warfare, making the balloon fully 300 per cent. more effective in its destined work of making reconnaissances. With an apparatus similar to the one we carried and with the addition of a sending apparatus a balloon could go up fom the headquarters tent on a battleground and floating over the enemy's position give the commanding officer exact details of every move made and every position, transmitting this information direct through the headquarters wireless station."

Meetings of Lewis Institute Branch.

The last two meetings of Lewis Institute Branch of the American Institute of Electrical Engineers were in some respects the most noteworthy gatherings yet held by this organization. On May 13th an original paper on "Composition and Properties of Insulating Materials" was read by one of the members, Mr. M. G. Kopf, electrochemist for the Automatic Electric Company.

Mr. Kopf described the manufacture and characteristics of nearly all insulating materials, among which were especially mentioned mica and mica products, vulcanized fiber, treated cloths, glass, porcelain, waxes, impregnated papers, oils, varnishes and shellacs, tar and bitumen products. The deleterious effect on the insulating power caused by the presence of moisture, acids and alkalis in any insulating compound was clearly explained. Tests of dielectric strength and ohmic resistance were described. After the reading of this paper there was a spirited discussion of the general subject of insulation.

On June 17th the Lewis branch held its closing meeting of the season. A special programme was arranged that began at 6:30 in the evening with a banquet in the dining hall of Lewis Institute. About 75 members and guests were present. Prof. P. B. Woodworth acted as toastmaster and speeches were made by Profs. H. E. Cobb and J. D. Nies and by Mr. M. G. Kopf. This was followed by a lecture in the auditorium of the institute by Dr. Henry Crew, professor of physics at Northwestern University, on the subject "The Monorail Car."

Dr. Crew explained and illustrated by a number of experiments the fundamental principles of the gyroscope. These were clearly shown to be dependent on Newton's second law of motion and on the law of conservation of energy. The application of the gyroscope to steadying ships against rolling was shown, and the early failures and ultimate success of this work were explained. Coming to the use of gyroscopes in the Brennan monorail car, Dr. Crew described the construction and operation of this phenomenal vehicle and demonstrated its characteristics by means of a model constructed in his laboratory at Evanston. This model car was easily run back and forth on a steel wire stretched across the room.

After the close of this interesting lecture a business meeting of the branch was held at which the work for next year was discussed and the following-named men elected as officers for the coming year: For president, R. M. Walker; for secretary and treasurer, M. G. Kopf.

The Jessie Walling Roller Mills Company of McMinnville, Tenn., which furnishes the town with electric lights and water, is building a new power station. Mr. S. D. Rowan is engineer in charge of the work.

Fuel Testing and the Smoke Problem.

At th[illegible] Cleveland, Ohio, on June [illegible]th, Mr. D. T. Randall, engineer in charge of [illegible] of the United States Geological Survey, gave an instructive address on the smoke problem. [illegible]ties collected by the government indicate that the increase in the use of coal during the last century has been [illegible] that if the consumption [illegible]tinues to increase at the same rate it is concluded the coal fields of the country will be exhausted before the end of the present century. However, Mr. Randall said, if by some means the increase in the use of coal can be checked and the output of the mines kept down to the present figures there will no occasion to worry about the coal supply.

As used at present for heat, light and power, the losses are so great that of the total heating value of the coal some of the largest and best power plants are able to utilize only about 10 per cent. of the energy in the coal. Nearly 2,000,000 horsepower in the form of gas is allowed to escape from the blast furnaces of the country. There is also a great fuel waste in the manufacture of coke.

To correct the present wasteful methods of utilizing our fuels, Mr. Randall told of the co-operation of men prominent in the affairs of the government, engineers, manufacturers and others, with the fuel-testing division of the technologic branch, whose work was begun at St. Louis during the exposition in 1904 by the United States Geological Survey, and has since been continued at St. Louis and Norfolk. The president has also appointed a number of prominent engineers to act as an advisory board on fuel and structural material investigations.

The experimental work is done under the direction of the chief of the technologic branch, the details being settled after consultation with engineers who are experts in the particular lines being investigated. A regular force of engineers, chemists and computers carry on the tests as planned and prepare the results for publication. The purposes of the fuel investigations now in progress are: To lessen the waste in the nation's fuel supply; to determine the amount, quality, properties and most efficient methods of utilizing the fuels; the analyzing and testing of coals; to determine means whereby low-grade fuels may be made of commercial value, and the abatement of smoke.

Mr. Randall said that a study of the fuel values of coals burned while conducting some 540 boiler tests has shown that the value of the coal depends almost entirely on the number of heat units which it contains as determined by a calorimeter, these relative values being influenced somewhat by the amount and character of volatile matter and of ash present in the coal. This information has strengthened the position of the government engineers who desire to purchase coal on a specification which has for its basis of payment the British thermal units and ash in the coal.

Investigations of the washing and coking tests of coals have also shown the possibilities of utilizing poorer grades of coal than are commonly used, and point to a very considerable saving in fuel supply. The experiments on the briquetting of coal have shown that the slack coal which is otherwise difficult to utilize may be made into artificial lumps and used with high efficiency in power plants or for locomotive use. A study of the furnace conditions in connection with the boiler tests points to possibilities of modifying furnaces so that practically all fuels may be burned without smoke under favorable conditions.

Some bulletins have already been issued on this work, but those which deal directly with the smoke problem are now in course of preparation. The government is investigating the possibilities only from the engineering and not at all from the legal standpoint.

Good Street-railway Service at the Republican Convention.

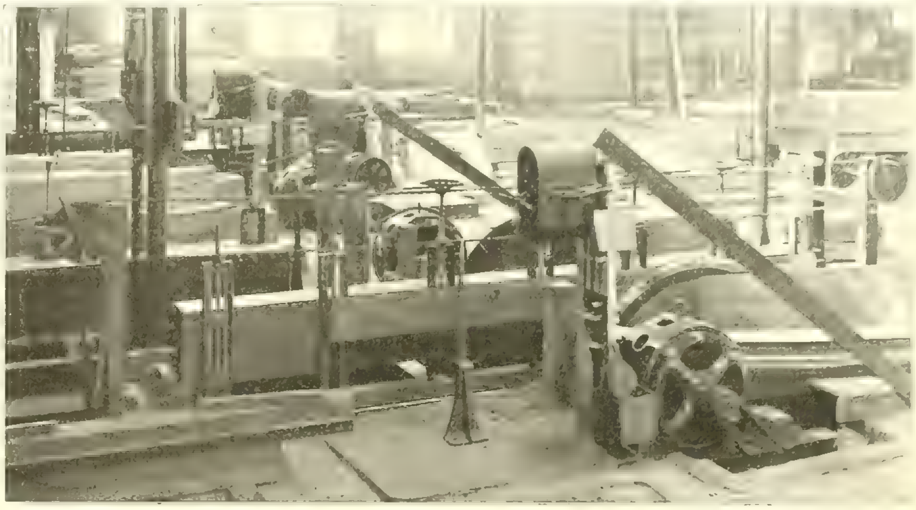
One of the best exhibitions of street railroading in Chicago was given by the Chicago City Railway Company in handling the Republican convention throngs. The new tracks on Wabash Avenue had been completed just in time for the convention, and the big pay-as-you-enter cars of the Cottage Grove and Indiana Avenue lines passing the convention hall on Wabash Avenue were operated without delay on a 26¾-second headway during the entire convention period. President Mitten took personal charge of the work at the Coliseum, and at every street intersection in the downtown district supervisors were stationed to direct the movement of the cars. The city's mounted police were a great [illegible] proceeded downtown only half filled.

Induction Motor Operating a Chair Factory.

[illegible]

[illegible] to the direct and group driving of woodworking machine tools used in a chair factory is that found in the plant of the Union City Chair Company, Union City, Pa. This factory, destroyed by fire about three years ago, was rebuilt in the summer of 1907, using brick fireproof construction throughout, and equipped with a central power house distributing three-phase, 60-cycle, 220-volt current to Allis-Chalmers induction motors driving various tools throughout the establishment. There were 45 of these motors installed, ranging in capacity from 1 to 30 horsepower.

The power plant is equipped with two 150-horsepower Union Iron Works water-tube boilers, which



THREE CIRCULAR SAWS IN CHAIR FACTORY DIRECTLY DRIVEN BY THREE 30-HORSEPOWER INDUCTION MOTORS.

carry a pressure of 125 pounds and supply a 300-horsepower steam engine direct-coupled to a 250-kilovolt-ampere alternator. The engine operates non-condensing, the exhaust being used for dry kilns and to heat the factory buildings during the winter months. A blower system, installed by Allington-Curtis Company of Saginaw, Mich., carries refuse wood and shavings to the boiler and is operated by a 30-horsepower induction motor.

The following table details the kind of tools, the maker, the size and speed of motor and the method of drive:

No.	Tool	Maker	H. P. Motor	Drive.
1	Circular cut-off saw	L. Houston Co., Montgomery, Pa.	3 h. p., 1,700 r. p. m.	Belted direct to tool
1	American gang rip saw	American Woodworking Co., Williamsport, Pa.	10 h. p. 1,130 r. p. m.	Belted to countershaft T. & L. pulley
2	30 in. planers	Baxter D. Whitney, Worcester, Mass.	15 h. p., 1,130 r. p. m.	Belted to countershaft T. & L. pulley
1	Cut off saw	American Woodworking Co., Williamsport, Pa.	3 h. p., 1,700 r. p. m.	Belted direct to saw
1	55-in. double exhaust fan	Allington-Curtis Co., Saginaw, Mich.	30 h. p., 850 r. p. m.	Belted to fan
1	Matcher	Myers Machine Co., Sheboygan, Wis.	10 h. p., 1,130 r. p. m.	Direct belt to machine. Motor fitted with double width pulley, driving T. & L. on mach.
1	6 in. sticker	American Woodworking Co., Williamsport, Pa.	7½ h. p., 1,130 r. p. m.	Direct drive
1	Band resaw	Cordesman-Rechtin Co., Cincinnati, O.	15 h. p., 1,130 r. p. m.	Direct drive
2	Band resaws	Cordesman-Rechtin Co., Cincinnati, O.	2 h. p., 1,700 r. p. m.	Direct drive
1	Columbia sander	Milwaukee Sander Mfg. Co., Green Bay, Wis.	10 h. p., 1,130 r. p. m.	Motor furnished with double width pulley driving to T. & L. pulley
1	24 in. planer	Whitney	10 h. p. 1,130 r. p. m.	Drive through countershaft T. & L. pulley
1	Grinder	American Woodworking Co., Williamsport, Pa.	3 h. p., 1,700 r. p. m.	Belted through countershaft
1	Bottom rounder	Whitney	7½ h. p. 1,130 r. p. m.	Direct drive
1	Conveyor		7½ h. p. 1,130 r. p. m.	Countershaft
5	Lathes	Whitney	10 h. p., 1,130 r. p. m.	Countershaft
	Sand room group		7½ h. p.	Countershaft driving [illegible] drum
1	Embossing machine	Union Embossing Machine Co., Indianapolis, Ind.	15 h. p., 850 r. p. m.	Direct drive to flywheel used with friction clutch
1	Boring machine	J. M. Nash, Milwaukee, Wis.	5 h. p., 1,700 r. p. m.	Belted to countershaft
1	Automatic chucking machine	Niagara Machine Co., Niagara Falls, N. Y.	2 h. p., 1,700 r. p. m.	Belted direct
8	Saw tables	Built by owner	1 h. p., 1,700 r. p. m.	Belted direct
2	Mortisers	L. G. McKnight & Son, Gardner, Mass.	2 h. p., 1,700 r. p. m.	Belted direct
6	Post borers	L. G. McKnight & Son, Gardner, Mass.	1 h. p., 1,700 r. p. m.	Belted direct
1	Tumbling room		7½ h. p., 1,130 r. p. m.	Group drive

The illustration shows three 30-horsepower Allis-Chalmers induction motors connected to three circular saws. The officers of the Union City Chair Company are: President and treasurer, J. C. Caflisch; vice-president and secretary, W. F. Olborg; superintendent, G. A. Stark. The electrical ma-

Railroads and Wood Preservation.

[illegible] said that more than 100,000,000 cross-ties are used annually by the railroads, while the average life of [illegible] years. Timber-testing engineers say it is reason[illegible] years may be secured by treating the tie with a good preservative and the use of improved devices for the prevention of mechanical abrasion. Similar results may be obtained by treating other wooden structures used on railroads.

[illegible] Cleveland, Cincinnati, Chicago and St. Louis Rail[illegible] committee, and C. G. Crawford, specialist in wood preservation, United States Forest Service, is its vice-chairman. The committee was divided into four sub-commitees to take up the work.

International Standardization Congress.

An international congress on electrical units and standards is to be opened in London on October 12th next. A memorandum has been drawn up which sets forth the proposals to be placed before the congress. Nine propositions are put forward, and the object of the congress may be summed up by saying that it is to consider and advise as to the steps which should be taken to bring about agreement in the definition of electrical units which form the basis of legislation in different countries and in the methods of constructing and employing the electrical standards necessary to give effect to these definitions.

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DEPARTMENTS.

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[illegible] closing number. The Index is prepared very care- [illegible]

the extended range of subjects embraced in the general electrical field to which the Western Electrician is devoted. The showing of the large amount and diversified interest of reading matter prepared for readers of this journal during a period of six months—half of a year's subscription—is one that arrests attention.

WHEN possible waterpower developments are calculated in money value some very large totals are reached, assuming, of course, that the power could all be sold if developed, which is, to be sure, a rather large assumption. Thus, according to estimates made by the United States Geological Survey, there is a minimum of about 2,800,000 indicated horsepower existing in the rivers having their headwaters in the Southern Appalachian Mountains. It is estimated that at least 50 per cent. of this indicated power is available for economic development. The rental of 1,400,000 horsepower at $20 per horsepower per year would amount to an annual return of $28,000,000. This amount is equal to a gross income of 5 per cent. on a capital of $560,000,000. Some of this power has already been developed, but a very small proportion—hardly enough to make any appreciable showing when the enormous resources of the region are taken into account.

WHAT THE man on the other side has to say should be known to everyone engaged in competitive business. It is therefore of interest to read the abstract of Mr. H. M. Daggett's paper on "High-efficiency Illuminants," presented on another page in this issue, for the author compares modern gas and electric lamps from the viewpoint of the gas engineer. The paper was presented in Boston a few days ago before the New England Section of the Illuminating Engineering Society (it is hard for some of us to realize that that society is not an exclusively electrical organization, so accustomed are we to think that illumination means electric light), and it did not bring out a great deal of discussion. But electrical men will not be disposed to agree with the author's statements either as to the quality or relative economy of the light of Welsbach lamps compared with, say, that of the tungsten electric lamp. We give part of Mr. Daggett's paper so that readers of the Western Electrician can see what these statements are.

PAY-AS-YOU-ENTER street railway cars are proving popular in Chicago unless it be with smokers. The cars have large carrying capacity, and hence there is usually a considerable proportion of men who would like to smoke. The only place where smoking is allowed is on the front platform, which is quite large and provides space for perhaps 12 or 15 men, standing, besides the motorman, who should be protected by a railing, although this is not always done. The smokers realize that they are something of a nuisance and have not been heard to complain because they are compelled to stand. But when the platform is crowded the starting and stopping of the car cause serious inconvenience, due to the lurching and jostling of the men who have no straps or handles to cling to as have standing passengers in the body of the car. There should be no difficulty in attaching loop straps to the roof of the front platform, and if this were done it would make riding there much more comfortable for those who wish to solace themselves with the comfort of the weed.

A SOCIAL EXPERIMENT which may have a considerable influence in improving the conditions of living was begun in Paris not long since in the shape of a workshop-apartment building where workmen may reside and at the same time have a shop with electric power at their disposal. The building is of brick and is seven stories high, and it contains [illegible] workshops and apartments. The latter consist of two or three living rooms with all the needed conveniences, besides a workshop having an area of 20 square meters. The whole is well lighted and ventilated. In the basement there are baths, and in the seventh story a laundry. The rent for the apartments is quite reasonable. Cheap electric power is one of the main features in this case, and it is to be had for six cents a kilowatt hour. Twelve of the shops are already occupied, together with their apartments, and some of them are used by nickel-platers and polishers. The current is taken from the city mains. A society has been formed for operating the present enterprise, and it is expected to realize three per cent. upon the outlay.

IN THE "SELLING ELECTRICITY" department of this week we give an article on "Wholesale Marketing of Electric Current in Chicago" which is worthy the attention of every central-station man. It will be seen that the Commonwealth Edison Company supplies a maximum demand of 46,000 kilowatts to electric railways in and near Chicago, while 85 of its larger industrial power customers have a connected motor load of 30,460 horsepower—an average of 358 horsepower to each installation. The total maximum installation demand of these wholesale customers is thus nearly 69,000 kilowatts—a figure which is probably unequaled elsewhere for electric power service to large consumers. The Chicago company has been a pioneer in selling current at low wholesale rates to railways and other large users, and its methods can be studied with profit. By high-class engineering, combined with energetic and intelligent selling methods, it is enabled to produce and market a tremendous volume of current at a low rate. Thus even the largest users find it advantageous to buy of the central station, with its scientific organization and great resources.

IF ALL THE PAPERS on the programme of the annual convention of the American Institute of Electrical Engineers to be held at Atlantic City from June 29th to July 2d, inclusive, are given due attention, the members present will be busy enough to be kept out of mischief. There are 34 papers on the programme, and with eight sessions it is figured that not more than 30 minutes can be given to each one. This is to include both the presentation of the paper in abstract and the discussion of the subject. This is too short a time for an important paper, and it is probable that it will be found necessary to devote less than half an hour to some of them, while perhaps others will be read by title only.

In preparing programmes for electrical conventions the field is so large and diversified that the temptation to present a large number of papers to cover it is almost irresistible. But repeated experience has shown that it would be better to have a smaller number of papers—leaving out some subjects, perhaps, in which interest is not general—thus providing greater time for discussion. It will be remarkable if the Atlantic City convention can be carried through in such a way as to give those present an intelligent idea of what each paper contains with something like an adequate discussion of it.

CITIZENS OF MILWAUKEE who are opposed to the agitation for a municipal lighting plant are pleased with a report of a committee appointed by the Greater Milwaukee Association to investigate the question of municipal ownership in that city. The committee was composed of men of standing and was admitted by all to be competent and unprejudiced. Briefly stated, the committee finds that for the city of Milwaukee to invest in a municipal lighting plant would be an act of gross business folly. Essentially, the report demonstrates mathematically that municipal lighting would cost the city far more money than it can get the service for under its contract with the private company. The city now pays $65 a year per lamp by contract, and there is a provision that whenever the city believes the price too high it can bring the matter before the state commission for settlement.

The Greater Milwaukee Association is concerned solely in the general welfare and progress of the city. Its judgment is believed to be free from prejudice and faddism and is not biased by obligation to any private interests. The committee, after exhaustive investigation based on expert estimates, comparative figures, and facts of the municipal finances, limitations and needs, decided squarely against the municipal-plant idea, which involves an expenditure of probably $1,000,000. The report should be conclusive.

Annual Convention of Canadian Electrical Association.

[illegible] of the Canadian Electrical Association [illegible] annual convention, which [illegible] Wednesday, June 17, 1908, [illegible] until the afternoon of [illegible] [illegible] in attendance were from all [illegible] the Dominion and were representative central-station men and engineers, the supply houses also being well represented. Among those present from the United States were George Williams of New York, C. R. McKay, [illegible] of Toledo, Ohio; Philip H. Hoover, Insulated Wire Company, New York, and H. P. [illegible] Underground Cable Company, New York. The delegates in attendance numbered about two hundred. The convention was a decided success, and all went away fully satisfied with the results.

Alderman J. J. Graham, on behalf of the mayor and corporation of Toronto, extended a hearty welcome to the city, and President Falconer and Professor Galbraith performed like offices on behalf of the University of Toronto. Owing to the courtesy of the two last-mentioned gentlemen the convention was held in the Chemistry and Mining Building of the University of Toronto, situated in Queen's Park.

In his annual address the president of the association, Mr. R. S. Kelsch of Montreal, pointed out that the recent financial depression had demonstrated that the electric-lighting companies were well suited to withstand such a time of stringency. As an evidence of the enormous growth of electric lighting on this continent, he said that the consumption of electric incandescent lamps for last year was $5,000,000.

The secretary-treasurer, Mr. T. S. Young of Toronto, reported that a special effort which had been made to interest a large number of light and power companies in the association had resulted in 92 such companies being represented. On February 12, 1908, a deputation from the association had waited on the Dominion government, and in consequence the registration fee for inspecting gas and electric meters had been abolished, effecting a saving to the lighting companies of $6,000. On the question of the reduction in the fees charged for the inspection of electric-light meters the government decided to wait for some time in order to ascertain how the revenue and expenditure would balance after having carried out certain improvements in the service. The policy of the government is to make the service self-sustaining, not to produce a profit.

Mr. Young thought that the question of duty on carbons was one which might be discussed at the convention, as the value of carbons imported into Canada was approximately $40,000 a year, which represented a duty of $14,000, which he considered to be an unjust burden placed upon the lighting companies.

Mr. Young's report showed that the last year had witnessed a substantial increase in membership, 120 new members having joined during the year, and the membership now standing at about 400.

The managing committee, to which was due the success of the convention, was composed of Messrs. R. G. Black of Toronto, A. A. Dion of Ottawa, B. F. Reesor of Lindsay, Ont., C. B. Hunt of London, Ont., J. M. Robertson of Montreal, J. J. Wright of Toronto, W. Williams of Sarnia, Ont., H. O. Fisk of Peterboro, J. W. Purcell of Walkerville, Ont., and J. G. Glassco of Hamilton. The efforts of these gentlemen were ably seconded by the president, Mr. R. S. Kelsch, and the secretary, Mr. T. S. Young, and everything was done to make the visit of the delegates interesting and profitable. Fine weather attended the convention throughout. The majority of the papers presented elicited a large amount of discussion, and the delegates went away profited by the information which they had obtained.

Wednesday was devoted to the reading and discussion of the following papers: "Power Rates and Factors Which Influence Them," by W. N. Ryerson of Niagara Falls; "How to Increase the Station Load," by George Williams of New York; "Lost and Unaccounted-for Current," by C. R. McKay, and "Various Electrical Power Plants by European Designers," by C. H. Mitchell. Mr. Mitchell's paper was written as the result of a recent visit to Europe. He pointed out that Canada's wealth in waterpowers was an asset to be seized upon and developed to the utmost advantage according to the expansion of the country.

Among the low-head plants described by Mr. [illegible]

Another interesting plant is that at Vigevano, near Milan, the electrical city of Central Europe, [illegible] 61 feet. The power from this station is used in [illegible] sumption, based on a flat rate and on a 24-hour day, average about $31 per horsepower-year, with [illegible] a ton.

Mr. Ryerson, in his paper on "Power Rates and Factors Which Influence Them," dealt with the flat-rate, the meter-rate and the sliding-scale methods of charging for power, and mentioned a fourth method which was termed second-class power. He said: The factors which have the greatest influence upon the rates to be charged are: First, the distance of the customer from the source of supply; second, the amount of power the customer desires to use; third, the character of the customer's load—whether steady or intermittent, and, if the latter, the time, frequency and duration of peaks, or, in other words, the load factor; fourth, the average power factor, and, fifth, whether the load will be balanced or unbalanced.

Mr. George Williams, in his paper, gave many hints on how to increase the number of users of electric light and power. He advocated newspaper publicity, and said: "The public must first be made familiar with what we have to sell and know its advantages before a demand for the product can be expected. In the smaller cities this process of education may be quickly carried on with very small investment, but in the larger cities a campaign of newspaper and other printed advertising and publicity would be necessary if quick results are desired."

Mr. Williams illustrated, by means of lantern slides, the growth of illuminated-sign lighting, outline lighting and decorative lighting in the large cities and towns of the United States.

On Thursday A. E. Fleming, W. A. Bucke and W. G. Chace contributed papers, respectively, on the following subjects: "Modern Street Lighting," "Electrical Plant Earnings per Capita" and "Regulation of Electric Currents or Circuits." Papers were also given by James Bicknell, K. C., on "Electrical Franchises," and by Robert McKay on "Contracts."

The paper by Mr. Fleming on "Modern Street Lighting" produced considerable discussion on the respective merits of the tungsten and Nernst and flaming arc lamps, and also other forms of open and enclosed arc lamps.

In the absence of Mr. Chace, R. G. Black gave an outline of the former's paper, and illustrated, by means of slides, the various forms of current regulators in use at the present time.

Mr. Bicknell defined a franchise as a privilege of a public nature conferred by legislative authority. He pointed out that the question of who owned the highway was an important one, as the electric companies are compelled to use the public highways in carrying out their business. It had been contended by the municipalities that the streets and highways are the property of and under the control of the provincial legislatures, and that therefore the Dominion Parliament could not interfere, but this contention had been negatived, and it is now clearly settled that the Dominion Parliament has the right to confer upon any company, properly constituted or incorporated by Parliament, powers over the streets and highways of any municipality in Canada. If a municipality entered into a contract with the Hydro-electric Commission, he said, the provisions of the Conmee Act did not apply, but he thought that if a municipality strove in good faith to live up to all the provisions of the Hydro-electric Commission's contract it would not be able to supply light, heat or power at as low a rate as a private electrical company efficiently and economically managed.

The basis of valuation in the case of a telephone company expropriated by a municipality would be its net earnings, with an allowance for the fran-[illegible]

"The National Electrical Code" was the subject [illegible]

Perhaps the most interesting feature of the con-[illegible] Toronto.

On Friday at 1 p. m. an association luncheon was given, followed by an illustrated lecture by R. J. Clark on the large power plants of America. [illegible] work on the American continent, notably at Sao [illegible]

A number of interesting exhibits were made, the principal exhibitors being the Canadian General Electric Company of Toronto, the Gas and Electric Power Company of Toronto, the Canadian Westinghouse Company of Hamilton, the Joyner-Greene Company and the Canadian Fairbanks-Morse Company.

Among the social features provided were: A moonlight excursion by the steamer Cayuga on Lake Ontario, a trip by special cars to Scarboro Beach Park and a baseball match at Hanlon's Point between the nines representing the manufacturers and the operating companies.

Those wearing the association's badge, which consisted of a maple leaf set in enamel, surrounded by the words "Canadian Electrical Association," were entitled to visit the various power stations and distributing plants in the city, and were also given free transportation by the Toronto Railway Company. A free telephone service was provided by the Bell Telephone Company for the use of the members during the convention.

The election of officers took place on Thursday afternoon and resulted as follows:

Pesident—W. N. Ryerson, general superintendent, Ontario Power Company, Niagara Falls, Ont.

First vice-president—R. M. Wilson, general superintendent, Montreal Light, Heat and Power Company, Montreal.

Second vice-president—R. S. Coate, Chatham Gas Company, Chatham, Ont.

Secretary-treasurer—T. S. Young, Toronto.

Managing committee—As previously mentioned, except that W. A. Pearson of Niagara Falls and R. S. Kelsch of Montreal succeeded Messrs. Robertson and Glassco.

It was left to the managing committee to decide upon the place for holding the next annual convention.

William Arnold Anthony.

The resolutions adopted by the directors of the American Institute of Electrical Engineers in honor of Past-president Anthony are as follows:

Whereas, In the death of Prof. William Arnold Anthony, who departed this life on May 29, 1908, the American Institute of Electrical Engineers has lost one of its earliest members, who throughout the formative years of the Institute served it devotedly as member and as president; and

Whereas, He was a pioneer among electrical engineers and in the cause of technical and scientific education in America; a teacher of rare ability and power to whom a host of pupils, now active in science and its applications, owe their first inspiration; and

Whereas, His skill as an experimenter, his enthusiasm, insight and devotion as a man of science commanded universal admiration, while his sterling character, single-mindedness, warmness of heart and generosity endeared him to all who knew him;

Be it Resolved, That the American Institute of Electrical Engineers expresses its sense of the great loss which the engineering profession and the cause of science has sustained in his death; and

Be it further Resolved, That these resolutions be entered in full in the Proceedings of the Institute and that copies be forwarded to the surviving members of his family.

Annual Convention of the Institute.

[illegible] of the American Institute [illegible] will be held at the Hotel [illegible] Atlantic City, beginning on June 29th [illegible]. A long list of papers [illegible] has been prepared for discussion. Following are the names of authors and subjects:

[illegible]—"[illegible] Voltage [illegible] Synchronous [illegible] Reference to the Split-Pole Con[illegible]."

[illegible] A. W. [illegible]—"A New Method [illegible]."

[illegible]—"[illegible] Development [illegible]."

[illegible] A. B[illegible]—"A New [illegible] Generator for [illegible] Falls."

[illegible] A. [illegible]—"[illegible] of the Manufacturer [illegible] the [illegible] Graduate."

6. Ernst J. Berg—"Tests with Arcing Grounds and Con[illegible]."

7. J. R. B[illegible]—"Steam Turbine Plant [illegible] bilities Resulting from Recent Engineering Developments."

8. J. R. [illegible]—"[illegible] Test [illegible] Power Plant. Discussion of Results in Relation to Cost of Power."

9. [illegible]—"Three-phase Power Factor."

10. W. Lee Campbell—"A Study of Multiple Automatic Switchboard Telephone Systems."

11. [illegible] Creighton—"Measurements of Lightning Aluminum Lightning Arresters, Earth Resistances, Cement Resistances, and Kindred Tests."

12. Carl J. Fechheimer—"The Relative Proportions of Copper and Iron in Alternators."

13. R. A. [illegible]—"Wireless Telephony."

14. S. B. Fortenbaugh—"Conductor Rail Measurements."

15. J. W. [illegible]—"Engineering Features of the Southern Power Company's System."

16. C. M. [illegible]—"Electricity as Viewed by the Insurance Engineer: Should the A. I. E. E. Interest Itself in Fire Protection?"

17. R. F. [illegible]—"Graphical Treatment of the Rotating Field."

18. Carl Hering—"An Imperfection in the Usual Statement of the Fundamental Law of Electromagnetic Induction." (With discussion by letter.)

19. A. E. Kennelly and S. E. Whiting—"The Measurement of Rotary Speeds of Dynamo Machines by the Stroboscopic Fork."

20. Ralph D. Mershon—"High-voltage Experiments at Niagara."

21. Harold Pender—"A Minimum-work Method for the Solution of Alternating-current Problems."

22. D. B. Rushmore—"The Relation of the Manufacturing Company to the Technical Graduate."

23. D. R. Scholes—"Fundamental Considerations Governing the Design of Transmission-line Structures."

24. C. E. Skinner—"The Testing of High-voltage Line Insulators."

25. H. C. Specht—"Induction Motors for Multispeed Service with Particular Reference to Cascade Operation."

26. C. P. Steinmetz—"The General Equations of the Electric Circuit."

27. C. P. Steinmetz—"Primary Standard of Light."

28. H. G. Stott—President's address.

29. Chas. E. Waddell—"Notes on the Electric Heating Plant of the Biltmore Estate."

30. Girard B. Werner—"The Determination of the Economic Location of Sub-stations in Electric Railways."

31. W. L. Waters—"Modern Developments in Single-phase Generators."

32. J. B. Whitehead—"From Steam to Electricity on a Single-track Road."

33. Jens Bache-Wiig—"Application of Fractional-pitch Windings to Alternating-current Generators."

34. J. Lester Woodbridge—"Application of Storage Batteries to Regulation of Alternating-current Systems."

The morning session of Monday, June 29th, will be begun at 11 a. m. There will be an afternoon session at two, and a reception followed by a dance in the evening at the Hotel Traymore. On Tuesday there will be a morning session at 9:30. In the afternoon there will be a tea at the Atlantic City Golf Club. An evening session will be held. Morning and afternoon sessions will be held on Wednesday and Thursday. The convention committee consists of W. C. L. Eglin, 1000 Chestnut Street, Philadelphia, and Charles Day, J. J. Gibson, Nathan Hayward, H. F. Lanville and Paul Spencer, all of Philadelphia.

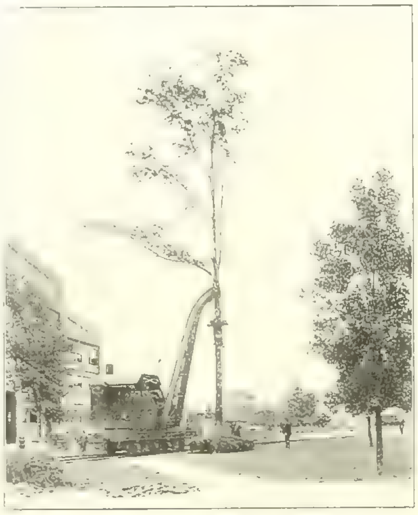
New Home for the Buffalo General Electric Company.

The Buffalo General Electric Company of Buffalo, N. Y., will erect a new building of its own [illegible] every modern convenience. It will [illegible] eight stories high with a high basement. In the basement will be placed a modern substation [illegible] of the surrounding territory. Special attention will be given to providing for elaborate display quarters where electrical appliances [illegible]

[illegible]

Transplanting a Tree by Locomotive Crane.

As part of its constant effort to beautify its factory grounds, 25 acres in extent, at Ampere, N. J., the Crocker-Wheeler Company has moved several large trees and replanted them in different locations on the property. On June 11th an oak tree 60 feet high, as shown by the accompanying



TRANSPLANTING 65-FOOT OAK BY LOCOMOTIVE CRANE.

illustration, was lifted by means of the Crocker-Wheeler locomotive crane, carried about 200 feet and replanted near the new postoffice, which is being built on the company's property. The handling of this large tree and the ball of earth in which the roots were embedded involved a nice calculation as to the center of gravity of the tree. The work was accomplished, however, without mishap. The C-W factory is becoming one of the "show plants" of the country.

Electric Dock Hoist.

A striking example of time saving through the use of a modern electric hoist comes from the Pacific Coast, where, in the yards of the Commercial Boiler Works in Seattle, a 65-ton boiler was raised from the dock and placed in position in the hold of the steamship Pennsylvania in the short space of 20 minutes. The illustration shows the boiler about to be placed in the hold.

The plant of the Commercial Boiler Works, engaged in the manufacture of marine boilers and in handling ship repairs, has its machines equipped with individual-motor drive, and to facilitate the loading of heavy materials it was found necessary to install electricity in the yards as well. The hoist used was supplied by the Lambert Hoisting Engine Company, and is driven by a 40-horsepower, type K Westinghouse direct-current motor controlled by a drum-type controller, affording nine forward and nine reverse speeds. From the drums of the hoist a ¾-inch steel cable runs to the top of the shear

[illegible]

legs, where it reeves through a set of blocks capable of lifting from 75 to 90 tons.

The boiler, which was lifted and placed in position in 20 minutes, was one of the largest ever built in Seattle. The worm-gear hoist, which was previously used, would have required three hours' time to raise the same load. A 15-ton boiler was recently loaded by the Lambert hoist in 4½ minutes.

The power which drives the hoist and the motors in the shop as well, is purchased from the Seattle-Tacoma Power Company, being transmitted by a two-phase line at 2,300 volts. It is utilized on the dock as direct current and in the shops as alternating current for two 50-horsepower motors driving heavy rolls, one 50-horsepower motor driving an air compressor and various small motors, all of standard Westinghouse manufacture. A motor-generator set is installed in the shop to supply the necessary direct current for the hoist.

A Modern Cement Plant in Alberta.

Forty-eight miles from Calgary, Canada, and surrounded by the small industrial town of Exshaw, named after one of the company's active directors, are situated the great new Portland-cement mills of the Western Canada Cement and Coal Company. The plant, comprising 15 buildings in all, has an approximate floor space of 3¼ acres and a daily capacity in finished product of 2,000 barrels. It is, without doubt, the largest and best equipped of its kind in the Dominion. The company owns over 1,200 acres of limestone quarries, from which the present plant may be supplied for a period of 500 years. The stone is of high grade and is quarried from solid rock by means of electric drills.

After being crushed, dried and ground, the limestone is carried to the mixing bins. At this stage of the process the chemist starts his analyses on samples taken every half hour from each bin. A constant check is thus kept on the quality of the limestone that goes to the mixing troughs. The next step in the process is the mixing of limestone with the shale. The Exshaw works are fortunate in having two separate and distinct qualities of clay to draw upon. Analyses are made of the clay as of the limestone, and the results form the basis for calculating the percentages of each to be used. The completed mixture, consisting of approximately 20 per cent. clay to 80 per cent. rock, is carried to the battery of tube mills, 16 in all, driven by means of electric motors.

The power-house equipment for this plant is typical of the best modern practice in every respect. Three Allis-Chalmers 1,000-kilowatt steam-turbine-generator units have been installed, each to generate current at 60 cycles, three-phase, at 600 volts. These turbines are driven by steam from Babcock & Wilcox boilers, using coal brought from the company's own mines. The current generated by the turbo units is devoted entirely to power purposes; the lighting load, consisting of some 40 arcs and 400 incandescents, is carried by the exciters. The Western Canada plant represents an investment of approximately a million and a half dollars. Sir Sandford Fleming, K. C. M. G., is president and Mr. P. D. MacKinnon is general manager.

The Contractors' Convention.

Preparations are nearing completion for the eighth annual convention of the National Electrical Contractors' Association. It is expected that this will be the largest meeting of the association. The dates are July 15th, 16th and 17th, and the headquarters and meetings will be at the Auditorium Hotel, Chicago. An excellent business programme is being prepared and some interesting discussions are assured. In the way of entertainment the members and guests will be well taken care of. This year the plan of entertainment has been put on a business basis, and all tickets for entertainments will be paid for individually at the time of registration. The full programme and further details will be printed later. Mr. C. R. Kreider, Fisher Building, Chicago, is chairman of the local committee. Mr. W. H. Morton, 94 Genesee Street, Utica, N. Y., is secretary.

Municipal Perplexities in Garrett, Ind.

It is said that the municipal electric light and water plant of Garrett, Ind., is no longer capable of meeting the demands placed upon it, while to put it in shape will require at least $15,000. The proposition of the majority of aldermen to add $15,000 to the city's debt is meeting with opposition by citizens, who contend that the plant has never been self-sustaining, much less capable of putting aside a fund for repairs and enlargements. They are opposed to municipal ownership and demand that the business be turned over to a corporation.

THE INSTALLATION, LABORATORY TESTING AND REPAIRING OF ELECTRIC METERS.

By [illegible]

The Repair Shop.

[illegible]

[illegible] in the maintenance and repair of meters and instruments but [illegible] the testing boards, lamp banks, etc., and for the making of special supports for installing meters, and other outside jobs for the meter department.

METER REPAIRS.

In the repair shops of large meter departments the carrying of a full line of spare meter parts, armatures, shunt-field coils, resistance cards, frames, etc., makes it possible to attend to repairs without having to return a defective meter to the manufacturer. The shop equipment also includes means for making over old pivots, small motor-driven winding machines for rewinding direct-current meter armatures and shunt fields, etc. These machines are similar to those used at the meter factory. Old-style armatures, if any such are in service, are wound with silk-covered wire or "cellulose-acetate" wire; new-style ones with the latter kind of wire only. Armatures and fields, when repaired or rewound, are put through a regular factory inspection.

A neat device for cleaning and polishing worn meter pivots may be made by using a small electric motor—a one-tenth or one-eighth horsepower, 1,200-revolution fan motor, with fan removed, answers well set on a convenient bench. The motor is to have a meter shaft-end for holding the pivots centered in one end of its shaft, and a hard rubber or fiber bushing of fairly large diameter fast on the shaft to bring the meter to rest quickly with the hand when the switch is opened. A standard pivot wrench is used to insert and remove the pivots.

With this rig a large number of pivots can be handled in an hour and made as good as new. The following abrasives and polishing agents, used dry, may advantageously be employed, in the order given:

Oilstone or slip, to repoint the pivot.

Strip of "Parton," crocus or 0000 emery paper on a small stick of soft wood.

"Diamantine," on a boxwood stick.

After using the last-named, which gives a high polish, the pivot is cleaned with a bit of cornpith before removing from the motor.

THE REHABILITATION OF THE OLD-STYLE METER

One of the most important functions of the repair shop is the rehabilitation of the old-style meters to enable them to keep pace with the advance of the art, thus keeping in service many old meters that would otherwise have to be consigned to the scrap heap. The experience and investigations of the central-station meter departments (large and small) have had a beneficial influence on meter and indicating-instrument manufacture by suggesting new improvements in meters and instruments and in testing methods. Some of the improvements that have been incorporated in the design of modern meters have also been embodied in the form of attachments or appliances that can be applied to old-style meters.

Among the most prominent of these appliances, many of which have been developd by the initiative of the central-station companies, are the adjustable friction-compensating coil for direct-current meters, the cup-diamond jewel, and a means for remounting the damping magnets, which in old-style meters were disposed parallel to the axis of the field coils, at right angles to that axis. Such refitting of old supply meters may often be done on the consumers' premises, without removing the meters to the repair shop.

TRAINING OF METER INSPECTORS.

The keeping in good order of the tools and special apparatus used in testing at consumers' installations may also be done at the company's repair shop. New men may advantageously be put [illegible] tical education in the general mechanical and electrical work of the meter department. Such a course makes the men conversant with the construction and operation of the various types of meters [illegible] expert meter testers.

[*The end.*]

NOTE.—This serial article, begun in the Western Electrician of April 4, 1908, is an advance publication of a portion of a forthcoming book by Mr. Baker on the general subject of "Electric Meters." It will be understood that the present serial refers to watt-hour meters used on customers' premises.

QUESTIONS AND ANSWERS.

Loading Generators.

C. P. A., Effingham, Ill.: We have two 85-kilowatt, 60-cycle, two-phase generators developing 2,200 volts and direct driven in parallel by two oil engines. At certain times of the day our load drops as low as seven amperes, while it is best for the engines that it should not go below 15 amperes. We have no large transformer near the plant, so we made a 2,200-volt water rheostat. This threw on about 45 horsepower, however, and steadily worked higher. We have no running water, or it might have worked all right. What other form of resistance or method of loading up the generators could we use?

ANSWER.

Any loading of the machines with a water or other form of rheostat is a pure loss of energy in heat unless this heat is utilized. If heat can be made use of, it will pay to have a special heating rheostat built. The inquirer does not state whether the plan of shutting down one engine unit when the load is light has been used. If even with this practice the load is too light, some plan of securing a temporary but paying load, such as for pumping water, should be sought. If nothing of this kind can be secured perhaps the following plan could be used:

Connect up 20 ordinary 16-candlepower incandescent lamps in series and put 15 such rows across the 2,200-volt mains. By having a switch in each row, this load can be added in one-half-ampere steps at a time. This arrangement would require 300 lamps, but is not as expensive as it seems, for lamps that have been collected for renewal on account of dimness can be used satisfactorily for this service till they finally burn out. The only expense would be for sockets and wiring, and this could be made to repay itself by arranging the lamps as an advertisement of the company's service (unless, of course, the lamps are so dim that such an advertisement would be undesirable), or placing them where their light would be beneficial.

Current in a Solid Conductor.

E. G. C., South Chicago, Ill.: Does electricity travel over the outside of a wire or does it travel through the interior bulk as readily as it does on the surface? Would a person sealed up inside of a copper ball be shocked or killed if this ball were cut in on the highest tension of alternating current or direct current?

ANSWERS.

Any direct current passes uniformly through all parts of the cross-section of any continuous metallic conductor whether solid, hollow, regular or irregular in cross-section. This is shown by the fact that the conductivity varies directly as the area of cross-section; i. e., a wire twice the diameter of another can carry four times as much current and has only one-fourth the resistance of the smaller wire.

With alternating currents of low frequency the same rule is practically true. As the frequency increases, however, more and more of the current is carried by the surface, especially with large conductors. At a frequency of 1,000 cycles per second the interior of a large conductor carries very little current. This peculiarity is known as "skin effect;" it is very much more marked with iron conductors, such as rails, than with copper conductors.

A person sealed in a copper ball that was put in series in any circuit would not experience any injurious or unpleasant effects due to the electric current because copper is such a good conductor that there would be practically no difference of potential between any two points in the ball and

[illegible]

Specific Gravity of Sulphuric Acid.

[illegible] distilled water.

[illegible]

Frenchmen at the Telephone.

[illegible] the French minister of telephones admits the pain [illegible] of getting Central by merely taking down the receiver. The reasons for the failure are both characteristic and conclusive. The Central employes take their time as of yore in responding, but while waiting the subscriber has no little crank by which to express his pent-up emotions. We suspect, however, that the failure of the American method is really due to less obvious but more fundamental reasons—the French system is entirely wrong at Central, and this wrong is augmented by the vain attempt to vocalize French numerals.

Getting Central in Paris is an easy task when compared with getting the number you want. When, after repeated turns of the crank, you finally manage to attract the young woman in charge of your district, the real excitement begins, provided you are not cut off at once by the glib phrase, "Pas libre" (busy). In Paris the districts bear numbers, not names, and the operator calls out to her companions the number of the subscriber you desire as well as the number of his district. Now this method, although somewhat vociferous and confusing, might possibly be all right in several languages. Unfortunately, French is not one of them. "Six" (six) and "dix" (ten) are often confused, as are "vingt" (twenty) and "cinq" (five). And so the operator, in repeating, adds with emphasis, "Deux fois cinq" (twice five) or "Deux fois dix" (twice ten), and here, again, is the inevitable confusion of "cinq" and "dix."

In the meantime the subscriber is waiting. When at last he gets a number he often finds that it is not the one he wants, and that he has disturbed an impolite stranger, who does not hesitate to make him aware of the error in that vituperate language, which is one of the strong points of French. Sometimes he resents the expletives hurled at him, but, in all events, he keeps them in mind for future personal use when he himself is called up in the small hours or interrupted in social diversions with, "Why don't you send the count his clothes?" or, "Remember, my little dear, after the theater, at 11—Café Américain—yes."

Foreigners, particularly Frenchmen, in this country express themselves as charmed with la baterie Américaine, but that is because they readily conform to the system which allows it to be used with perfection. They complain, however, that our charges are excessive, and that telephones are not as accessible as in some European countries. In Norwegian and Swedish towns, for example, even the local tariff is according to distance. For one, two and three cents you can cover as large an area as you can in New York for five. In Christiania and Stockholm there are telephone stations at convenient intervals along the street where, for one cent, you can summon a cab or talk with a friend who lives within a mile of the telephone you use. People, it has been said, get the government they deserve. It is probably true that they also get the telephone in a similar manner—modified, perhaps, by exigencies of temperament and language.—From the New York Times.

Prussian Railroads May Use Westinghouse Traction System.

A Berlin dispatch of June 21st says that the Westinghouse interests in Germany have formed a combination with the Bergmann Electric Company of Berlin, whereby the latter will install the Westinghouse traction system in that country. The agreement is said to have been reached for the purpose of furnishing the requirements of the Prussian state railway administration, which has decided to electrify the steam railways, $12,500,000 already having been appropriated to begin this work. Sigmund Bergmann, the head of the Bergmann company, was associated with Thomas A. Edison for a number of years. The company has works in Berlin employing 5,000 men, it is said.

SELLING ELECTRICITY.

[illegible] articles, suggestions and examples which will be of assistance in the [illegible] existing demand for electric current and to create new demands.

Wholesale Marketing of Electric Current in Chicago.

During the last two years and particularly within the last few weeks, the Commonwealth Edison Company of Chicago has closed contracts whereby it supplies current for power to every street and elevated railway in Chicago except one. Inasmuch as all, or nearly all, of these companies have generated their own current, this feat is a remarkable one, and demonstrates very clearly the extraordinary efficiency of the great Fisk Street generating plant of the central-station company which makes possible the low price at which current can be sold—evidently lower than these important transportation companies can make it for themselves.

The most important of these railway customers is the Chicago City Railway Company (South Side surface lines), which is supplied with 20,000 kilowatts. Just as soon as the railway company can provide the necessary sub-stations its present generating plants will be shut down entirely, and the total ultimate demand from this one customer of the central-station company will be no less than 40,000 kilowatts.

The Chicago Railways Company (North Side and West Side surface lines) takes 10,000 kilowatts, and ultimately will require much more, as the various old generating plants are gradually shut down.

The Chicago and Oak Park Elevated Railroad Company requires approximately 5,000 kilowatts. This company does not generate any current at all.

The Metropolitan West Side Elevated Railway Company takes about 4,500 kilowatts. In addition, this company produces a large amount of current in its own generating plant.

The Northwestern Elevated Railroad Company is supplied with about 4,000 kilowatts from the central station. It will take more as soon as it can provide necessary sub-stations.

The North Shore Electric Company, which is itself a central-station company, doing business outside of the city limits of Chicago, is a customer of the Commonwealth Edison Company to the extent of about 1,500 kilowatts. This current is purchased at wholesale, and much of it is resold to operate the Chicago and Milwaukee electric interurban railway. Before long, the North Shore company will take much more current than it is now taking.

The Illinois Tunnel Company, which operates the electric freight tunnels under the streets in the central portion of Chicago, takes about 1,000 kilowatts to supply current to its locomotives.

Thus seven customers of the Commonwealth Edison Company now take an aggregate of 46,000 kilowatts for the purpose of operating electric railways.

All of these customers buy 9,000-volt, 25-cycle current at the switchboard at the Fisk Street power house. They transmit the current to their own sub-stations, where they transform it and distribute it as suits their own convenience.

In selling current to these large users it is evident, of course, that a very low rate must be made, else the electric railways would generate power for themselves. The method of charging is this: A primary charge of a certain amount per maximum kilowatt per year is made. In addition there is a secondary charge of a certain amount per kilowatt-hour. The first charge covers interest and fixed charges on investment; the second charge covers operating expenses. A guaranteed load factor [illegible] is required, and at the present [illegible] from $20 to $50 per [illegible]

[illegible]

of these no less than 85 have motor installations of 100 kilowatts (133 horsepower) or over. The total capacity of these 85 motor plants is 30,460 horsepower, or an average of over 358 horsepower each, showing that they are large plants. These installations are of the most diverse description, embracing department stores (which use a large amount of power for elevators, fans, pumps and other purposes), warehouse plants, newspaper offices, large metal-working establishments, foundries, electrical works and factories and manufacturing establishments of all kinds.

The secret of this remarkable record may be discovered easily. By combining on a scientific basis good engineering and good selling the Commonwealth Edison Company has been enabled to reduce the selling price of electricity at wholesale until it can sell at a fair profit to the very largest consumers current cheaper than these customers can make it themselves. To do this in its own community should be the aim of every central station the whole country over.

How Scranton Met the Business Depression.

From the paper on "Evolution of New-business Building," prepared by George N. Tidd and Duncan T. Campbell and read at the recent Chicago convention of the National Electric Light Association, the following is taken:

At the first shadows thrown over the country by the financial stringency, from which we are just recovering, many central stations, forgetting exactly what had been gained by them through a progressive commercial department, withdrew their selling forces from the field of their activity and in this way not only lost many and valuable customers immediately, but imperiled their present business.

The men who created the first new-business departments recognized the fact that their advantage lay quite as much in retaining what business was connected as in getting new consumers connected to their lines. These men, probably through experience, realized that with a public-service corporation the greatest danger lay in separating itself too far from the people, hence they filled the commonly existing gap with representatives skilled not only in new-business getting, but in making friends. As a normal and logical consequence, a great deal of the company's business was subject to the individuality of the representatives, and when this powerful factor was discharged, the customer, reacting as by the example of the lighting company, withdrew some of his expenses, for the first item to be cut by the smaller merchant is invariably electricity.

So large an institution as the Commonwealth Edison Company, as well as central stations in towns of 5,000 population, profited by maintaining their new-business departments.

Geographical conditions do not appear to affect the question.

A conspicuous example of quick and effective results under similar conditions is that of the Scranton Electric Company. Carrying a new-business force of 12 men, it not only used these representatives during the depression, but kept up its newspaper advertising, also indirect advertising, and, above all, its nerve. The officers probably figured that keeping up appearances was about their best asset. The city and its suburban neighbors were redivided into districts, and new energy was infused into the new-business force by a grant of wider authority. The representatives were practically made managers of their several districts and given to understand that the officers would look to them not only for results in additional business, but for maintaining the efficiency of the present business as well. As a perfectly natural consequence these representatives looked deeper into the affairs and conditions of their districts, became more familiar with them, and produced new business far in excess of all expectations.

While it may be argued that a large percentage of this increase was a natural result of the work that had gone before, it must be realized that if a depression is serious enough to visibly affect a central station, it will hit the average man in the same proportion, and in all probability he will feel the blow more. The representatives in Scranton [illegible] that their company was [illegible] that it was there to keep [illegible] in providing its distrib[illegible] and that it would [illegible] all the new business that could [illegible] The representatives [illegible] had done, pointed to what [illegible] the marked air of [illegible] which the city had assumed [illegible] They had proved that electricity was the perfect illuminant up to the hard times, and they stuck to the fact that these same hard times could not possibly impair its value.

Of course it will be admitted that the personality of the representative was 90 per cent. of the means to this end, and that it was a guess on the part of the central station as to its efficiency in the face of tight money. That is a fact; but the company figured that business kept was business gained, and it relied upon that self-same personality to retain that business.

The advertising was specialized, and the copy was made to talk hard, cold sense. As a consequence, when an advertisement bearing the signature of the Scranton Electric Company was read, it carried with it the perfect assurance that it was true. The result of this specializing and clean-cut work, added to the increased efficiency of the representatives, was the increase of new-business returns to a figure scarcely credible and reduction to an absurdly small fraction of the cut-off orders issued to the distribution department. Incident to the Scranton campaign—when the property was acquired by its present owners a year ago—the president publicly assured the citizens that the policy of the new-business campaign would inspire a civic pride which would revolutionize the general appearance of the business districts, not only from a lighting standpoint, but in other features.

The prediction has been more than fulfilled. Scores of new store fronts have been installed within the last year, and the city has established a national reputation for progressiveness.

Inspiring News from Hastings, Mich.

At the Chicago convention of the National Electric Light Association, Mr. F. H. Plaice, manager of the Thornapple Gas and Electric Company of Hastings, Mich., contributed the following to the "Evolution of New-business Building" department, edited by George N. Tidd and Duncan T. Campbell:

"The Thornapple Gas and Electric Company of Hastings, Mich., is a small transmission company with long lines in a sparsely settled country serving less than 10,000 people in four towns. We, with others, felt the effects of the sudden hard times. Unlike some of our more powerful neighbors, we redoubled our efforts instead of laying off our men, and this force has had to be enlarged.

"For the five months ending April 1, 1908, we have closed power contracts with 21 customers, installing therefor 48 motors aggregating 414 horsepower, the increase in connected horsepower for the period named being 160 per cent. In doing this we have displaced six steam engines ranging from 6 to 150 horsepower, eight gasoline engines ranging from 2 to 15 horsepower and one 15-horsepower waterwheel. One of these contracts will require us to arrange for the delivery of 200 additional horsepower by July 1, 1908, and by the time this is in your hands we shall have closed another contract for 80 horsepower.

"During the same period we have increased our lighting services by 22 per cent., the increase being 135 customers, totaling over 3,000 16-candlepower units equivalent, putting 10 gasoline lighting plants out of business and one 30-kilowatt isolated plant. We have been handicapped in the lighting field by a change from a flat-rate basis toa meter, with the accompanying disturbances, but our earnings show a very satisfactory gain over corresponding period of last year.

"Owing to the change in selling basis, we have not tried to push spectacular or sign lighting, but have devoted our energies to the pushing of residence lighting and power. The present outlook is that this will be our policy for the balance of the year, and the indications are that our power load will show not far from 300 per cent. increase for the year."

Good Service Imperative.

In writing to thank us for information furnished him in his effort to prevent his city being saddled with a municipal lighting plant the editor of an Ohio paper says:

"While we have fought against municipal ownership because of its fallacies, we realize the company has been working for municipal ownership by giving very bum service."

It goes without saying that the people of this country will not long stand for poorer service than they have a right to expect. Sometimes, of course, the demand is too small to make first-class service commercially possible; but there are unfortunately instances where the service is inexcusably bad. It is not right that the only alternative to enduring such a service should be municipal ownership with the train of evils it entails. That is why men who are both progressive and conservative are advocating the establishment of state commissions with power to compel adequate service under penalty of loss of franchise. The average intelligent citizen is opposed to municipal ownership save as a last report. He shouldn't be driven to it by bad service, and a strong [illegible] of broad minded men will see to it that he isn't.—From "Concerning Municipal Ownership."

High-efficiency Illuminants from the Gas Engineer's Viewpoint.

[illegible] on June 10th [illegible] devoted to [illegible] Illuminants [illegible] [illegible] Mr. [illegible]

[illegible] Improvements, however, generally work out to the ultimate advantage [illegible] lamps and [illegible] to still further become perfected, increasing their value to the consumer, and resulting in larger sales by, and [illegible]

It is well to study some of the features of the most efficient [illegible] of operation. Particular types chosen for comparison are the tungsten and tantalum electric and the inverted gas lamp and the so-called gas "arc lamp."

The speaker then described the four types of lamps. He said that the inverted type of incandescent gas lamp [illegible] vancement of gas lighting. In general, the burner and mantle are in substance the same as the familiar upright-mantle burners adapted, however, to burn in the inverted [illegible] a combination is [illegible] hemisphere, and 67 per cent of the total light [illegible] thrown downward without the [illegible] reflectors. The upright burners with reflectors distribute 55 per cent. of the total light above the horizontal. The great advantage of this one point can be readily appreciated. The many points of superiority in the single inverted gas lamp have indicated to manufacturers the desirability of making a larger unit of this general type. In a short time so-called inverted gas "arc lamps" of medium and large candlepower will be on the market, embodying all of the excellent features of the single inverted lamps, which will place them on the same high-efficiency basis. There is only one size of the inverted lamp, namely, the one rated at 75 candlepower, which value relates to the maximum light obtained in one direction, the vertical. This value is obtained without the aid of reflectors. This lamp consumes not over three cubic feet of gas per hour, the specific output being 25 candlepower-hours per cubic foot of gas. The life of the mantles used is not guaranteed, as they may be easily broken by mechanical shock, but, from experience in maintaining the lamps, it is known that 600 hours is a fair average, in which time the candlepower will not decrease by more than 20 per cent. Unlike electric filaments, mantles never burn out. Mechanical breakage usually determines their life, although it is generally economical to renew unbroken mantles after about 800 hours of use.

TABLE OF LAMP DATA AND COMPARATIVE COSTS.

	Gas		Electric	
	Arc	Inv	Tantalum	Tungsten
1. Rate per 1,000 cu. ft. and per kw. hour	$1.00	$1.00	$0.10	$0.10
2. Consumption in cu. ft. per hour, or watts	18.8	3.0	40.0	60.0
3. Rated candlepower	375	75	20	48
4. Rated specific output or specific consumption	20	25	[illegible]	[illegible]
5. Mean spherical cp. of unit (Tant 40 watt, Tungsten 60 watt)	228.7	54	12.8	36.6
6. Specific output or consumption based on mean s. cp.	12.16	18.[illegible]	[illegible]	1.64
7. Mean lower hemispherical cp. of unit	244.0	70.6	16.4	39.36
8. Specific output or consumption based on mean l. h. cp.	12.07	23.53	[illegible]	[illegible]
9. Hours life of unit	400	600	600	800
10. First cost of unit	$10.00	$1.50	$[illegible]	$1.75
11. Price of renewal	.15	[illegible]	.30	[illegible]
12. Cost of total consumption for 1,000 hours	18.8[illegible]	3.00	[illegible]	6.00
13. Cost of cons. and renewals for 1,000 hours	20.30	3.42	4.50	7.38
14. Comparative cost of cons. and renewals per 1,000 hours reduced to 100 mean s. cp.	8.87	6.3[illegible]	28.48	20.1[illegible]
15. Comp. cost of cons. and renewals per 1,000 hours reduced to 100 mean l. h. cp.	8.32	4.84	27.44	18.75
16. Inspection and maintenance, yearly charge	7.20	2.40	none	none
17. Cost for cons. and I. and M. for 1,000 hours	26.00	5.40	4.50	7.38
18. Comp. cost cons. and I. and M. per 1,000 hours reduced to 100 mean s. cp.	11.37	[illegible]	[illegible]	[illegible]
19. Comp. cost cons. and I. and M. per 1,000 hours reduced to 100 mean l. h. cp.	10.65	7.64	7.44	18.75
20. Comp. cost including first cost, cons. I. and M. per 1,000 hours reduced to mean s. cp.	15.74	12.77	32.28	24.94

[illegible] given diameter with the light source in its center. This is not regarded as the correct principle for rating, for it does not give an idea of the value [illegible] such a rating is wrong, generally speaking, because a light source may be of high spherical candlepower [illegible] direct the light where needed, it is much lower in efficiency than a lamp which may give, by virtue of its design and construction, a better distribution. For this reason the illuminating value of a lamp [illegible] of mean lower hemispherical candlepower.

[illegible] two bases, the spherical and lower hemispherical, but have not been compared as to rated or nominal candlepower, as these are entirely misleading.

Referring to the preceding table, the gas rate at $1 per 1,000 cubic [illegible] per kilowatt-hour are believed to be as near an average as could be used for the analysis, although they vary in almost every city. The value of 1,000 hours is taken as the average time of using the lamps for one year—practically three hours daily for 333 days. From these figures and others shown in the table, taken from standard authorities, results have been obtained showing actual comparative operating costs of the four lamps. To obtain exact figures with any particular gas and electric rates, it is necessary merely to substitute them in place of the $1 and 10-cent rates.

It is very noticeable, by referring to items 4, 6 and 8 of the table, that apparent efficiency is reduced when the actual total light or the actual total downward light is taken for the standard. Comparing item 5 and item 3, it will be noticed that the mean specific candlepower is lower in all cases than the rated candlepower.

Item 12 shows the comparative costs of consumption of the units, regardless of their candlepower, and item 13 shows the comparative costs of the different units, including their renewals. Items 14 and 15 show actual comparative costs, reduced to the same candlepower, and including the renewals. Item 15 gives the most accurate comparison, because the downward light is the useful light. It will be noted that the cost of lighting with the inverted gas lamp is only about one-fourth of the cost with the best electric.

Some companies provide a system of inspection and maintenance on gas lamps. This system includes, in addition to weekly cleanings, free renewals of glassware and mantles. Item 16 shows the rates on the lamps considered. A customer obtaining this service can estimate the cost of gas and add it to inspection and maintenance cost, and obtain the total cost, there being only the two costs to use in determining the total lighting bill. The electric companies provide a similar service in lamp renewals. The old carbon-filament lamps were renewed free of charge, but for the two lamps in question a nominal charge is made for renewals, as shown by item 11. A comparison of the costs for consumption and inspection and maintenance (for the gas) and consumption and renewals (for the electric) and reducing to an equal candlepower basis, is shown by items 18 and 19. The best electric costs about 2½ times as much as the inverted gas. Items 20 and 21 show the comparison when the first costs are considered. A consumer in buying illumination can get the same results with the inverted gas lamp as with the tungsten electric lamp and save more than 57 per cent. of the cost. This takes into consideration the purchase price of the lamps and their up-keep, with weekly cleaning and all renewals when required.

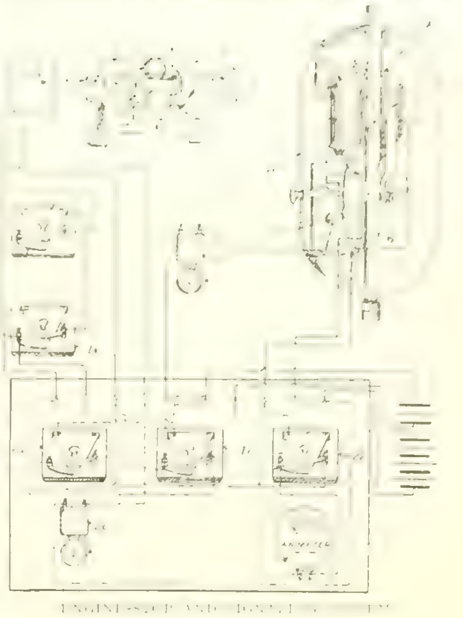
The costs of wiring for electric and piping for gas are about the same for moderate-sized installations. If the electric installation includes wall switches, the cost for the electric is materially higher than that for the gas.

The point may be raised in the minds of some that the estimates on the various lamps compared should have been based on their use with their standard glassware. In answer, it should be stated that whatever change might result by using any style reflector (changing the distribution of the light) could be produced as well on one or all, although not in reality putting them on the same basis. The peculiar construction of one lamp or its inherent features might require a certain kind of reflector more than another, in which case it would be manifestly unequal to compare them with the reflectors as the loss by each different reflector would have to be deducted. The comparison of bare lamps is, therefore, considered to be more nearly accurate.

At the conclusion of the reading of the paper there was a brief discussion, participated in by [illegible]

A Simple Safety Engine-stop and Signaling System.

[illegible]



[illegible]

fected by the Union Stop and Signal Company of Boston, which on account of its characteristics has been called by it the Simple System. The accompanying diagram shows its general arrangement.

The tripping device (4) is 5 by 8 by 4 inches in dimensions and has a door with glass front. For Corliss engines this goes on the column of the governor and does what the latter should do in case of over-speed, namely, prevent the valves from opening. This is done by the rod (6). Speed-limit device (12) runs on ball bearings off of the shaft of the engine at normal speed of 450. No springs are used. The contacts are set for from two to ten rotations above normal. The extension of the balls pushes the disk so as to make a wiping contact and this sends the current through magnets (5), thus releasing rod (6).

When applied to a condensing engine the rod extends down to open a balanced valve, breaking the vacuum. Screw (8) resets the latch (7) on the armature (A) and also pushes switch (9) to contact (10), thus cutting in the bell which takes all the battery current. A short-circuit of any kind splits the current and rings the trouble bell (20), having no effect on magnets (5). This is a new feature in engine-stop wiring.

Tests can be made with keys (21) and (22) while the engine is running; (21) shows the condition of wires, (22) the condition of battery. Keys (16) are used to stop the engine from a distance, and the engineer always has at least one located near him.

A signaling system can readily be made of this apparatus by the use of an annunciator and electro-mechanical gong in place of bell (11). The signal calls are: One bell, stop; two bells, ahead slow; three bells, back; four bells, more speed, and five bells, full speed.

Thus the person that breaks the glass and presses key (16) is in communication with the engineer after having stopped the engine by the first press of the key. The engineer closes his throttle, resets his stop and stands ready for signals. There are a number of patents pending that cover the various features of the system.

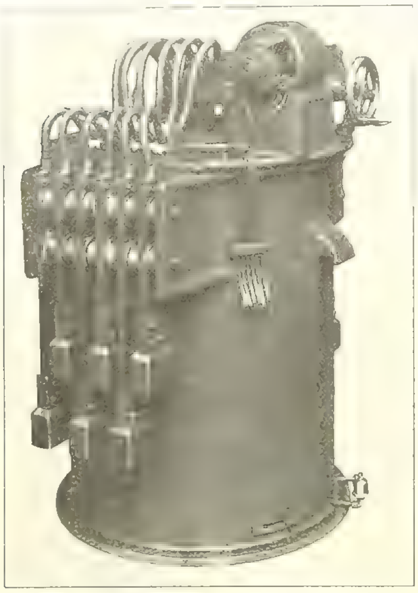
Large Issue of Patents to One Concern.

On June 16th 24 United States patents were granted to employes of the General Electric Company and assigned by them to the company. There were also granted three patents to employes of the old Stanley Electric Company and the General Incandescent Arc Light Company, which have been merged into the General Electric Company. Thus the latter company came into the possession of 27 patents issued on one day. Nearly all these were on electrical devices.

Westinghouse Potential Regulators.

The modern practice in central-station distribution of alternating current is to maintain a constant potential on the station bus-bars, so that the feeders radiating therefrom are all supplied at the same voltage; and in order to secure good regulation throughout the whole system, means must be provided for regulating the voltage on each feeder.

Owing to the variable conditions of load, it is apparent that good regulation can only be provided by compensating for the voltage drop on each feeder independently of all the others, and it is



SIX-PHASE AIR-BLAST INDUCTION REGULATOR.

for this purpose that a new line of potential regulators built by the Westinghouse Electric and Manufacturing Company was primarily designed. The two principal types of regulators manufactured are the induction type and the step-by-step type potential regulator.

The first type effects the regulation of a single-phase circuit by altering the position of a coil in a magnetic field, thereby changing the magnetic flux passing through the coil; and the second type by cutting in or out, by means of different taps, sections of the winding of a regulating transformer. The polyphase induction regulator differs in principle from the single-phase. Both of these types of regulators are made for either single-phase or polyphase circuits.

Practically all potential regulators, of whatever type, are variable-ratio transformers, and because they are transformers rather than consumers of energy, it follows that the product of the volts and amperes on the feeder side of the regulator is equal to the product of the volts and amperes on the generator side, less a small loss in the regulator itself. As the efficiency of the regulators is high, this loss is very small.

Standard regulators are built to give an increase or a decrease of 10 per cent. of the generator voltage. It is therefore evident that they handle but 10 per cent. of the energy of the circuit, and the total efficiency of the system is very slightly affected by them. For example, if the regulators have an efficiency of 95 per cent., the loss of energy on the entire system due to the regulators will be one-tenth of five per cent., or one-half of one per cent.

An advantage of the induction-type regulator is that it lends itself readily to automatic operation so that a constant potential may be maintained on the feeder circuit without attention on the part of the station operator. Most of these regulators are oil immersed and self-cooling, although air-cooled regulators are built and some of the largest sizes are oil-immersed and water-cooled.

The capacity of the regulator for any given service depends upon the range of regulation required and the total load on the feeder. For example, a 100-kilowatt circuit with 10 per cent regulation would require a 10-kilowatt regulator; or if only five per cent. regulation was necessary, a 5-kilowatt regulator would be required.

The induction regulator resembles an induction motor in general construction. These regulators [illegible]

through the winding. In the middle or neutral position the two windings are at right angles so that the primary has no effect on the secondary winding and therefore has no effect on the voltage of the circuit. By rotating the primary either way from the neutral position a voltage is impressed on the series winding, which either increases or decreases the feeder voltage. This action is analogous to that of a booster on a direct-current circuit.

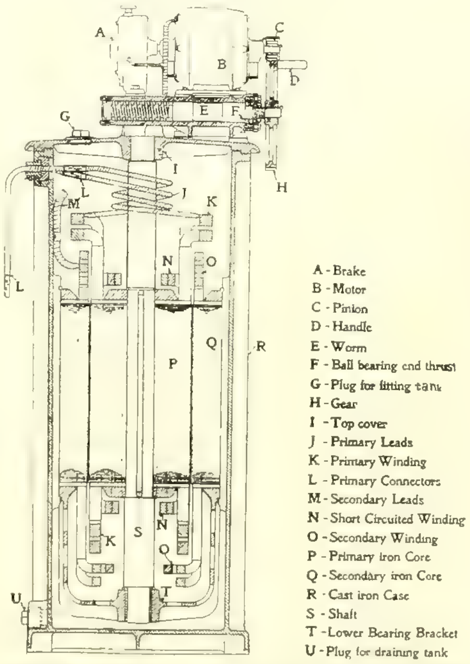
The polyphase induction regulator is similar to the single-phase regulator, except that both the primary and secondary elements are wound with as many sets of coils as there are phases in the circuit. These windings are distributed throughout the complete circumference of the cores and closely resemble the windings of an induction motor.

The essential parts of a single-phase induction regulator are a rotatable primary core and windings, assembled on a shaft, and a stationary core with windings, which is mounted in the regulator case. The rotor is operated by means of a worm-wheel and worm, the shaft of the latter being driven either by a handwheel or by a motor through spur gearing. Provision is made for either alternating or direct-current motor drive, but the former is generally furnished. The brake used in connection with the motor drive is effective in its action and is entirely enclosed.

The iron for both primary and secondary punchings is from the best grade of transformer iron and is selected with a view to keeping the iron loss at a minimum, thus assuring a good all-day efficiency for the regulators. In designing these regulators great care has been taken to arrange both the primary and secondary windings so that they will be uniformly cooled by the circulating oil and may be easily assembled and dismantled. The coils are machine-wound and insulated before being put in the slots, and they are shaped so that they may be pushed through the slots into place without being sprung or bent in the least.

In motor-driven induction regulators the operation of the motors is controlled by means of relays. As the current-carrying capacity of the contacts or switches for starting, stopping and reversing the motor must be ample, entailing a substantial construction, and as the accuracy of regulation must be approximately from one-half to one per cent. under all conditions, it has been found desirable to divide these functions between two relays: First, the voltage-regulating relay; second, the auxilary relay.

The first relay is, in effect, a contact-making voltmeter which is connected to the circuit to be regu-



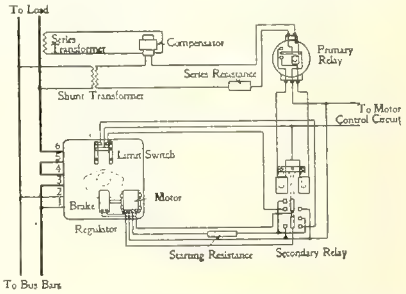
CROSS-SECTION OF SINGLE-PHASE MOTOR-OPERATED INDUCTION REGULATOR.

lated. Its functions are to close one contact when the voltage of the circuit is below the desired value, and to close another contact when the voltage exceeds the desired value. This relay will also be found useful in cases where it is desired to regulate by hand, as aside from its function of controlling automatic regulators it can be used for lighting signal lamps. It can be used to light up a lamp of one color when the voltage is too high and one of another color when the voltage is too low, thus calling the attention of the station operator to the fact that the voltage should be adjusted.

The second or auxiliary relay is connected between the voltage relay and the motor circuit and is designed to relieve the contacts of the primary relay from carrying the whole current required to operate the motor. The auxiliary relay is in effect an electrically operated double-pole double-throw switch with carbon contact.

The principle of operation of the step-by-step type potential regulator is practically the same as that of the induction regulator. Both consist of regulating transformers, but in the step-by-step type the series coil is divided into a number of sections which may be successively cut in or out of the circuit to be regulated instead of varying the flux through the entire coil, as in the induction type.

The step-by-step type regulator has been developed in two general mechanical forms, the drum-type and the dial-type regulator. The former comprises a drum and finger-type switch, similar to a railway controller, and the latter a face plate with a dial switch for switchboard mounting. The drum-type regulator can be placed on the station floor in front of the switchboard, or it can be placed behind the switchboad and operated by means of a handwheel through chains, or shaft and gears. It



CONNECTIONS OF AUTOMATIC INDUCTION REGULATOR ON FEEDER CIRCUIT.

may be mounted in a horizontal, vertical or inverted position as required.

Dial-type regulators can be built for almost any current by using an auxiliary series transformer and an auto-transformer for circuits carrying very heavy currents. By using as auxiliaries a series and a shunt transformer these regulators can be readily adapted to circuits up to 6,600 volts. Special forms of the step-by-step regulator are also built for handling heavy currents through a number of electrically operated switches controlled from a master switch.

The Electron Theory.[1]

By Edward A. Partridge.

The object of this paper is to set forth the electron theory and to describe briefly its experimental foundations. The theory came into being when it was established that negative electricity is atomic in character; that a negative charge is always a whole number multiple of a definite indivisible quantity of negative electricity. The atom of negative electricity has been named an electron. The first hint that electricity is discontinuous was given by Faraday's work on electrolysis.

To show that in electrolysis equal quantities of electricity are always associated with equal numbers of atoms of a monovalent element and that the ratio between the quantity of electricity passed through a solution and the number of atoms set free is twice as great for a divalent element as for a monovalent element is to indicate that matter and electricity are similar in constitution.

But Faraday's laws of electrolysis remained for more than 50 years the only statement of fact best explained on the hypothesis of atomic electricity.

Maxwell's far-reaching theory of electricity and its immediate consequence, the electromagnetic theory of light, seemed to fasten attention upon differential equations and to cause men to be satisfied with a mathematical statement of the propagation of a disturbance and not to inquire concerning the nature of electricity. Then, too, the experimental verification by Hertz of Maxwell's theory emphasized its importance. But how unsatisfactory the theory of electricity seemed to students 15 years ago. There was little connection between electrostatics and electrolysis, or between electrodynamics and the theory of thermocurrents, and the phenomena of vacuum tubes were but little understood.

It is in this last field that the greatest harvest of truth has been reaped. Sir William Crookes in 1879 read a paper entitled "Radiant Matter." In that paper he described many of the phenomena caused by what we now call cathode rays. He maintained that the effects he described were due to streams of negatively electrified particles of matter that were shot off from the cathode and by their mechanical energy produced the observed effects. Crookes' view was opposed by the Continental physicists and defended by the English, with the result that the phenomena have been most thoroughly investigated in a long series of brilliant experiments. One of the side results of the work with vacuum tubes was the discovery of Röntgen rays. Finally it has been established that the properties of the cathode rays are independent of the nature of the residual gas in the tube. A cathode ray particle possesses the same mass and the same charge of negative electricity if produced in hydrogen or oxygen, carbon dioxide or helium.

* * *

J. J. Thomson has elaborately worked out the

1. The opening and closing paragraphs of a paper recently read before the Franklin Institute, Philadelphia.

[illegible] that any further increase in the number of electrons will [illegible] in properties, recalling the progressive change in a line of the periodic system of the elements.

The work of J. J. Thomson [illegible] attempt to explain the periodic system. Thus far it is merely an analogy.

Our knowledge of the [illegible] at the present time almost limited to the results of Stark and his school on the canal rays. Canal rays are observed in the space behind the perforated cathode. They are particles that carry a positive charge of electricity. They have masses of atomic magnitude and so are sharply differentiated from cathode rays, whose particles have masses but 1/1000 that of the hydrogen atom. Canal rays have been observed in many gases. And also the lines in the spectra show the Doppler effect, that is, are displaced in consequence of the motion of the centers of the emission of the light. The Doppler effect in the spectra of canal rays has been observed in the lines of mercury, nitrogen, carbon, oxygen, helium, argon, potassium, sodium and lithium.

It appears from Stark's work that an atom residue, positively charged, after having lost a single electron, yields a spectrum consisting of series of doublets. If the atom has lost two electrons it emits light, the spectum of which contains series of triplets. The band spectrum appears to be radiated from the complete atom that is electrically neutral.

From what has been thus far said it would appear that the electron theory has been elaborated to explain certain results of modern experimental physics. The idea has, however, been reached through another channel. Plank by applying general reasoning of the style adopted in thermodynamics and energetics in general to the theory of radiation has deduced the mass of the hydrogen atom and also the charge that he denominates the elementary quantity of electricity. This determination of Plank of the mass of a hydrogen atom and the charge constituting an electron is to my mind one of the most remarkable intellectual results ever achieved. Drude speaks of them as being probably the most accurate values of these constants that we possess.

The fact that no optical phenomenon depending on the motion of the earth through the ether has ever been observed, provided the source of light is terrestrial, has led Einstein to formulate what he calls the principle of relativity. This principle assumes that no such phenomenon is possible. Plank and Stark combined in this principle with the principle of least action and deduced the most remarkable fact that the mass of a body at rest is equal to its internal energy divided by the square of the velocity of light. The smallest inertia with which we are acquainted is that of a single electron. This inertia multiplied by the square of the velocity of light gives us the value of the elementary quantity of energy. Enough has been presented to show how fundamental the electron theory has become and what a wide range of phenomena are correlated by its application. The theory seems destined to play an ever-expanding role in the science of physics and gives promise of profoundly influencing philosophic thought.

Chicago Surface Roads Make Good Financial Showing.

Reporting to the city controller, the Chicago City Railway Company shows that during May the additions to property account through expenditures was $436,861. Against these expenditures there was allowed 15 per cent. additional in accordance with the provisions of the ordinance, making the total increase to capital account $502,396 for the month. The total capital account now stands at $30,526,403.

On this amount the City Railway Company is allowed to deduct five per cent. from earnings, so that this source of revenue is now at the rate of $1,528,820, or 8.43 per cent. on the $18,000,000 capital stock of the company. In addition to this the company will get 45 per cent. of the net profits, so that according to the figures of last year the earnings are now at the rate of more than 15 per cent. per annum. The dividend paid, both regular and extra, amounted last year to nine per cent.

The Chicago Railways Company during the month of May increased its capital account through expenditures by $283,620. This, plus the 15 per cent. for brokerage and construction, raised the total for the month to $326,163. The total capital account now stands at $33,355,647.

The new interurban electric railway between Denver and Boulder, Colo., was opened for regular service last week. Hourly service will be given. It is said the steam train leaving Boulder in the morning and returning from Denver in the evening will be abandoned.

CORRESPONDENCE.

Continental Europe.

[illegible] a short-circuit. Part of the multiple switchboard [illegible] water, so that there were a number of subscribers lines thrown out of use for a time. This number [illegible]

The Zermatt-Gornergrat mountain railway in Switzerland has recently been opened for service, and is already carrying a great number of tourists. The trains wind up the mountain slope to the elevated station of Gornergrat, which lies at 10,000 feet altitude above sea level. In some places the road passes between cuttings of solid snow 20 feet high.

A generating station is to be erected for the Pernik mines in Bulgaria, including the lighting and motors for use underground, as well as the lighting at the surface. Bids for the needed material have been asked.

One of the largest steam turbines which have yet been built in Europe has been conducted by the Franco-Tosi Company of Legnago, Italy. It is built on the Brown-Boveri system, under a license from that firm. It was ordered by the German Transatlantic Company, and is one of three of like capacity which are to be built for the latter company. These machines have a capacity of 12,000 horsepower, and the first of them is now completely finished. They are intended for use in a large electric plant which the German company is to install at Buenos Ayres. The two other machines will no doubt be finished during the present year. A temporary load of 14,000 horsepower can be carried by these turbines for two hours' time. A speed of 750 revolutions per minute is the standard in this case, and the wheels are coupled on the same base with Brown-Boveri three-phase alternators, which are wound for 12,000 volts.

Regarding the question of waterpower in Norway, where it is proposed to erect a number of hydraulic plants of large capacity, it appears that the cabinet proposed a bill recently which excluded foreigners from purchasing the rights for waterfalls, mines and forests in Norway, and these were to be allotted exclusively to Norwegian capitalists. However, the present bill has been withdrawn and a new one substituted for it, according to which a kind of state monopoly is proposed, and the concessions will be ceded for waterfalls, mines and forests to natives, but only for a limited period. The clauses of the contracts will also be modified if the annual production from these sources exceeds a stipulated amount. The municipalities will have pre-emption rights in these cases.

A concession has been granted for a new tramway line in Holland, and it will be operated by the Amsterdam and North Holland Tramway Company. The line is to run from Amsterdam to the town of Krommenir, and will have two branch lines, making a total length of 27 miles. It is to be finished within two years.

An electrically operated cable incline is to be built from the station of Obervellach, lying on the railroad from Schwarzach to Millstatter See, up the slope of the Groppenstein. It will reach the locality of Stadt Ober-Vellach, which lies at the summit.

In Hungary an electric railroad is to run from the station of Versecz, on the state railroad, to the suburbs of this locality. A. de C.

Great Britain

London, June 12.—The first single-phase railway in Great Britain is now in commercial operation. It is the Heysham, Morecambe and Lancaster line of the Midland Railway Company, on the northwest coast of England. The potential is 6,600 volts and 23 cycles. Current is supplied from an existing gas-driven generating station. The rolling stock, which has been built by the company, consists at present of three trains, there being three motor cars, two with Siemens equipments and one with Westinghouse equipments. The former are fitted with an all-electric control, while the latter has the Westinghouse electro-pneumatic control. Four trailer cars have also been specially built. The length of the route, which is in the nature of a Y inverted, with Morecambe at the top, is five miles to Lancaster in the one direction and four miles to Heysham in the other. The Siemens motors on the cars are nominally of 180 horsepower and the Westinghouse 150 horsepower each. The section of road selected for this experiment is a difficult one, for it contains many bridges, and the conditions generally should insure a result of some practical value, although the service to be maintained is only a 20-minute one.

Apropos of the Midland Railway single-phase electrification, mention may be made of the progress upon the London, Brighton and South Coast Railway Company's line from London Bridge to Victoria, also upon the single-phase system. Eight [illegible] revenue as being due to the use of metallic filament [illegible] others the actual decrease in certain large consumers' bills is given. For instance, at Croydon, a dozen large consumers succeeded in effecting a [illegible] in another case a particular consumer saved 48 per cent. It is satisfactory to record, however, that the one-time air of despondency in connection with this matter seems to be wearing off, or, at any rate, the comments upon the effect of the use of metallic-filament lamps do not assume that gloomy [illegible]

G.

New York.

New York City, June 20.—The steel superstructure of the Blackwells Island Bridge, work on which was begun in October, 1904, is now complete. The work was done by the Pennsylvania Steel Company. There remains to be finished the paving of the roadways, the laying of rails and the provision of approaches.

The Board of Superintendents of Manhattan has recommended that a genuine evening trade school be opened at the Stuyvesant High School at the beginning of next session. The present Stuyvesant Manual Training High School, Superintendent Maxwell says, is not a trade school, and he makes the distinction that a manual training school aims primarily at intellectual and physical training, with an all-around development in view, while the trade school seeks to train expertness in one particular line; and he declares that the chief aim of the trade school is to shorten the time in which a boy may become a journeyman. The plan is to open 16 or 18 rooms in the Stuyvesant School and employ a corps of as many teachers, experts in their line.

The New York Times showed its enterprise by securing and printing a draft of the Republican platform in its issue of June 16th, three days before the revised document was adopted by the convention. It was the only New York paper that got the "story," and its "beat" was made the more effective when it was found that the platform adopted at the convention on June 19th had but few alterations from the one printed in the Times. Two enterprising Chicago papers were able to print the platform simultaneously with the Times by reason of the one-hour difference in time in the two cities. The story was over 5,000 words in length and was transmitted by telegraph to the two Chicago papers in 38 minutes.

It is said that inquiry among electrical interests discloses the fact that the General Electric Company has increased its business considerably from the low point in the period of depression. It is believed that a still further improvement will follow after the election, or even before that if good crops are assured. There are many enterprises of an electrical character that are being held up waiting for these events to be settled. The Westinghouse company is also improving in its general business. There are still occasional revivals of the old-time report that the General Electric Company is contemplating taking over or absorbing the Westinghouse Electric and Manufacturing Company. It can be said on the highest authority that there is no basis whatever for this report, that neither the Westinghouse interests nor the General Electric have any thought or wish to form such a combination even if it were entirely feasible.

Because he caused a suit to be started restraining the Board of Estimate from taking action on the six contracts for building the Fourth Avenue subway in Brooklyn, Controller Metz was charged with bad faith and denounced in a mass meeting on Thursday, held under the auspices of the West Brooklyn Board of Trade, in Prospect Hall. About 2,000 persons attended the meeting, and when resolutions were offered condemning the action of the controller in obtaining the injunction to delay work on the bore they went through with a shout. The resolutions asked the Board of Estimate to authorize the issue of corporate stock to the amount of $2,800,000 for the subway so soon as the court obstacle should be removed. W.

Southeastern States.

Charlotte, N. C., June [illegible].—It is reported in Georgia that Thomas F. Ryan and associates are

negotiating for the purchase of Tallulah Falls. As [illegible] by establishing a forest reserve later, protect the falls and the timber also, preventing a waterpower development.

[illegible] increasing its business handsomely.

The Citizens' Electric Company of Macon, Ga., will shortly hold a meeting of the stockholders, when directors and officers will be elected. It is proposed to erect a large power plant, not only for private and public lighting, but also to supply such manufacturing plants as will desire electric power for their machinery.

The bond issue for Richmond's municipal lighting plant, as proposed, has been sanctioned by the two bodies of the City Council and is with the mayor. The light committee, however, recommended a renewal of the old contract with the local company for 1,000 lights at $52.50 per annum, but the company is unwilling to extend into outside territory where lights may be required. L.

Ohio.

Toledo, June 20.—An ordinance has been approved by the Council committee on ordinances of the city of Toledo providing for a change in the plan of making street-car stops in the downtown section. After the passage of the new rule, cars will stop on the near side of the street for the purpose of taking on and letting off passengers, and will make no stop on the far side of the street.

The Toledo Section of the American Institute of Electrical Engineers will go to Detroit on June 25th to attend the launching of an immense freighter at Ecorse, and also to be present when a section of the new tunnel under the Detroit River is sunk. It will make the trip on the Detroit, Toledo and Monroe electric line. In the afternoon a regular session will be held at the Hotel Cadillac, where various subjects will be discussed. The trip promises a session of profit as well as pleasure to the participants.

In order to defeat the plan of erecting a municipal lighting plant at Lima, Ohio, for which bonds will be sold the latter part of this month, the Ohio Electric Railway Company has submitted a new proposition for city lighting, offering to sign a new 10-year contract at $57.50, a reduction from $85, which the present contract calls for. The Council has taken the proposition under advisement.

The various companies which have been maintaining poles and wires in the downtown section of Toledo, Ohio, have been granted an indefinite period in which to place them underground. The mayor announces that the poles will be hewed down whenever it appears that the owners are not in good faith making an effort to place their wires in conduits as required by the ordinances.

It is reported that a deal is on for the merging of the Springfield and Xenia, the Springfield, Troy and Piqua, and the Dayton and Xenia interurban railways. Warren J. Bicknell, former president of the Lake Shore Electric, is said to be interested in bringing about the merger.

J. C. Weaver, proprietor of two large hotels at Kenton, Ohio, has brought suit for an injunction against the Kenton Gas and Electric Company, to restrain it from shutting its service off from his property. He refuses to pay the lighting bills, claiming them to be unreasonable. H. L. S.

Indiana.

Indianapolis, June 20.—An agreement has been reached between the Board of Public Works of Richmond and the officials of the Terre Haute, Indianapolis and Eastern Traction Company on the proposed new franchise. A special meeting of the Council has been called to adopt the franchise. The granting of this franchise will end a contention which has lasted over two years, the city contending all the while for universal transfers between city and interurban cars.

Mayor Boehne of Evansville walked over the entire city system of the Evansville and Southern Indiana Traction Company, which operates the [illegible] cars and other equipment now in use by the company. He then sent a communication to the Coun- [illegible]

Company have decided to make additional improvements on the local plant. New boilers and machinery will be installed, and other betterment added, costing upward of $40,000.

James H. Wallace, president of the Central Trust Company of New York, has purchased the property and franchises of the Lafayette Gas Company, the Logansport Gas Company and the Fort Wayne Gas Company, representing bondholders. All the properties were originally natural-gas companies, but when the natural gas failed they were converted into artificial-gas plants. The eastern bondholders will consolidate them into one organization. It is understood that a number of other gas and electric-light plants will be merged with the new organization.

The Southwestern Alexandria Telephone Company, with a capital stock of $15,000, has filed articles of association with the secretary of state. The company proposes to construct and equip a telephone exchange and telephone system throughout Madison County. James Wright, Andrew Bird and others are directors.

A telephone war has been waging in Warrick County, with Boonville as its center, between the Cumberland company and an Independent telephone company, for nearly a year. The contention is over the granting of a franchise to the Independents to operate in Boonville. The Independent Company has telephones on each side of the city and desires to establish an exchange in order to connect the two systems. At a mass meeting of business men held during the last week resolutions were passed urging the Council to grant the desired franchise. The Independents promise connection with Louisville and Indianapolis as soon as the new exchange is established and equipped. This will also afford the merchants connection with a number of country telephones.

Since the eight-hour law for railroad telegraphers became effective in this state, a few months ago, several of the railroads have experienced difficulty in obtaining men to operate all lines with the telegraph. In consequence, they are now compelled to operate three tricks at all points where stations are kept open day and night. This has resulted in a telephone system being installed on a number of branch lines which handle freight traffic almost exclusively. The railroad officials declare the telephone is less expensive, while the railroad service is by no means impaired. S. S.

Illinois.

Peoria, June 20.—A proposed ordinance for the street railway in Springfield has been drafted by the company and provides for the payment to the city of two per cent. of the gross earnings of the company the first 10 years and four per cent. the next 10 years of the ordinance. The company further agrees to have the subway built and the cars in operation through it within 60 days after the passage of the ordinance. The part concerning the purchase of the lines after the termination of the franchise is taken from the Cleveland (Ohio) ordinance. The company also agrees to double-track the streets downtown within three years. The ordinance will not be presented to the Countil till the company has secured the majority of the frontage on the streets that the company desires to run upon.

The McHenry Electric Service Company of McHenry has been incorporated with a capital of $25,000 to furnish electric service. George K. Paige is an incorporator.

An electric railway across the width of the state is planned by the Vincennes, Centralia and East St. Louis Traction Company, which has taken out incorporation papers. The principal office of the company is to be in Chicago. The company proposes to build from a point on the line of the state of Indiana, opposite the city of Vincennes, to East St. Louis. J. J. Burns of Chicago is an incorporator.

Some of the offices of the Illinois Traction Company have been moved to the city of Springfield, and the engineer of maintenance of way, R. McCalman, will move next week from Decatur to the new offices now being fitted up for him at Springfield. The building was formerly occupied by the Consolidated Street Railway Company, but has been overhauled and remodeled to suit the convenience of the traction company. C. F. Handshy, general superintendent of transportation, will also have his offices on the second floor.

Preliminary work in connection with the survey for the Bloomington, Pontiac and Joliet electric line has been commenced by Chief Engineer Butler and his assistants. As soon as the work of checking up the survey has been completed the actual work of grading will be commenced. The officials of the line agreed that if the business men of Pontiac would agree to buy $25,000 of bonds they would build at once to Pontiac. This has been subscribed, and with a little work on the part of the men of Bloomington the line could be built [illegible]

Northwestern States.

[illegible] culated asking the Village Council of Albany, Minn., to consider a proposition for putting in a lighting [illegible]

J. J. Colburn has been granted a franchise at Hinckley, Minn., to build an electric-light plant, the village agreeing to use not less than $800 worth of electricity a year.

The Common Council of Hartford, Wis., has decided to build a municipal light plant at a cost of not more than $27,000. Provision is to be for 2,300-volt, 60-cycle, single-phase alternating-current plant, with 30 and 60-kilowatt generators.

Judgment of foreclosure has been rendered by Judge Burnell against the Winnebago Traction Company of Oshkosh, Wis.

The stockholders of the Ashland Light, Power and Street Railway Company of Ashland, Wis., have authorized the issue of $450,000 bonds to extend the lines through the residential portion of the city, rebuild the gas manufacturing plant and for new cars.

The Western Electric Company will locate a distributing plant in Minneapolis. It expects to have a five-story building, 88 by 88 feet, on the ground, ready for occupancy by October 1st.

City Attorney Wilson of Duluth, Minn., reports that the city is empowered by its charter to acquire and operate an electric-light plant.

The electric-light company at Fergus Falls, Minn., has taken an option on the electric-light plant at Wahpeton, N. D., and asked the City Council for a 20-year franchise.

The Point of Rocks Telephone Company of Custer, S. D., has been incorporated by John Ziemet and others for $25,000 to construct a system covering Sylvan Lake and other points.

The Beresford Telephone Company of Beresford, S. D., has been incorporated to construct a general system covering points in the southeast part of the state. Capital authorized is $50,000.

The plans for the building for the Home Telephone Company of Oskaloosa, Iowa, have been changed to make it fireproof. It will cost about $50,000.

Owing to the refusal of the Bell Telephone Company to connect with them, the Independent telephone companies at Marshalltown, Iowa, will spend $200,000 putting in a new automatic exchange. R.

Pacific Slope.

San Francisco, June 17.—The ordinance fixing telephone rates for the coming fiscal year, providing for an average reduction of 10 per cent. from existing charges, was finally passed by the San Francisco Board of Supervisors this week. Besides reducing the city rates, the new ordinance takes from the telephone company the right to dictate as to the employment of operators on private-exchange boards.

The San Francisco, Oakland and San Jose Consolidated Railway Company has filed its application with the City Council of Oakland, Cal., for permission to construct and operate an electric line along Poplar Street, from the present Twenty-second Street line to Court Street. The company has already purchased a piece of property at Twelfth and Poplar streets, where it will commence the construction of a station, in case its present application meets with favorable action.

Preparations are being made by the Forest Service to install a telephone line from Headquarters at Quincy, Cal., to a ranger's station which is being installed near Claremont, on the Middle Fork slope. The line will be about six miles in length.

Advices from Corona, Cal., say that George I. Larmy of Los Angeles has purchased Lake Elsinore from the Temescal Water Company. Mr. Larmy plans to drain the lake of its present contents, then build a large dam across the eastern end, and construct a power plant on banks of Santa Ana River, 35 miles away, and develop 3,000 kilowatts. Contemplated improvements will cost at least $500,000. The plans include four generators.

The Reno Power, Light and Water Company's large flume caught fire recently and was not extinguished until a large section was destroyed and the power house had a narrow escape. The lighting service was suspended for a time. This is the second case in California when a water flume was burned.

The board of supervisors of Monterey County, Cal., recently granted C. P. Baird and W. L. Lierly of Santa Maria a franchise for electric lighting and power privileges, etc.

The Portland Railway, Light and Power Company has applied for a franchise to build and operate electric-railway extensions on 40 streets of the city, including many miles of lines and costing hundreds of thousands of dollars. Permission has been granted.

The university regents have let the contract for the Washington University power house and plant. The award for the construction of the power house [illegible] The Hallidie Machinery Company obtained the contract [illegible] $72,900.

It has been announced that J. D. Farrell, general manager for Harriman in the state of Washington, and Samuel Hill, son-in-law of James J. Hill, have taken an option on the controlling interest in [illegible] Irrigation and Power Company at Priest Rapids, on the Co-

[illegible] River, 30 miles [illegible] of [illegible] [illegible] Northern, Chicago, [illegible] Railway. [illegible]

Spokane capitalists have planned to install a [illegible] organized the Orient Waterpower Company. [illegible]

[illegible] the Lost River Light and Power Company, in which [illegible] Rockwell, [illegible] gon Light and Power Company, near the mouth of Powder River in Oregon, is interested. The waters of Cedar Creek will be diverted through a 700-foot pipe line to a concrete power house and will generate 150 horsepower for the Mackay mines and 50 horsepower for lights to the town. Mr. Rockwell lives at Ontario, Ore. A.

PERSONAL.

Mr. R. M. Trumbull of Chicago has been appointed district engineer of the Westinghouse Electric and Manufacturing Company, with headquarters at Cleveland, Ohio.

Mr. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, made the speech at the Chicago convention putting Franklin Murphy in nomination for the vice-presidency.

Mr. George R. Armstrong, for four years district manager of the Rocky Mountain Bell Telephone Company at Butte, Mont., has been promoted to superintendent of the Eastern Idaho division.

Mr. Charles N. Black has resigned the position of vice-president and general manager of the Kansas City Railway and Light Company to become vice-president and general manager of the United Railroads of San Francisco.

Mr. C. E. Canfield has recently resigned his position as designer of alternating-current generators with the Western Electric Company of Chicago, and has become chief engineer with the Warren Electric Manufacturing Company of Sandusky, Ohio.

Mr. J. G. Atwell, superintendent of the Zanesville division of the Ohio Electric Railway Company, has resigned. He has been connected with the concern for nine years. Mr. N. C. Draper of Fond du Lac, Wis., has been chosen as his successor.

Mr. Richard M. Jackel, formerly employed by the Fort Wayne Electric Works, has recently been appointed superintendent of the Reynolds Electric Flasher Manufactuing Company of Chicago. Mr. Jackel started with the Fort Wayne company 13 years ago, when only 16 years of age.

Mr. Hugh J. McGowan of Indianapolis, prominent in electric-railway interests and president of the Indianapolis Traction and Terminal Company, has gone to Germany to take a rest for several months before again taking up his business duties. Mr. McGowan has been ill for some time.

Mr. E. M. Scribner severed his connection with the Western Electric Company of Chicago on June 1st, and associated himself, as vice-president and general manager, with the Technical Publishing Company of San Francisco, publisher of the Journal of Electricity, Power and Gas.

Mr. Stephen G. Hobert, consulting engineer for Richard E. Schmidt, Garden & Martin, architects, Chicago, has just received an appointment as consulting engineer on the advisory board of the Smoke Inspection Bureau of the city of Chicago. Mr. T. E. Donnelley is head of this smoke commission.

The committee on science and the arts of the Franklin Institute of Philadelphia has awarded the Elliott Cresson gold medal to Patrick B. Delaney of South Orange, N. J., for his system of automatic telegraphy. The Cresson medal is bestowed under a deed of trust dating from 1848 and is awarded for "some discovery in the arts and sciences, or for the invention or improvement of some useful machine." It is considered by ininventors one of the most highly valued honors.

Superintendent R. T. Gunn of the Fort Wayne and Wabash Valley Traction Company has resigned to accept a position of general manager of the Eastern Wisconsin Railway and Light Company, with principal office in Fond du Lac, Wis. For the time being, Mr. F. T. Hardy will assume the duties of that position. Mr. Gunn came to the Fort Wayne and Wabash Valley company about a year ago, from Lexington, Ky., where he had been general manager of the Lexington Railway and Light Company.

Mr. William F. Forbrich of the business department of the Western Electrician and Miss Mary Louise Woerner were married at noon on June 24th at Holy Cross Church, Chicago, by the pastor, Rev. Father D. D. Hishen. A reception and wedding breakfast at the home of the parents of the [illegible] hearty and sincere.

[illegible] night manager for the company in Washington. D. C. He had long been in charge of the telegraph office in the congressional press gallery in Washington, and through his wide acquaintance and intimate friendship with newspaper men the company often sent him to presidential conventions. It was while directing the dispatching of convention news at the Republican convention in the Coliseum that he was taken ill on June 18th. Mr. Young was born in Washington in 1838. He was [illegible] Association.

ELECTRIC LIGHTING.

[illegible] light plant in Gillett, Wis.

Roderick Stover of Albuquerque, N. M., plans installing an electric-light plant in Clovis, N. M.

McKinney, Tex., proposes to issue bonds to the amount of $8,000 for the extension of the electric-light plant.

The Economy Steam Heating and Electric Company of Sedalia, Mo., has increased its capital stock from $50,000 to $125,000.

At a recent meeting of the City Council of Portage la Prairie, Manitoba, it was decided to purchase the electric-lighting plant owned by the private company.

The power plant of the Portland (Ore.) Railway, Light and Power Company at Cazadero is reported to have been partially destroyed by fire on June 21st. The plant is valued at $750,000.

The City Council of Cumberland, Wis., has ordered a special election to be held June 29th for voting on the proposition to borrow $25,000 from the state. The money is needed to install a new electric-light and water plant and to make other improvements.

The new power plant of the Panhandle Lumber Company in the town of Spirit Lake, Idaho, has been completed. It has two 750-kilowatt turbine generating units and will supply current for the town. The generating equipment was supplied by the Westinghouse company.

The Public Lighting Commission of Detroit, Mich., will receive bids until July 8th for installing electric generating equipment in the public lighting plant in accordance with specifications on file in the office of the commission, 40 Atwater Street, East. F. T. Bowles is secretary of the commission.

The City Council of Lincoln, Neb., has sustained Mayor Brown's veto of the ordinance giving the city permission to enter the commercial-lighting field. The mayor says the city is not in a position to do commercial lighting, and the capacity of the plant is barely sufficient to light the streets and public buildings.

Recently incorporated electric-light companies include the following: Tyler Electric Company, Tyler, Tex., capital 50,000; Kirksville Light, Power and Ice Company, Kirksville, Mo., capital $11,000; Greenfield Electric Company, Greenfield, Mo., capital $3,000; Cannon Falls Electric Service Company, Cannon Falls, Minn., capital $25,000.

The Northern Light Electric Company is asking a 20-year extension of its franchise in Wahpeton, N. D. If granted, the local plant will be taken over by the Fergus Company, which is building a waterpower plant at Fergus, N. D. The new arrangement, the company says, would bring with it reduced rates for current. The Council is considering the proposition.

A dispatch from Hagerstown, Ind., to the Indianapolis News says: "For the reason that the municipality of Hagerstown has exhausted its funds in building an electric-light plant, and because the revenue derived from three saloons has been cut off by remonstrance, the Town Board is considering how best money can be raised. The limit of town indebtedness has been reached. One proposition is to annex the suburbs known as Haiti and Fancy Hill."

The Fremont (Ohio) Power and Light Company has made application to the Council to use the streets for a commercial lighting and power supply. The company proposes to erect a power plant at Ballville and utilize the water of the Sandusky River for furnishing power to run its plant. The company may build an electric railway between Fremont and Tiffin in connection with the other details of its project.

[illegible]

ELECTRIC RAILWAYS.

E. J. Lander and associates have made application [illegible] The promoters are all business men in Grand Forks, and propose to build an up-to-date line. An ordinance has been introduced in the City Council.

The Vincennes, Centralia and St. Louis Transit Company has been licensed to incorporate. The principal office will be in Chicago and the declared purpose is to build an electric railway from the eastern state line near Vincennes, Ind., to a point near St. Louis. The board of directors includes J. J. Burns and M. O. Peoples of Chicago.

The Chattanooga Southern Railroad, operating between Chattanooga, Tenn., and Gadsden, Ala., 92 miles, may be converted into an electric road and operated with high-speed interurban equipment. The line has been in the hands of receivers for some time and engineers think it will make a good interurban proposition. W. W. Kent and E. C. Osborn of Chattanooga are the receivers.

A movement is on foot among the business men of Joliet, Ill., to unite with the merchants of Wilmington and others along the line to insure the building this season of the proposed electric railway of the Joliet and Southern Traction Company from Joliet to Wilmington. The line is surveyed, the right-of-way contracts have been made and the construction of the line now depends upon the aid that is given by the people who will be benefited by the building of the road.

Directors of the Pine Bluff-Little Rock Transit Company met in Pine Bluff, Ark., recently to consider plans for building the road. It is proposed by the directors to build an electric interurban railway between Little Rock, Pine Bluff and Star City, a total distance of about 80 miles. A committee was appointed to secure an engineer who will make a survey of the route as proposed and to estimate the cost. W. F. Campbell of Little Rock is president of the company and S. A. Miller of Pine Bluff is vice-president.

The Kansas-Colorado Railroad Company was incorporated a few days ago for the purpose of building an electric or steam railway from Canon City, Colo., to Garden City, Kan. The company is capitalized for $5,000,000, and the proposed line will pass through all the principal cities and towns in the Arkansas Valley. The general offices of the company will be in Pueblo. It is proposed to construct a power plant in the Canon City coal fields, so that fuel may be secured at minimum cost. The incorporators include S. H. Atwater of Canon City and A. H. Warner of Garden City, Kan.

The new section of the Rapid Transit subway on Market Street, Philadelphia, from Broad Street to the Delaware River has been completed by the contractors and turned over to the traction company, which will lay the rails and put up the wires and stations. The portion of the subway west of Broad Street has been in operation for a year and is entirely satisfactory. The entire new system from the river to Sixty-ninth Street may be in operation by August. The Philadelphia subway and elevated system is said to have no equal anywhere. A north-and-south subway through the city is now being agitated.

Manager E. M. Walker of the Citizens' Railway and Light Company of Muscatine, Iowa, has established a new wage scale whereby all conductors who have been in the employ of the company for two years get a raise of six per cent. in wages, and, after serving three years more, will get another raise of six per cent. The motormen, who at the present time get 12 per cent. more than the conductors, will receive an advance of 5½ per cent. in salary. According to Mr. Walker, the company has one of the finest forces of conductors and motormen in the state, and very few accidents occur, the men being very careful and attentive to duty.

At the latest meeting of the committee on local transportation of the Chicago Council Mr. George Weston, engineer for the committee, presented his report, which showed that the Northwestern Ele-

[illegible] the Loop congestion. The Metropolitan and South Side companies, however, will not agree to the [illegible] that would be [illegible] from extra car miles. The committee believes the objections to be insufficient and will ascertain its legal rights to force the objecting companies into [illegible].

TELEPHONE.

The Farmers' Mutual Telephone Company of Pierson, Iowa, has been incorporated with a capital of $12,000.

The Omaha Independent Telephone Company will begin building its plant in South Omaha, Neb., about July 1st.

The Mammoth Springs and Memphis Long-distance Telephone Company of Mammoth Springs, Ark., has been incorporated.

H. Grills, Sanford, Manitoba, will receive bids until noon on June 30th for the construction and installation of a complete telephone system for the municipality of Macdonald. Plans and specifications may be seen at the municipal hall at Sanford, Manitoba, and also at the Department of Telephones, Winnipeg, Manitoba.

The Wisconsin Telephone Company will on August 1st issue new stock to the extent of $1,500,000, the cash to be used for improvements and extensions in Wisconsin. Every share already has been engaged by the present shareholders, it is said, and will be issued to them at par. This will place the total capital stock at $9,000,000.

One of the American consular officers in Mexico reports that a company in his district, composed principally of Americans, has secured a 15-year concession from the Mexican government to build a long-distance telephone line in that country. Manufacturers of telephone supplies and those desirous of obtaining further information may address the secretary, whose name may be secured from the Bureau of Manufactures, Washington, D. C., by referring to file No. 2346.

PUBLICATIONS.

The Frank Mossberg Company of Attleboro, Mass., has just issued a special catalogue covering metal reels, spools and beams. This catalogue not only covers reels and spools for the entire wire-manufacturing industry, but also for the textile industry. Copies of the catalogue will be sent to anyone interested upon request.

The Forestry Service of the United States Department of Agriculture has issued circular 140 entitled "What Forestry Has Done," by Treadwell Cleveland, Jr. Mr. Cleveland reviews the history of forestry as practiced in the civilized countries and shows the necessity for the work. He concludes by drawing the chief lessons of forestry abroad.

In its June issue the Illuminating Engineer of New York prints one of its pages with white letters on a black background as a practical means of testing such a reversal of the present method of printing, which has been suggested as of benefit to the eye. In this case, however, it does not appear to be easier to read this particular page—perhaps not as easy—as others printed in the ordinary manner; that is, black on white.

The comprehensive and valuable article by Franklin J. Truby on "Automatic Telephony" in the Western Electrician of January 11, 18 and 25, 1908, has been republished in handsome pamphlet form by the Automatic Electric Company of Chicago and doubtless may be had on request. It gives the reader, with diagrams and half-tone illustrations, an excellent idea of the method by which telephoning without exchange operators is accomplished.

The Triumph Electric Company of Cincinnati has just issued a beautiful bulletin entitled "Illustrations of Triumph Motor Drives." The bulletin does not go into the details of the construction of the company's motors, as these are all described in other bulletins, but by means of illustrations the bulletin shows the application of motors to the various types of machines, such as lathes, planers, printing presses, boring mills, hoists, etc. The com- [illegible] upon application.

The Central Electric Company, Chicago, is distributing a new circular containing some valuable engineering data on the economy of the new "Silico Vanadium" steel used in Pittsburgh transformers. [illegible] efficiency" and "standard-efficiency" transformers is [illegible] efficiency" transformers. Copies of the circular will be [illegible] upon request.

One of the most complete catalogues and price lists that have been issued describing car-lighting cells has just been published by the Electric Storage Battery Company of Philadelphia. This company for the last 17 years has manufactured and developed special types of batteries for car-lighting service, and through the experience thus gained it has obtained a thorough knowledge of the requirements of railroad men and of the essential details requisite for the construction of a reliable cell. The cells, therefore, described in this catalogue are not the results merely of theoretical demonstration, but also of careful study and the knowledge gained by years of actual operation. The company manufactures two general types of elements for car-lighting service, viz., the Chloride accumulator, in which the elements contain Manchester positive plates and box negative plates, and the Tudor accumulator, the elements containing Tudor positive plates and rolled negative plates.

SOCIETIES AND SCHOOLS.

The Short Circuit Club of Philadelphia held its annual outing at Coney Island on June 13th. The committee in charge was composed of C. W. Ridinger, H. M. Raphael, H. B. Parke, B. F. Perry and W. L. Collins. The organization now has about 100 members, composed of persons in the electrical trade.

At a meeting of the San Francisco branch of the National Electrical Contractors' Association held on June 11th the following-named officers were elected for the ensuing year: President, Robert W. Martland; vice-president, Paul C. Butte; secretary, F. W. Myers; treasurer, Charles E. Wiggins. Meetings will be held every week in the association rooms in the Grant Building.

A new departure in the college of engineering of the University of Minnesota is an increase in the length of engineering courses from four to five years. This is for the purpose of adding to the amount of general culture work required heretofore and at the same time rearranging and increasing to a small extent the technical work. It is believed that this will result in turning out a still better grade of engineers, although it may cut down the number of students for a time. The added work consists of additional requirements in modern languages, economics and political science. The first year is uniform for all courses, so that students need not choose their special course until after one year's work at the university. As the first four years provide a good general education, it is proposed to give the degree of Bachelor of Science at the end of the fourth year. Most of the purely technical work comes in the fifth year, upon the completion of which will be offered the degree of Electrical Engineer, Mechanical Engineer, Civil Engineer, etc., as the course requires.

MISCELLANEOUS.

The American Nailless Horse Shoe Company of Lebanon, Pa., has placed a contract with the Brown Engineering Company of Reading, Pa., covering a complete electrical and mechanical equipment for the new plant for the manufacture of nailless horseshoes. The plant will be driven by electric motors and lighted electrically.

The twenty-second annual outing of the employes of the Westinghouse Electric and Manufacturing Company is announced for Saturday, July 18th, at Rock Point Park, near Pittsburg. An elaborate programme of games, races, etc., is planned. The Electric Club baseball team is scheduled to play the Elwood City team.

Two high-grade fire boats, among the first to be propelled by electricity, are being completed for the Chicago fire department. They will be known as the Joseph Medill and the Graeme Stewart, and the pumps will be capable of throwing 45,000 gallons a minute. The Joseph Medill was launched at Manitowoc, Wis., on June 22d. It is said the two boats will cost $219,000.

Congress has appropriated $1,335,520 for the use of the United States Geological Survey in carrying on its excellent work in the fiscal year 1908-09. The money will be applied to numerous purposes, among which are: Forest-reserve topographic surveys, $75,000; water-resources investigations, $100,000; structural-materials investigations, $100,000; fuel-testing investigations, $250,000.

General Superintendent George H. Whitfield and electrical contractors of the city of Richmond, Va., are making arrangements for an electrical exhibition to be held in that city soon under the direction of the Passenger and Power Company and others. The main purpose of the exhibit will be to demonstrate the various economic uses of electricity in the home, the store and the small manufacturing plant.

The production of anthracite coal in Pennsylvania in 1907 reached the total of 76,432,421 long tons, [illegible] and that [illegible] greatest, by $7,003,269 tons. The value of the product, including that of the coal used at the mines, of which no account has been taken in estimates for previous years, was $163,584,056, an average of $2.35 per ton, or five cents per ton in excess of the average price in 1906.

General Greely, who introduced the war system of telephones and telegraph in Cuba during the Spanish-American war, returned recently from a visit to Japan. Concerning the system as used by the Japanese army, General Greely says that at the battle of Mukden, with a front of 80 miles, General Nogi found the system worked so perfectly that not a single battery could suffer damage or be put out of action without headquarters knowing the injury, and thus be enabled to close up the line and replace the guns.

Col. John Van Wormer, a member of the Civic Federation, who is now in Europe, is reported in a recent London dispatch as saying that he does not think public ownership of public utilities has been an unqualified success. He finds it has resulted in the burden of taxation being enormously increased and that, while all the smaller officials are scrupulously honest, the men up to the top display human weakness as much as their brethren in the United States. This, he is quoted as saying, also applies to business men.

Lightning struck the main stable on the estate of Enos M. Barton, president of the Western Electric Company, at Hinsdale, Ill., on June 21st, and the fire which followed cost the life of one of the employes and did damage estimated at probably $15,000. The grounds constitute 1,200 acres and are among the most elaborately appointed in the West. Six buildings, including the main stable, waterworks building, carriage houses and two smaller buildings were destroyed. The beautiful residence of Mr. Barton and the buildings surrounding it were not endangered, as they are in another part of the grounds. Four of the most valuable horses of a string of 35 in the main stable were burned.

TRADE NEWS.

Market interest and inquiries for copper are said to have increased considerably recently, and more business has resulted. Electrolytic wire bars in the regular market were quoted on June 20th at 13 cents.

Buyers of ignition supplies will be interested to know that the Manhattan Electrical Supply Company, 17 Park place, New York, has just issued a 12-page folder showing the line it manufactures, including spark coils, switches, battery connectors, etc. A thoroughly revised edition of the company's pocket-size catalogue—168 pages—"Something Electrical for Everybody," is also ready for distribution and can be had by writing to the company.

The Merchants' Association of Warsaw, Russia, is contemplating the establishment, in a building specially provided for that purpose, of a permanent exposition of articles and goods of all sorts manufactured beyond the limits of Russia, for the purpose of getting better acquainted with the foreign trade. The leading exporters and manufacturers of England, Austria, Hungary, Switzerland, Belgium and France, as well as government institutions, like chambers of commerce of Austria and France, have already expressed their desire to promote the plan. Business concerns of the United States should be acquainted with the opportunity.

Allis-Chalmers Company reports an increase during May of 80 per cent. in new business over the preceding month, comparing very favorably with the average of 1907, which was the largest year in the company's history. This abnormally rapid gain may be largely ascribed to the fact that during the last six months inquiries for power and electrical machinery have been larger, despite the depression in actual trade, than at any previous period. While the majority of such "prospects" failed to materialize as sales at the time, negotiations concerning them were not allowed wholly to lapse, and, with improved financial conditions, many of these deferred contracts are now being closed.

The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., is preparing to enter the field of electrical specialties on an extensive scale. The company has heretofore made electric controlling devices only, its plant being one of the largest in the world devoted to the manufacture of this class of apparatus. The new specialties will consist at first of snap switches and lamp sockets. The five-story building on Thirteenth Street and St. Paul Avenue, fronting the Cutler-Hammer plant, has been purchased by the company and equipped for manufacturing purposes. The new industry will be conducted on a scale of considerable magnitude and will prove an important addition to Milwaukee's manufacturing interests.

BUSINESS.

Allis-Chalmers Company, Milwaukee, reports a recent influx of orders for its electric motors of various sizes and for various applications. Among the buyers mentioned are the Schlitz Brewing Company, Milwaukee; Cudahy Packing Company, Cud-

[illegible] Standard [illegible] McNeil & Libby, Chicago.

The Rio de Janeiro [illegible] Company [illegible] Dossert & Co. [illegible]

[illegible]

Edward G. Acheson, Jr.; secretary, W. H. Arison; [illegible] expert, Edward Goodrich Acheson, who discovered [illegible] offices and works are in Niagara Falls.

DATES AHEAD.

[illegible]

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 16, 1908.

890,592. Protective Device for High-potential Systems. Richard Apt, Berlin, Germany, assignor to the General Electric Company. Application filed August 17, 1906.

A lightning [illegible] through a spark gap.

890,593. System of Distribution. [illegible] Armstrong, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 13, 1907.

In a railway system [illegible] the trolley wire.

890,601. Winding Machine. John G. Callan, Lynn, Mass., assignor to the General Electric Company. Application filed January 10, 1905.

This winding machine has [illegible] rotating member on which the [illegible] electrically operated means [illegible] disconnecting the power shaft [illegible] has made a predetermined number of revolutions.

890,607. Railway Signal. Arba G. Clark, Schenectady, N. Y., assignor to the General Electric Company. Application filed October 14, 1907.

The signal comprises a movable arm, a driving motor therefor, and a quick-break switch for the motor consisting of stationary contact and a contact carried by the arm, one contact having a spring-finger and the other being adapted to deflect and pass on opposite sides of the finger for different directions of movement.

890,615. Automobile. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company. Application filed February 8, 1904.

The vehicle contains a prime mover, an electric generator driven thereby, an electric motor having a number of armature windings, and a controlling switch adapted to connect the generator to the motor, to vary the series-parallel connections of the latter and also to vary its field ampere-turns.

890,617. Alternating-current Motor. Max Déri, Vienna, Austria-Hungary, assignor to the Stanley Electric Manufacturing Company. Application filed December 16, 1902.

The primary winding of the motor is adapted to be connected to a source of current and the secondary winding is provided with a commutator and brushes. A transformer has its primary connected in series with one of the windings, and a magnetizing winding connected to its secondary.

890,621. Circuit-controlling Device. George H. Dorgeloh, Schenectady, N. Y., assignor to the General Electric Company. Application filed October 5, 1907.

A starting rheostat comprises a resistance-varying switch, an electromagnetic switch in series therewith, means whereby the latter switch is closed by the initial movement of the resistance switch, and an overload magnet independent of the position of the resistance switch for controlling the electromagnetic switch. (See cut on next page.)

890,622. Sytem of Motor Control. Edgar F. Dutton, Schenectady, N. Y., assignor to the General Electric Company. Application filed February 21, 1907.

The controlling switch for a motor is governed by a master switch from a distance through a magnetic brake and a set of magnetic clutches and limit switches acting on a switch-moving motor.

890,627. Motor Control. Friedrich Eichberg, Berlin, Germany, assignor to the General Electric Company. Application filed January 23, 1907.

In combination with an alternating-current motor is a transformer having its primary winding connected to the source, a second transformer having its secondary winding connected to the motor, and a set of magnetically-actuated switches arranged to connect the other two windings of the transformers to different points on each other.

890,630. Driving Mechanism. George W. Euker, Pittsfield, Mass., assignor to the Stanley-G. I. Electric Manufacturing Company. Application filed June 24, 1905.

An electric motor has on its driving shaft a friction disk engaging a friction wheel which can be shifted in position to change the speed. The motor circuit is opened and closed by shifting the wheel.

890,638. Variable-voltage Transformer. Edward F. Gehrkens, Schenectady, N. Y., assignor to the General Electric Company. Application filed July 26, 1906. Renewed January 31, 1908.

This transformer has a magnetic core, flat primary and secondary coils thereon, the secondary and the portion of the core enclosed thereby being movable away from the primary in the plane of the secondary coil, and a magnetic member secured to and movable with the [illegible]

[illegible]

890,661. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed April 23, 1906.

A series of transmitting and receiving devices are connected each at a different point to an all-metallic line, the [illegible] key and means to insert the sources in series to the line.

890,664. Trolley Wheel. Thomas Langen, Brooklyn, N. Y. Application filed April 8, 1907.

In a trolley wheel [illegible] side of the connecting member.

890,670. Circuit-closer for Automatic Trainstops. Joseph H. Lynch, Red Bank, N. J. Application filed May 2, 1907.

In combination with a horizontally and vertically movable [illegible] road-bed adapted to move the shoe sidewise while at the same time raising it.

890,679. Lightning Arrester. Ezra B. Merriam, Schenectady, N. Y., assignor to the General Electric Company. Application filed November 8, 1906.

Means are provided for establishing a jet of water in a closed metal shell as a discharge path for abnormal current, and also means for utilizing the vaporizing action of a heavy discharge through the jet to develop a high velocity blast assisting in the interruption of the discharge.

890,695. Combined Signal and Springjack. James L. McQuarrie, Oak Park, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed May 5, 1906.

An electromagnet attracts a curved armature mounted on one end of a rocking arm that carries a signal at the other end. The insertion of a plug in the springjack releases the armature and signal.

890,697. Protective Device for Unipolar Machines. Jakob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company. Application filed October 4, 1905.

A unipolar dynamo has conductors cross-connecting the brushes at opposite ends of the armature conductors, protective devices comprising portions surrounding the cross-connecting conductors and responsive to the flux surrounding them, and means controlled by the devices for opening a circuit of the machine.

890,699. Method of Operating Induction Motors. Robert H. Parker, Schenectady, N. Y., assignor to the General Electric Company. Application filed December 4, 1905.

An induction motor having both rotor and stator coil-wound is operated by producing two rotating fields in the motor, one rotating at synchronous speed with respect to the stator and the other rotating in the opposite direction at a speed with respect to the stator corresponding to the slip of the rotor below synchronous speed.

890,718. Circuit-breaker. Arthur Smith, Schenectady, N. Y., assignor to the General Electric Company. Application filed April 24, 1906.

An electrically operated switch which can be manually controlled has an alarm circuit which is closed when the position of the switch does not correspond with the position of the controller.

890,719. Motor-starting Panel. Arthur Smith, Schenectady, N. Y., assignor to the General Electric Company. Application filed January 17, 1907.

In combination with a rheostat provided with automatic no-voltage release features is an automatic overload circuit-breaker arranged to be tripped as the controlling element of the rheostat moves toward starting position.

890,722. Regulation of Dynamo-electric Machines. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company. Application filed August 7, 1905. Renewed January 31, 1908.

A generator with a multiphase exciting winding and a multiphase generating winding has a low frequency exciting circuit containing resistances connected to the exciting winding, and a vibrator responsive to the voltage of the generating winding for controlling the resistances.

890,730. Variable-voltage Transformer. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company. Application filed July 26, 1906. Renewed February 5, 1908.

This transformer has the primary and secondary coils spaced apart on the core, which has a pivotally-mounted portion adapted to open by its movement the magnetic circuit threading both coils. A rectilinearly-mounted magnetic member between the coils is adapted by its movement to shunt the primary flux away from the secondary coil. (See cut on next page.)

[illegible] the General Electric Company. Application filed [illegible]

[illegible]

[illegible] Application filed August 9, 1907.

[illegible] gages the resistance coil.

[illegible] descent Arc Light Company. Application filed April 29, 1905.

[illegible] connected to its driving shaft by means of a friction disk [illegible]

890,763. Arc Lamp. Richard Fleming, Lynn, Mass., assignor to the General Electric Company. Application filed May 18, 1904.

The lamp has a double-walled annular casing through which the vapors generated are forced to pass before escaping from the lamp, perforations in the lower and upper parts of the casing and tubular lateral passages through the wall of the casing to admit fresh air.

890,764. Dredging Apparatus. Randolph E. S. Geare, New York, N. Y. Application filed July 18, 1907.

This dredge has a rotary pump, an electric motor operatively connected therewith, an enclosure for the motor, means for supplying electric energy to the motor and means for maintaining increased pressure within the motor enclosure.

890,770. Fixed Polarity Separable Attachment Plug. Harvey Hubbell, Bridgeport, Conn. Application filed September 5, 1907.

A cap for attachment plugs comprises a porcelain block having knife-blade contacts extending therefrom and binding screws, and a two-part metallic cover for the block, one of the parts engaging the other part externally and having an opening through which the wires pass.

890,776. Damper for the Upper Harmonics of Alternating Electric Currents. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company. Application filed April 28, 1905.

An alternating-current machine is supplied with a squirrel cage circuit made of a resistance sufficiently high to effectively suppress the upper harmonics.

890,781. Electric Transformer. Louis Maiche, Paris, France. Application filed September 23, 1907.

This transformer has no magnetic core, and little length but large diameter, the primary winding being enclosed in the secondary winding.

890,783. Switching Electric Currents. Samuel W. Mauger, Schenectady, N. Y., assignor to the General Electric Company. Application filed June 26, 1902.

An electric distribution system comprises a generator, a number of automatic feeder circuit-breakers, auxiliary circuit-breakers of greater capacity in series therewith and between the feeder circuit-breakers and the generator, all at the distributing station, and electro-responsive devices of different time limits for tripping the several circuit-breakers.

890,788. Retort. Charles F. McKenna, New York, N. Y. Application filed April 22, 1903. Renewed September 30, 1907.

A closed chamber comprising a vessel and a removable cover therefor is provided with an electric heater within the chamber, a gas receiver, and a tubular connection between the cover of the chamber and the receiver.

890,797. Elevator Safety Device. George B. Rice, Sewickley, Pa. Application filed June 4, 1906.

An electrical device under the control of a governor normally holds the jaws of a gripping device open.

890,803. Method of Tuning. Melvin L. Severy, Arlington Heights, and George B. Sinclair, Winthrop, Mass., assignors to the Choralcelo Manufacturing Company. Application filed August 7, 1905.

The method of tuning a vibrating magnetically sensitive body consists in producing in close proximity thereto magnetic pulsations corresponding to the number per unit of time vibrations designed for it, and then tuning the latter until its loudness and quality of sound show it has reached its true pitch.

890,815. Reversing Device for Explosive Engines.

[illegible] Hastings, Minn. Application filed [illegible], 1907.

[illegible] comprises a timer having a rotatively adjustable case and contacts arranged to break [illegible] when the timer case is adjusted [illegible] amount of load. An engine-driven centrif[illegible] connections arranged to [illegible] circuit through the timer when the [illegible] below a predetermined speed.

890,827. Battery. Adolph T. Vigneron, Providence, R. I., assignor of one-half to Herbert B. Vigneron, Providence, R. I. Application filed January 10, 1907.

A battery cell consists of a casing having two contact poles, the connecting surface of each being located in a recessed portion formed in the casing whereby correspond[illegible] required to enter the recesses to contact with the poles.

890,840. Pole-changer. William E. Butler and Morgan L. Lane, Omaha, Neb. Application filed March 11, 1908.

This pole-changer is used for transmitting to the ringing circuits of telephone lines different types of current impulses from a constant current source.

890,850. Telephonic Protector Against Electromagnetic Effects. Celio Duó, Buenos Ayres, Argentina. Application filed November 30, 1906.

The device has six superposed and related windings to the second and third of which the telephone is connected.

890,851. Electric Meter and Service Box. Charles G. Durfee, Rochester, N. Y. Application filed June 3, 1907.

A service box and a gutter box are secured adjacent to each other. The cover of the first box is provided with projections for engaging with an end of the gutter box and preventing its removal.

890,855. Culinary Apparatus. William S. Hadaway, Jr., East Orange, N. J., assignor to the Hadaway Electric Heating and Engineering Company. Application filed July 5, 1907.

A fluid-containing vessel is provided with external electrical means for imparting heat thereto and a heat-insulating barrier located within the vessel for determining the fluid circulation.

890,856. Electric Heating Device. William S. Hadaway, Jr., East Orange, N. J., assignor to the Hadaway Electric Heating and Engineering Company. Application filed July 3, 1907.

A resistance unit comprises an insulating plate and a connecting ribbon wound thereon in the form of a flattened helix and slotted to provide a zigzag path for the current, the slots being only disposed between the bends of the flattened helix. (See cut.)

890,857. Culinary Apparatus. William S. Hadaway, Jr., East Orange, N. J., assignor to the Hadaway Electric Heating and Engineering Company. Application filed September 26, 1907.

In combination with a fluid-containing vessel is a second vessel within it, a third vessel suspended in the second, and means for supporting the third vessel at different heights, also electrical means for heating the inside wall of the second vessel.

890,858. Electric Heating Device. William S. Hadaway, Jr., East Orange, N. J., assignor to the Hadaway Electric Heating and Engineering Company. Application filed September 26, 1907.

This device consists of a number of rods disposed side by side, and a resistance strip which extends back and forth between the rods and is insulated from them.

890,866. Contact Box for Electric Railways. George H. McFeaters, Johnstown, Pa., assignor to the Lorain Steel Company. Application filed June [illegible]

[illegible]

[illegible] Smith, Bridgeport, Conn., assignor of one-half to [illegible] H. H. Smith, Bridgeport, Conn. Application filed [illegible]

[illegible]

890,887. Process of Recovering Copper from Copper-bearing Solutions. Luis Amenábar, Co[illegible] Application filed December 4, [illegible]

[illegible] jecting it to the electrolytic action of currents of great density whereby a non-coherent precipitate of copper is formed and carried to the separator by the circulating solution.

890,891. Insulator Pin. Conrad J. Dorff, Chicago, Ill., assignor to Fredric Greer, Chicago, Ill. Application filed November 18, 1907.

The pin has a supporting member and two tapering screw sections yieldingly attached thereto at the smaller end of the sections.

890,905. Punitive Device. John R. Hinton, Cashmere, Wash. Application filed May 28, 1907.

Two doors are held in open position by a catch. A floor plate closes the circuit of two electromagnets when depressed by the weight of a body and thus releases the catch and closes the doors.

890,911. Printing Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed December 19, 1905.

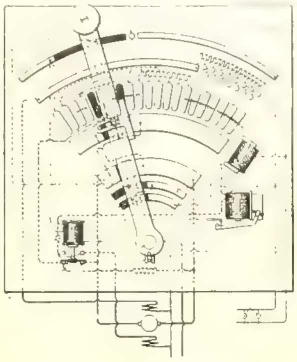
In a submarine printing telegraph there are means to transmit impulses of the same duration and intensity but alternately of opposite direction and means at the receiving station to print for each three of the impulses received the desired character, in combination with means to return the receiving mechanism through an additional impulse to its normal condition. (See cut.)

890,942. Electric Switch-throwing Mechanism. William H. Turner, Leeds, England. Application filed April 18, 1907.

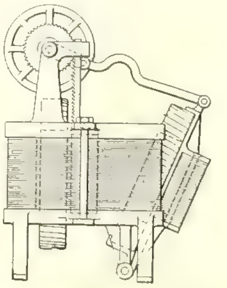
A solenoid and core are associated with a connecting rod and lever, a rachet-toothed wheel and cam, a driving pawl pivoted to the lever, and a switch-operating rod provided with rollers bearing on opposite sides of the cam.

890,960. Electrically Operated Adding Machine. Roy L. Burd, Detroit, Mich., assignor to Burroughs Adding Machine Company, Detroit, Mich. Application filed February 7, 1907.

In combination with an electric motor are driving connections, including a normally-restrained clutch, and manipulative means for releasing the clutch, also an electric lock for the latter controlled by the speed of the motor.



NO. 890,621.—STARTING RHEOSTAT.



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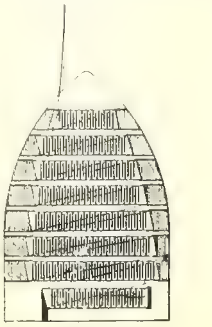
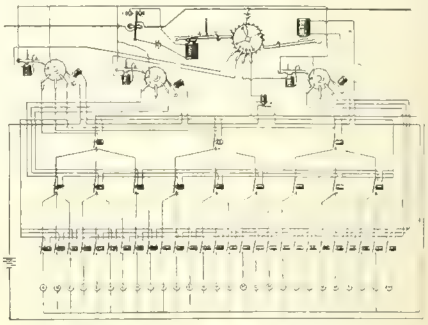


NO. 890,856.—HEATING UNIT.



NO. 890,911.—PRINTING TELEGRAPH.

890,971. Speed Regulator for Dynamos. Otto H. Erickson, Minneapolis, Minn. Application filed August 3, 1907.

A driven shaft has a friction-clutch member secured thereon, a driving clutch member, an enclosing revoluble and slidable case carrying the latter, and mechanism housed within the case for controlling the contact of the friction devices to regulate the speed of the shaft.

890,979. Multiple Series Relay Controller. Clark T. Henderson, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed September 6, 1907.

This motor controller comprises a number of resistance sections controlled by electromagnetic switches, a number of electromagnetic relay switches, one for each of the resistance switches, connections whereby the operating winding of each of the relay switches is connected in series with the motor armature by the resistance switch that precedes it in order of operation and is short-circuited by its corresponding resistance switch, and a main switch for closing the armature circuit that is also adapted to close the circuit through the operating winding of the first relay switch.

890,982. Rotary Field Magnet. Jack Hissink, Berlin, Germany. Application filed May 17, 1906.

The magnet is provided with uniformly distributed recesses of uniform radial depth to receive the windings, the cross section of the recesses varying in such a manner that the distribution of ampere-turns on the magnet follows a sine law variation.

890,988. Electric Coil and Method of Producing Same. Isidor Kitsee, Philadelphia, Pa. Application filed February 11, 1907.

This coil consists of a series of strips forming a series of independent windings insulated from each other, the inner end of each of the strips being connected to the outer end of the next contiguous strip to provide a continuous path for the current through the coil.

891,017. Coil-box Switch for Ignition Systems. Richard Varley, Englewood, N. J., assignor to the Varley Duplex Magnet Company. Application filed March 25, 1907.

A coil box having a recess in its front face is provided with spring blades projecting downward in parallel directions from blocks in the recess, a rotatable block having [illegible] movable to engage certain of the blades, and having a depending lever and a plug adapted to be inserted between the remaining blades to complete a circuit connection therebetween.

891,018. Power Meter. Charles E. Vawter, Jr., Blacksburg, Va. Application filed November 6, 1907.

[illegible] dynamometer [illegible] provided with means to [illegible] shaft the power of which is to be measured. [illegible] between a part of the dynamo and the dynamometer are arranged to vary the flux directly as the torque varies. There are means to vary the speed of the rotating element of the dynamo directly as the angular velocity of the shaft varies, and a voltmeter is connected to the armature terminals of the dynamo.

891,039. Electrical Contact Terminal. Charles W. Clifford, Trenton, N. J. Application filed June 13, 1906. Renewed December 10, 1907.

A fuse plug is formed of a single blank of metal, the head being formed from the middle portion of the blank, and the shank from the two end portions thereof, the latter abutting at their edges near the head forming a comparatively deep cup, and separated at their outer ends, forming a bifurcation of the shank.

891,049. Crossing Protector for High-tension Lines. John F. Dostal, Denver, Colo., assignor of one-third to William J. Baker and one-third to Clifford W. Humphreys, Denver, Colo. Application filed February 27, 1906.

A hook-member for a crossing protector comprises a body portion having at one end means for connection with a conductor and having its other end curved rearwardly and terminating in a rearwardly disposed spherical convex face.

891,112. Spark-plug Protector. Charles H. Stuart, Newark, N. Y. Application filed November 13, 1905.

This protector has an insulating body adapted to enclose the plug and means for fastening the body to the plug and connecting the conductor with the plug.

891,123. Trolley. John C. Wilkins, Swissvale, Pa. Application filed October 27, 1906.

On each side of the trolley wheel levers are pivoted to the ends of the axle, which have hooked ends extending over the trolley wire.

891,221. Train-lighting System. Joseph L. Woodbridge, Philadelphia, Pa. Application filed June 21, 1907.

A direct-current generator is arranged to generate two different voltages, the higher one for charging storage batteries and the lower one for supplying the train lights. An automatic switch connects one battery terminal to the high-voltage circuit when the difference of potential between this and the low-voltage circuit exceeds a certain limit. Otherwise the battery is connected to the low-voltage circuit.

891,223. Process for Manufacturing the Filaments of Electric Incandescent Lamps. Werner von Bolton, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Original application filed December 28, 1905. Divided and this application filed February 24, 1906.

The process of making filaments from pulverulent metallic tantalum consists in electrically heating the metal in a state of granular agglomeration in an indifferent environment until the several particles thereof metallically unite to form a homogenous mass and then drawing down such mass into filament form.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 23, 1908:

454,476. Electric Regulator for Constant Potential. C. Hering, Philadelphia, Pa.

454,485. Electric Arc Lamp. H. Lemp and M. J. Wightman, Hartford, Conn.

454,486. Overhead Electric System. C. A. Lieb, New York, N. Y.

454,488. Commutator for Dynamos or Motors. C. A. Lieb, New York, N. Y.

454,503 and 454,504. Signal Attachment for Telephones. A. D. Sundeen, S. B. Molander and G. W. Anderson, Mora, and A. M. Carlsen, St. Paul, Minn.

454,522. Trolley-pole Mechanism. G. H. Larkin and J. Tomkins, St. Paul, Minn.

454,555. Magnetic Separator for Paper Pulp. G. H. Atkins, Palmer, Mass.

454,558. Incandescent Electric Lamp. T. A. Edison, Menlo Park, N. J.

454,598. Galvanic Battery. P. Hathaway, New York, N. Y.

454,604. Electric Search Light. G. Sautter, Paris, France.

454,622. System of Electric Lighting. N. Tesla, New York, N. Y.

454,625. Electric Signal for Railway Trains. F. P. Lenahan, Wilkes-Barre, Pa.

454,626. Electric Motor. F. B. Rae, Detroit, Mich.

454,627. Electric Motor. A. B. Roney, Chicago, Ill.

454,643. Electric Signal-receiving Instrument. G. L. Foote, Brooklyn, N. Y.

454,650. Regulating Electric Lights and Power. I. Herzberg and A. Herzberg, Philadelphia, Pa.

454,671, 454,672 and 454,673. Lightning Arrester. E. Thomson, Swampscott, Mass.

454,698. Method of and Apparatus for Heating Bars by Electricity. E. F. Angell, Somerville, Mass.

454,746. Electrical Fire Alarm. B. W. Leonard, Saybrook, Conn.

454,816. Electric Circuit Closer. J. H. R. Ward, New York, N. Y.

454,[illegible]. Electrode for Secondary Batteries. B. Andersen, Texarkana, Tex.

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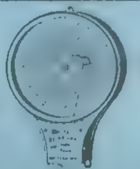

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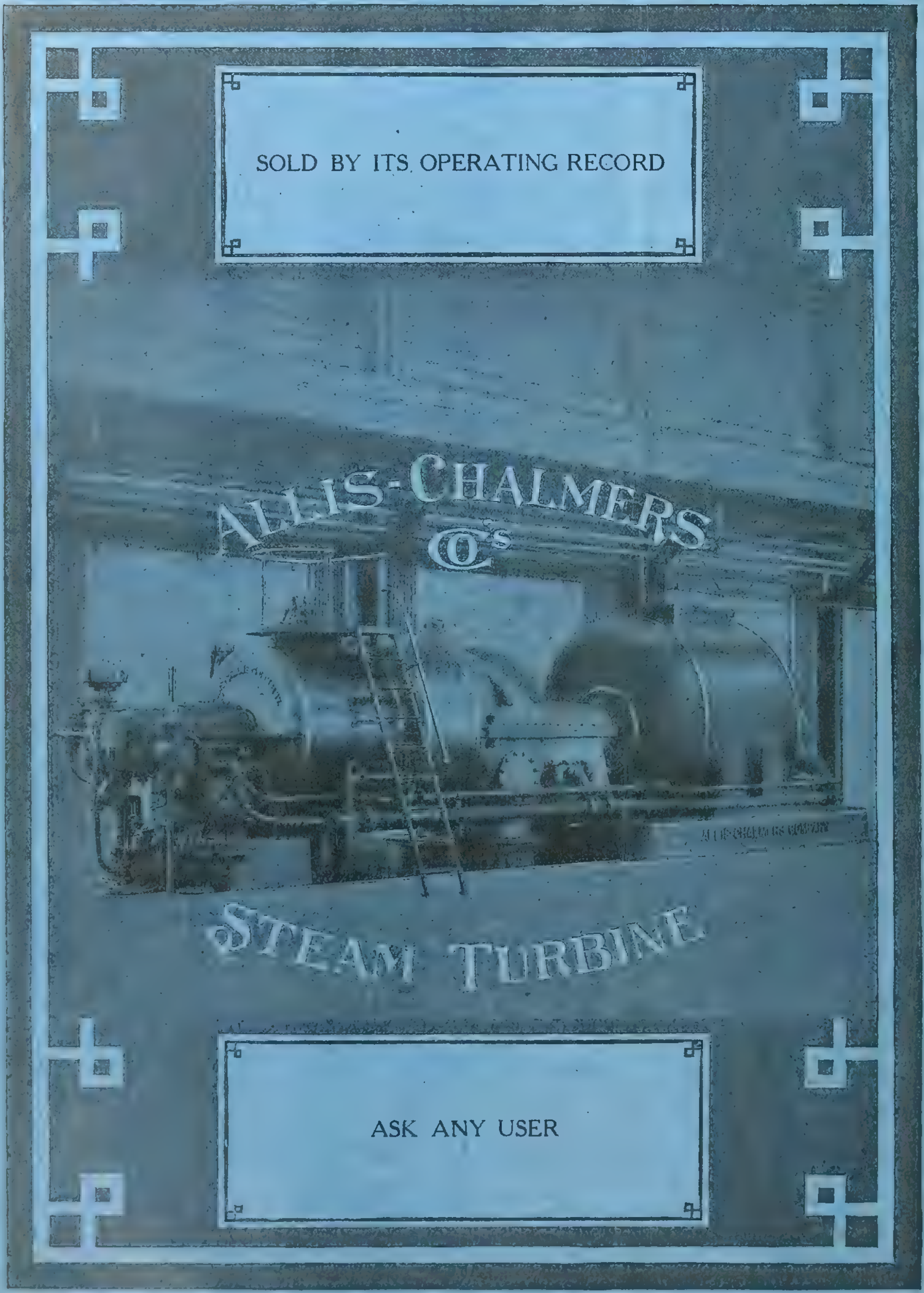

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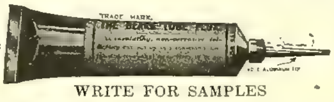

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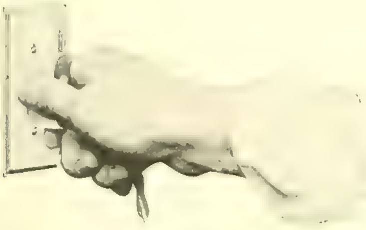

Flush Receptacle with Plug Inserted

They are the best we can make, and nobody can make better ones. The price is as low as is consistent with high quality. Our line is complete. Write for prices.

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Porcelain Bus-Bar Insulator

No. 269—Bus-Bar Insulator

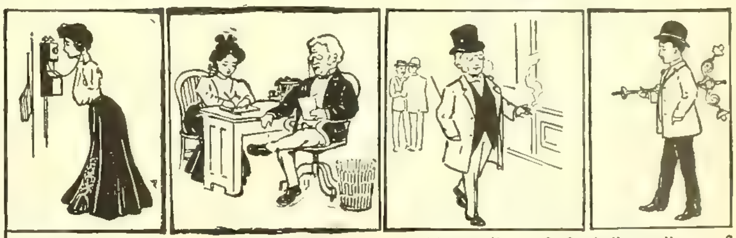
This insulator is representative of a general line of insulators which have been in use for some time to provide strong, reliable support for wire, tube or flat-bar conductor supported vertically or horizontally.

This insulator can be supported on our pins Nos. 2, 4, 8, 20, 34 or 200, and will be found entirely ample for 12,000 volts. The cap is made of cast iron cemented in place upon the insulator. The two studs are not attached directly to the cast part, but are threaded into a short steel bar which is attached centrally to the iron cap and by swiveling may be adjusted to any size bus-bar up to 2½ inches high by 2½ inches wide. It is intended when once the bus-bar is in place that superfluous length of the studs be cut off.

Weight, each	6 lb.
Size, pinhole	1 inch
Code Word	Koppelriem

THE LOCKE INSULATOR MFG. CO.
VICTOR, N.Y.

Many Ways of Getting Orders



Will you phone us? Or drop us a line? Will you call on us? Or shall we call on you?

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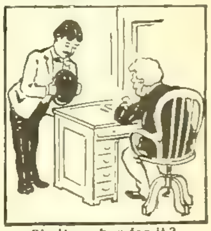
WE MANUFACTURE the most popular line of GAS and ELECTRIC FIXTURES in the World. We have the most complete catalogues in existence, illustrating all grades, from the inexpensive fixture for the cottage to the classical fixtures for the palace; also supplies directly connected with the lighting industry. We are always in the lead and strictly up-to-date. That's why we want YOUR ORDER.

Write for circulars on fixtures for TUNGSTEN LAMPS. We were first to "do it."



Shall we beg for it?

Or must we pray for it?

Or go after it with an ax?

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FOR LARGE AND IMPORTANT INSTALLATIONS

Where high efficiency, low maintenance, great capacity and long life are factors most rigidly demanded, the Gould Storage Battery has established a reputation second to none. We offer the actual performances of the many street railway, central station and isolated plant batteries installed by us in the last seven years as convincing proof of the superiority of the Gould system and the Gould Integral plate. *Write for our bulletins and data.*

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WORKS
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Haller Sign Wks., Inc.

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OUT WEST we're "WAVING our TORCH," O.K.

You have not had much success with "Flaming Arcs," have you?

What kind did you use?

There are "Flames" and "Flames," and "Lamps" and "Lamps," but there is only one "SUNRAY EXCELLO" FLAMING ARC LAMP for outdoors, and "PEARL WHITE EXCELLO" FLAMING ARC LAMP for indoors.

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3,000 cp.—550 watts
17 hours,
D. C. or A. C.

M. H. Candlepower, 3,000; 6 amp. and 10 amp. Two lamps in series on 100 to 120 volts; four lamps on 200-240 volts. A. C. any frequency.

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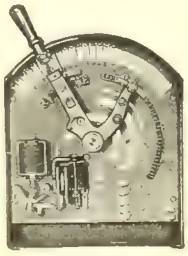
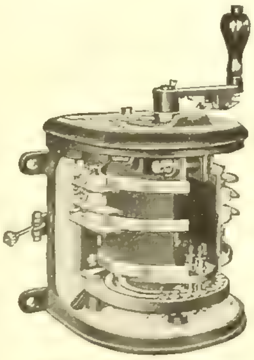
CUTLER HAMMER CONTROL

MACHINE TOOL and PRINTING PRESS Controllers

Nearly 100 pages of our complete catalogue are devoted to descriptions of Cutler-Hammer Machine Tool and Printing Press Controllers



Printing Press Controller, "Carpenter" Type. (Bulletin 85½.)



Machine Tool Controller (Bulletin 78.)

The Cutler-Hammer Mfg. Co., MILWAUKEE

Electric Controlling Devices for all purposes 3

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HABIRSHAW Highest Grade Wires

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HIGH VOLTAGE TRANSMISSION CABLES

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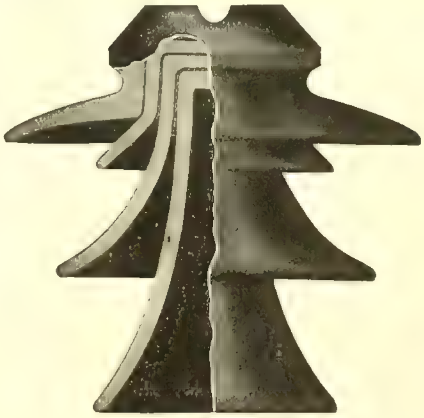

No. 4088

A SATISFIED CUSTOMER IS YOUR BEST ASSET

Uninterrupted service will satisfy your customer. Eliminate interruptions on your transmission line by using our Gas-Fired Insulators.

THE NEW LEXINGTON HIGH-VOLTAGE PORCELAIN CO.

New Lexington, Ohio, U. S. A.

CENTRAL ELECTRIC CO., Chicago, Ill., General Western Sales Agent

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Cap. K.W. No. Cycles
Volts Pri. Sec.

Standard Special 3-Phase.

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FOR G. E. RECEPTACLE No. 50746

NOTHING BETTER MADE

3-inch diameter, 1½ inches deep. Four outlets in sides. For ½-inch conduit only.

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Complete stock of all standard boxes, covers, etc., on hand and can make immediate shipment from Utica, Boston, [illegible]ew York, Chicago or San Francisco

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UTICA, N. Y.
CHICAGO OFFICE: 269 S. C[illegible]al Street

LOCAT[illegible]
FO[illegible]

Electrical Factories

ON THE

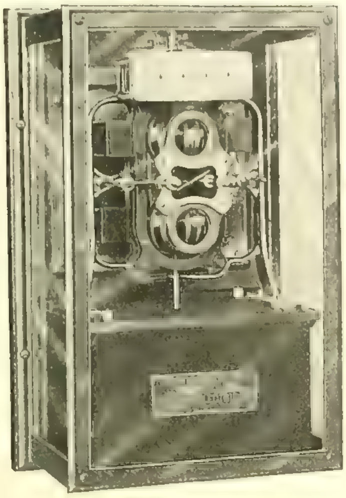
Illinois Central R. R.

For full information address

J. C. CLAIR,
Industrial Commissioner
No. 1 Park Row, CHICAGO, ILL.

General Electric Company

Thomson Recording Wattmeters
Type CS



This new type is the first and only direct-current meter of capacities below 800 amperes having astatically arranged armature and shielded damping magnets protecting meter from effects of external magnetic fields and short-circuits.

For Direct-Current Switchboard Service

Capacities 50 to 600 Amperes—110, 220 and 550 Volts
Both 2 and 3 Wire

High torque—light-weight moving element—superior initial and continued accuracy—large 4-pointer register—direct reading in K.W. hours.

1771

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I-T-E
Circuit-Breaker

LITERATURE

Will You Help Us Provide It?

We announced in the "Electrical World" issue of June 6th, that we had deposited with the "Electrical World," New York, Twelve Hundred Dollars ($1200.00) in cash to be distributed to the writers of the best essays on the use of circuit-breakers.

We are glad to comply with the request of the postal authorities who suggest that we make it perfectly clear that this offer is open to every one and is not limited to the readers of the "Electrical World." Every user of electricity who is acquainted with the I-T-E Circuit-Breaker and its wide field of usefulness, may enter this competition.

In the unexpected event of a tie for any prize offered, the value of the prize will be divided equally between or among those tying.

The conditions of this competition make it worthy of your attention, and a copy of same will be mailed on receipt of request, addressed

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QUALITY is remembered after PRICE is forgotten we stick to selling Sable Belting because

a Sable Belt will transmit 25 to 33 per cent. more power than any oak tanned belt.

To prove it we will send one on 30 days' trial. If it is not all we claim it may be returned at our expense. "All shoes LOOK alike but you still buy a $5.00 shoe although there are hundreds of brands of $3.00 shoes. Why? Send for *Booklet No. 4*"

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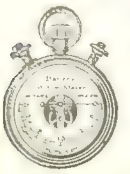

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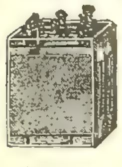
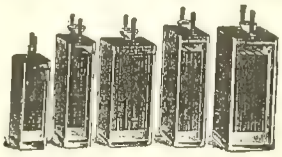


Sparking Battery



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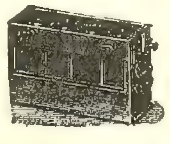

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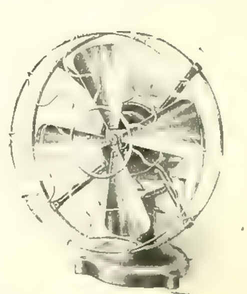

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We do not intend to change or increase our list prices, we do not follow our competitors.

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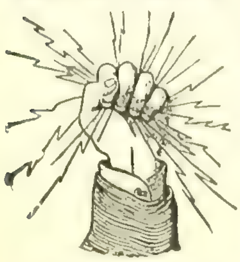

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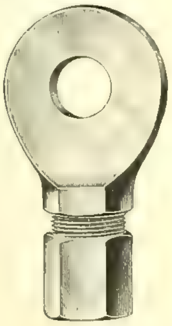

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Simple and strong.

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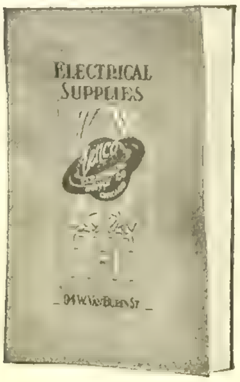

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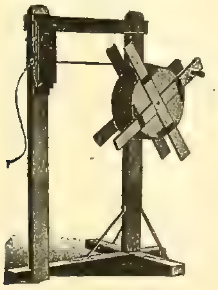

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Reels wire into a neat coil and shows number of feet.

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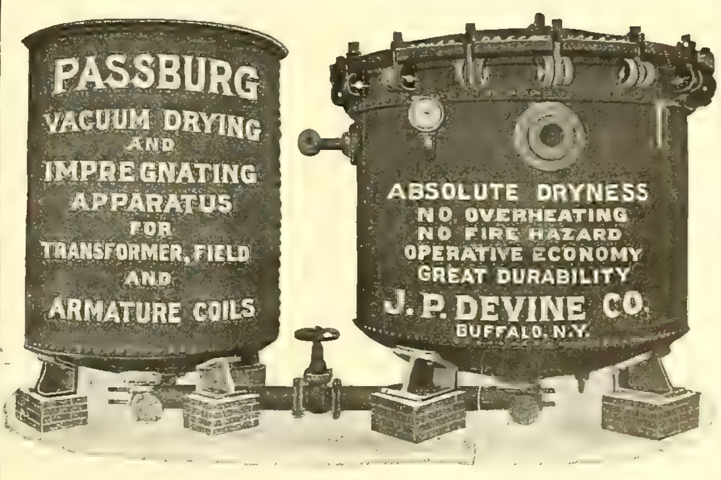

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[illegible] reliable and experienced man [illegible] Dynamo and Motor tester and [illegible] department in factory [illegible] Will also accept position with a [illegible] Expert work on multiple [illegible] system. Address Box 831, care of Western Electrician, 507 Marquette Building Chicago, Ill.

POSITION WANTED

Central-station engineer experienced in operating and improving power lighting and water plants. Competent as chief engineer in large [illegible] or manager of medium-sized property where wide-awake business-getting methods would show results. Correspondence solicited with party requiring consulting engineer for several small properties. Best references. Address Box 842, care Western Electrician, 507 Marquette Bldg., Chicago, Ill.

WANTED

Three or four vertical waterwheels, together with harness to operate at a head of about eight feet, wheels to be 45, 50 or 54 inches. Address Box 830, care of Western Electrician, 507 Marquette Bldg., Chicago, Ill.

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We will give exclusive territory to result-bringing salesman. We manufacture new and re-filled class A lamps. Our salaries and commission will interest you. What can you do? Answer. Address Box 826, care of Western Electrician, 507 Marquette Bldg., Chicago, Ill.

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A German Storage Battery manufacturer, located in Chicago, wants to enlarge present facilities. Has well-established business. Needs some additional capital and re-location for factory with cheap power. Liberal inducements for right man. Address Box 819, care Western Electrician, 507 Marquette Building, Chicago, Ill.

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Do you need a man?
We can get him for you.
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Combination gas and electric-light plant in Huntsville, Mo., a town of 3,000 inhabitants. Gas coal in immediate vicinity. Chemical analysis shows $5\frac{1}{4}$ cubic feet to pound of coal. Electric-light plant new and in first-class condition, machinery of the latest type and pattern. Cement block building. Fourteen-year franchise with city contract for same term. Splendid opportunity to buy this electric and gas business for half its value. Communicate with JOHN N. HAMILTON, Trustee in Bankruptcy, Huntsville, Mo., or W. B. HOMER, Attorney, Rialto Bldg., St. Louis, Mo.

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1	1	Emerson, self-starting, class E, 110 volts	2000
1	1	Westinghouse, 110 volts	1900
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1	1	Wagner auto 208 v., model A	2000
1	1	Gen. Elec., type I. S., form L, 110 volts, direct-connected to No. 2 Enterprise Meat Chopper	1875
2	1½	Holtzer-Cabot, 110 volts, self-starting	2500
1	2	Gen. Elec., 110 v., type I. S.	1875
2	2	Wagner, model A, 110 v., auto	2000
1	3	Gen. Elec., type I. S., form L, 110 volts	1875
1	3½	Wagner, model Z, 110 v., auto	2000
1	3½	Wagner, Model Z, 220 v., auto	2000
1	10	Wagner, 110 volts, auto	1600
1	15	Wagner, auto, 208 volts	1600
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Send for our Monthly Bargain Sheet, showing complete stock, with net prices.
GREGORY ELECTRIC CO., CHICAGO, ILL.

Bids Wanted for Electric Light Plant

SEALED BIDS will be received by the City Council of the city of Valley City, North Dakota, up to 8 o'clock p. m., Monday, July 6, 1908, for the sale of the city's electric light plant. Said bids must be addressed to the City Auditor of said city and must be endorsed on the outside thereof, "Bids for Electric Light Plant."

No bid will be considered which is for a less sum than $40,000, and all bids must be accompanied by a certified check for 5 per cent of the amount of bid, and made payable to the City Treasurer of said city.

An exclusive 20-year franchise will be granted the successful bidder, the terms and conditions of which will be agreed upon on the acceptance of any bid.

An inventory and any information desired can be obtained from the City Auditor of said city upon application.

The right is reserved to reject any and all bids.

By order of the City Council. Dated May 12, 1908.

H. F. HALVERSON,
City Auditor of Valley City, N. D.

TELEPHONE TROUBLES Price 25 Cts.

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ELECTRICAL COMPOUNDS
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Electrical Construction
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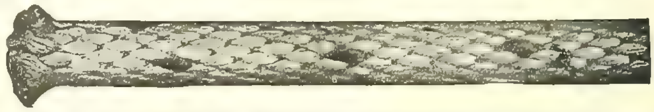

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with the Fibre-Graphite Commutator Brush.

Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre Graphite is therefore the most economic brush on the market. Send for price list.

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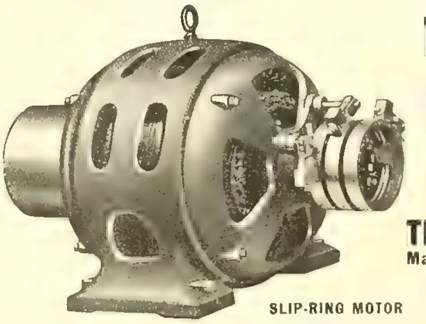

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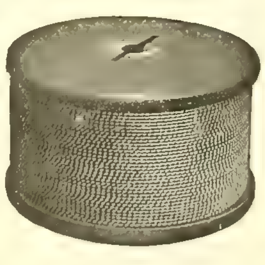

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FIRST CLASS EQUIPMENT THROUGHOUT.
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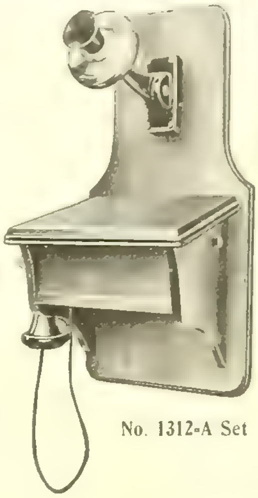
To meet the demand of railway companies for a scheme whereby their existing telegraph lines may be used for telephone service, we have developed a complete line of apparatus.

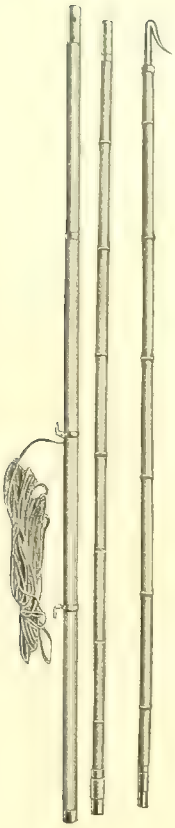
Different methods are employed according to the service that is required. The railway composite system is very popular where it is desired to secure one telephone circuit for several stations from one grounded telegraph line. With this system the telephone apparatus may be added to the line without changing or rewiring the telegraph instruments. The apparatus is simple and gives splendid transmission.



No. 1312-A Set

Western Electric Quantity means Low First Cost

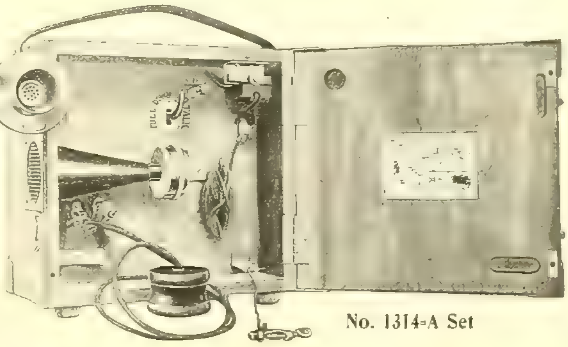
Western Electric Quality means Low Maintenance Cost



The No. 1312-A telephone set is for use at a permanent station.

The No. 1314-A telephone set is portable so that it may readily be carried on a train. Connection can be made with a composited telephone and telegraph line by means of the jointed pole and 100 foot cord shown in the illustration.

Our **Bulletin T-206** gives complete information on the installation and maintenance of these telephones for railway service. This will gladly be sent free upon request.



No. 1314-A Set

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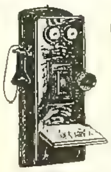
REG. U. S. PAT. OFF.



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Known and Used the World Over
Have you Tried Them?
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If not, will you allow us to send a Sample?
International Telephone Mfg. Co.
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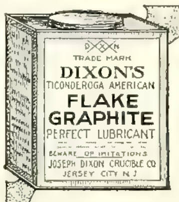

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Successful engineers use it. Write for free booklet and sample—write to-day.

Joseph Dixon Crucible Co.
Jersey City, N. J.

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
Olive & 19th Sts., St. Louis, Mo.

"An Ounce of Service

is worth a ton of sentiment." That's a pretty good motto; it occupied a prominent place on the walls of the Illinois Association's Convention hall in Champaign the last week in May. It was the keynote of the Convention; it is becoming the keynote of the Independent movement.

That Ounce of Service

are you giving it to your subscribers, or are you giving them a fraction of it and the rest in sentiment? The people who have had their ton of sentiment in connection with the Independent movement are now clamoring for their ounce of service.

You can give it

to them, in quantity, with your present manual equipment, perhaps, but you can't give it in quality without automatic equipment. The Independent-Bell struggle is going to result eventually in the "survival of the fittest." Get automatic equipment and be among the fittest.

Our Automatic System has been adopted in the following cities:—

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Auburn, N. Y.
Battle Creek, Mich.
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Berkeley, Cal.
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Champaign, Ill.
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Cleburne, Texas.
Columbus, Ga.
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Houston, Texas.
Jonesboro, Ark.
Kenton, Ohio.
Lake Benton, Minn.
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Lincoln, Neb.
Los Angeles, Cal.
Manchester, Iowa.
Marianao, Cuba.
Marion, Ind.
Medford, Wis.
Mt. Olive, Ill.
New Bedford, Mass.
Norfolk, Neb.
Oakland, Cal.
Ocean Park, Cal.
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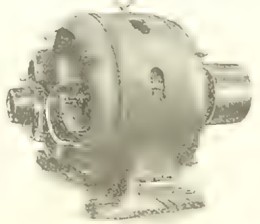

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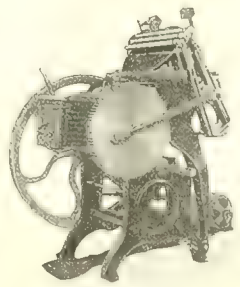
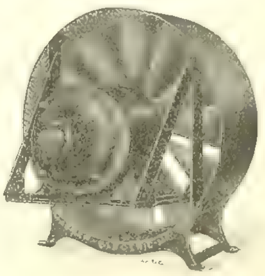


The motor application above suggests many possibilities for electric drive in printing shops. You will note that while this is a belted outfit, it is a variable-speed outfit, with variable-speed box underneath the feeding table. The pressman has absolute and instantaneous control over this outfit. This outfit is extremely economical of operation.



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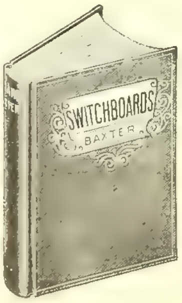

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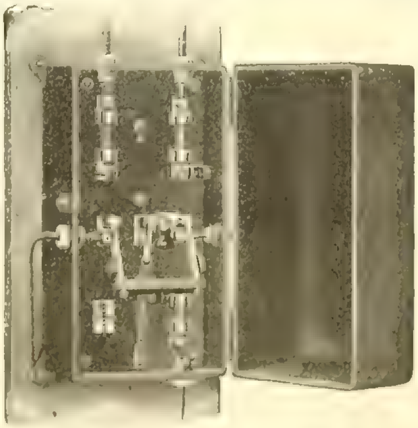

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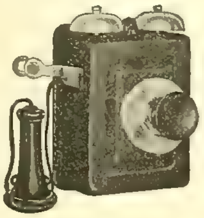

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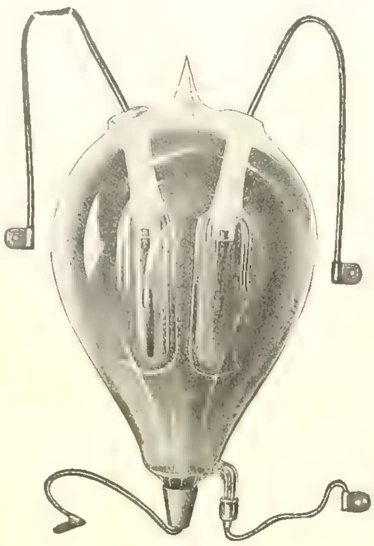

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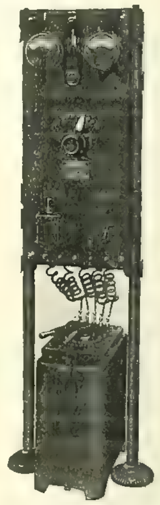

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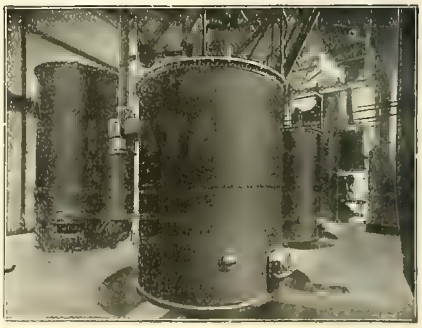

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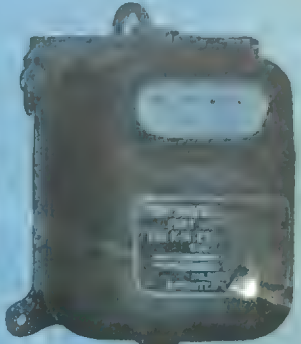
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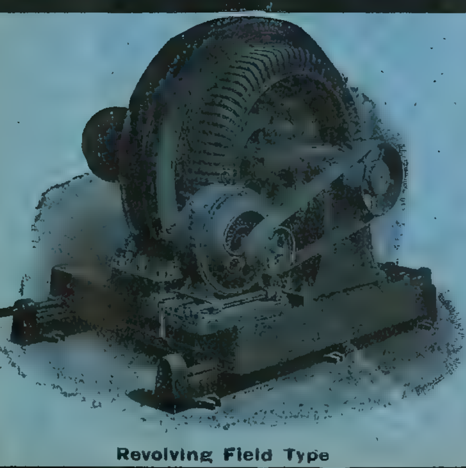
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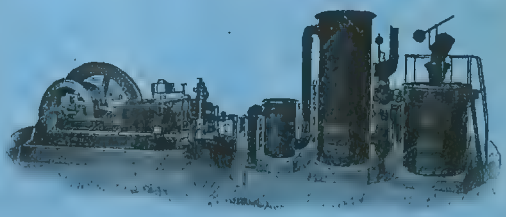

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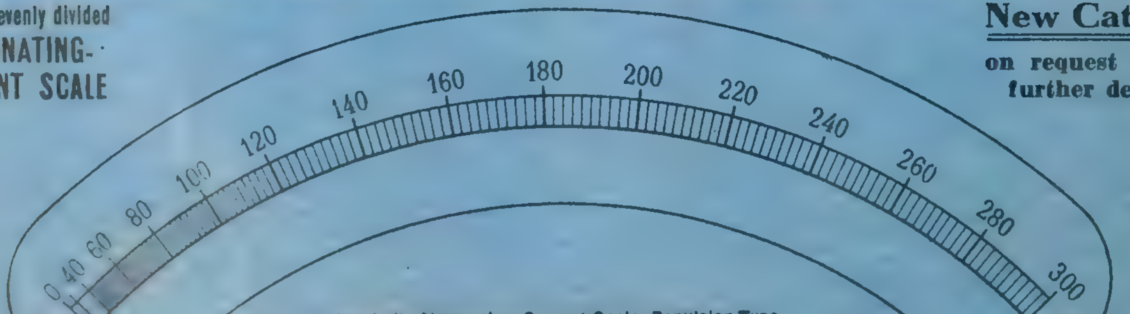

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